The 6th ISTAP International Seminar on Tropical Animal Production

“Integrated Approach in Developing Sustainable Tropical Animal Production”

PROCEEDINGS

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PREFACE

On behalf of Faculty of Animal Science, Universitas Gadjah Mada, I am pleased to present you the 6th International Seminar on Tropical Animal Production (ISTAP) which is held on October 20 – 22, 2015 at Auditorium drh. Soepardjo, Faculty of Animal Science UGM, Yogyakarta. Under the main theme “Integrated Approach in Developing Sustainable Tropical Animal Production”, we expect that information and ideas on animal production systems in the tropics and its related problems will be shared among participants, thus we can elaborate an integrated approach in developing sustainable tropical animal production. I believe, this can be achieved since more than 250 animal scientists, researchers, students, and producers from more than 15 countries join this seminar.

In this moment, I have to address my great thanks to all people who have contributed for the success of this seminar. First, to all participants, thank you for your contributions, time, and efforts in participating in all sessions in this seminar. We also would like to extend our gratitude to the reviewers and editors for dedicate their expertise and precious time in reviewing and editing the papers. I deeply appreciate the hard work of all members of the Steering Committee, Organizing Committee, and students of Faculty of Animal Science UGM for making this seminar achieved a great success!

I hope all of you enjoy the seminar and Jogja as well!

Dr. Cuk Tri Noviandi

Editor in Chief
REPORT FROM ORGANIZING COMMITTEE

Dear all of the scientists, delegates, participants, ladies and gentlemen,

Praise be to The Almighty for His Merciful and Beneficent to raise up this memorable moment for all of the scientists and delegates from all over the world who were interested in Animal Science field to meet up together.

On behalf of all the members of Board Committee, it is my great pleasure and honor to welcome all of you and impress thankful, and present a high appreciation for your participation in joining the 6th ISTAP in Yogyakarta, one of the Special Region in Indonesia where culture and tradition live in harmony with the modern nuance and educational spirit makes it a beautiful venue of this seminar.

During this event, we have distinguished scientists from all over the world to present plenary papers Livestock Management, Production, and Environment; Feed, Land, and Landscape for Sustainable Animal Production; Livestock Industry and Technology; Economics, Social, and Culture in Livestock Development; and Special issue on Halal Food, Safety and Regulation. It is noted that around 200 scientists as well as livestock producers, companies, graduate and postgraduate students from 15 countries attend the seminar; and more than 160 research papers will be presented. We can see great enthusiasm of all the scientists to solve livestock problems as well as to share valuable information and knowledge for human prosperity all over the world.

The 6th ISTAP Program consists of scientific and technical programs as well as social and cultural activities. The scientific and technical programs offer 4 plenary sessions, field trip, and many scientific sessions (both oral and poster presentation). The social and cultural programs of the 6th ISTAP are very important as the scientific and technical programs since the promotion of friendship and future scientific cooperation are also central to this seminar. Opening Ceremony offers you the Seminar Program a glance. Participants will attend a warm invitation from Dean Faculty of Animal Science UGM in a Welcome Dinner that will give you the most memorable moment to attend. Field trip activity offers a wonderful sightseeing to the most spectacular natural landmark in Yogyakarta, Merapi Lava Tour and Ulen Sentalu Museum. We do hope that you will not miss any of these wonderful opportunities.

Closing Ceremony will be held on October 22nd, 2015, immediately after the last session of presentation. The 6th ISTAP award will be announced for some participant as an appreciation for their valuable research.

Finally, on behalf of 6th ISTAP Committee, I wish all of the participants having a great achievement of success and fulfill the expectation as well as enjoying the interaction with all scientists participating in the seminar.

High appreciation I may acknowledge to the Rector of Universitas Gadjah Mada and Dean Faculty of Animal Science UGM, who have concerned to facilitate the seminar site host.

Special thank to the Steering Committee, Scientific Committee, Reviewers and Editorial Boards for their great contribution to make the seminar successfully organized.

Terima kasih (Thank you).

Sincerely Yours,

Prof. I Gede Suparta Budisatria, Ph.D
Chairman
The Organizing Committee of the 6th ISTAP
WELCOME ADDRESS

Selamat pagi (Good morning)

Dear Rector of Universitas Gadjah Mada, all of Invited Speakers, honorable guests, all of delegates, participants, distinguished guests, Ladies and Gentlemen Attendants of The 6th ISTAP,

It is my great pleasure and honor to extend a warm welcome to all of you at The 6th International Seminar on Tropical Animal Production, which be held on October 20 – 22, 2015 at Auditorium drh. Soepardjo, Universitas Gadjah Mada, Yogyakarta Indonesia. This seminar is proudly organized by Faculty of Animal Science Universitas Gadjah Mada.

The contribution of this seminar to the development of national food security is truly significant for introducing of new scientific knowledge and equipments that is much needed in Indonesia to maintain a safe and secure environment and to look at more effective ways to meet future challenges. We can see great enthusiasm of the entire participant to present their latest research as well as to share valuable information and knowledge for human prosperity all over the world.

In these 3 days of seminar, we have invited some Plenary Speakers and Invited Papers who are qualified as scientists and bureaucrats in animal science field to share their valuable information and knowledge. Other participants can deliver their precious research through oral and poster presentations.

Finally, on behalf of Faculty of Animal Science, we would like to extend our sincere gratitude to the Minister of Rural, Rural Development, and Transmigration, Republic of Indonesia, Mr. Marwan Jafar, for his generosity to be with us here to give Keynote Speech. Then, it is our great honor and pleasure to have qualified scientists and bureaucrats as Plenary Speakers and Invited Papers to share their valuable knowledge during the plenary and concurrent sessions. Moreover, special thank you is for the Steering Committee, Scientific Committee, Reviewers and Editorial Boards for their great contribution to make the seminar a great success. Also, we would like to congratulate and deliver high appreciation to the Organizing Committee as the organizer for their great contribution and generous efforts to make the seminar successfully organized.

And to all of the participants, I hope that this seminar will always success and bring some acknowledgement for all of us. Also, I wish all of the participants having a great achievement of success and fulfill the expectation as well as enjoying the interaction with all participants.

With all of our hospitality, we will try our best to make your brief visit to our country become a wonderful and memorable moments. We are looking forward to meeting you all in the future event.

Wish you all a very pleasant and most enjoyable stay in Yogyakarta, Indonesia, beside you scientific journeys.

Terima kasih (Thank you).

Sincerely Yours,

Prof. Dr. Ali Agus
Dean Faculty of Animal Science UGM
OPENING REMARKS

Dear all of Scientists, distinguished guests, delegates, participants, Ladies and Gentlemen,

On behalf of Universitas Gadjah Mada, I am happy to welcome you and present a high appreciation for your participation in joining the 6th International Seminar on Tropical Animal Production hosted by the Faculty of Animal Science UGM in Yogyakarta from 20 – 22 October 2015.

Under the theme of “Integrated Approaches in Developing Sustainable Tropical Animal Production”, we do hope that this seminar concludes with shared ideas and best practices, technology, and global networks that are required to increase animal production. The increase of animal production as one source of food is crucial to feed the world given that the population is expected to increase from 6 billion to about 8.3 billion in 2030. According to FAO (2008, 2009), the consumption of animal food increased from 10 kg/per annum in 1960, 26 kg/per annum in 200, and it is expected to be 37 kg/per annum. Animal production is an integral part of food production and contributing for the quality of human food supply. Animal and agricultural production is an important component in the integrated farming systems in developing countries as this produces high quality foods, provides job opportunities in rural areas, as well as enriching livelihood.

As a tropical country with high animal biodiversity, Indonesia and other tropical countries, have a variety number of indigenous and local animal genetic resources and germ plasm. This variety of animal germ plasm could be explored and developed not only for animal and food production but also for animal conservation. Apart from being exploited as food resources, it is therefore important to consider animal conservation. Conservation will protect the genetic potency of local bred and their family, and the domesticated animal bred, and this would secure our future food resources.

In these 3 days of seminar, we believe those aforementioned issues will be discussed, and technical solution as well as recommendation will be provided to solve the existing problems in tropical animal production.

Finally, on behalf of Universitas Gadjah Mada, we would like to congratulate and thanks to the Faculty of Animal Science UGM as the organizer for their great efforts to make the seminar successfully organized. To all of participants, I wish all of you have a great discussion and interaction with other scientists participating in the seminar as well as enjoying your time in Yogyakarta.

Thank you

Prof. Ir. Dwikorita Karnawati, M.Sc., Ph.D.
Rector of Universitas Gadjah Mada
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Strategies to increase the domestic production of raw milk in Indonesia and other South East Asian countries

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**ABSTRACT:** The increases in domestic milk production throughout Asia have failed to keep up with the increasing demand for liquid milk and processed dairy foods. Consequently self-sufficiencies have and are still falling to such an extent that Asia now accounts for over 40% of the world’s total dairy imports. Taking Indonesia as a case study, poor on-farm management, selling off dairy cows for beef and high animal feed prices are major contributors to their 30% self-sufficiency in raw milk. Small herd sizes (from one to five milking cows) are also a major constraint to increasing per cow performance. Increases in national milk production can result from more dairy farms, more cows per farm and/or higher milk yields per cow. Because of very high herd wastage rates, importation of dairy heifers from overseas is the main way to increase the national herd size. Such animals require high quality feeding and herd management, particularly during their early post-arrival phase and this is rare to find with most of the unskilled small holder farmers. There is increasing interest in “mega dairy farms” holding 500 to 1,000 or more milking cows in virtually all of the South East Asian countries. This review concludes with listing 14 pros and 19 cons, as well as other considerations, when assessing the potential viability of large scale intensive dairy farms in the humid tropics.

**Keywords:** Milk production, dairy demand, feeding and herd management, large scale, intensive dairy farms.

**AN OVERVIEW OF THE DAIRY INDUSTRIES OF SOUTH EAST ASIA**

Globally, agriculture provides a livelihood for more people than any other industry (primary or secondary) while dairy farming is one of the major agricultural activities. Hemme and Otto (2010) estimated that 12 to 14% of the world’s population (in fact 750 to 900 million people) live on dairy farms or are within dairy farming households. Milk is nature’s most complete food and dairy farming represents one of the fastest returns for livestock keepers in the developing world. Furthermore, the majority of these farmers are small holders, with average herd sizes often as small as one to five milking cows. In fact, small holder dairy (SHD) farmers produce over 80% of the world’s annual 240 billion litres of milk.

The Asia-Pacific region has seen the world’s highest growth in demand for milk and dairy products over the last 30 years. Even though Asia has increased its milk outputs (as a percentage of global production) from 15% in 1981 to 37% in 2011, it still accounts for over 40% of the world’s total dairy imports. The consumption of milk and dairy products in Asia has doubled over the last 30 years, now contributing to more than 60% of the total increases in global consumption. In the future, per capita milk consumption in SE Asia is expected to nearly double from the current 10 to 12 kg/hd/yr to 19 to 20 kg/hd/yr by the year 2020 (Delgado et al., 2003). This 3% per annum growth will lead to a total milk consumption of 12 million tonnes/yr by 2020, which Delgado et
*al (2003) predict will require 9 million tonnes of milk/yr net imports just to satisfy this demand. This is up from the 4.7 million tonnes of milk/yr imported in 2000. In summary by 2020, SE Asia will then only be producing 25% of its total milk requirements. Such growing demands have arisen by a combination of:

- increasing per capita incomes
- the emergence of affluent middle class people in many low to middle income countries
- westernisation trends which increase the demand for protein foods and value added dairy products
- increasing urbanization
- expansion of modern retail outlets (with refrigeration cabinets) throughout Asia

In other words, higher incomes and increasing urbanisation have combined with economic reforms and market liberalisation policies to heighten the import dependency of many countries in this region. Asia has then become increasingly dependent on the highly competitive, but ever increasingly volatile, global dairy commodity markets.

Table 1 presents FAOSTAT (2010) data from 19 countries in South and East Asia on the numbers of dairy cows and milking buffalo and their total annual milk production, together with their changes in self-sufficiency over the last 10 years or so. To give an idea of the role of dairy products in their diet, the per capita consumption of all dairy products is also included in this table. These range from extremes of Pakistan (over 170 kg/capita/yr) to Laos (with only 2 kg/capita/yr).

With regards to changes in self-sufficiency of milk and dairy products, several countries have maintained close to 100% self-sufficiency, while others have been unable to maintain previous levels of self-sufficiency because demand has greatly exceeded supply. Others have minimum levels that have hardly changed over the last 10 years.

Most Asian countries still and will rely heavily on imported dairy products even though many have active government policies to increase domestic milk production. There are a group of Asian countries with low per capita milk consumption and low self-sufficiencies and these are likely to be the ones with most pro-active dairy development programs. These include Philippines, Indonesia, Thailand, Malaysia, Vietnam, Cambodia and Laos.

**Table 1.** The size and self-sufficiency of selected Asian dairy industries in 2010

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<th>Buffalo population (000 head)</th>
<th>Total milk production (Kt or million kg)</th>
<th>Self-sufficiency in milk (%)</th>
</tr>
</thead>
<tbody>
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<td>Afghanistan</td>
<td>3,500</td>
<td>-</td>
<td>1,401</td>
<td>100</td>
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INDONESIA: AN EXAMPLE OF A DEVELOPING DAIRY INDUSTRY

Indonesia’s dairy industry and dairy products industry is undergoing a boom with market demand rising by over 10% on an annual basis for the past ten years due to changing consumer habits and population growth. While not a traditional part of the Asian diet, dairy products such as milk in fresh and powdered form as well as cheese and yoghurt are gaining popularity to become a regular feature on the shopping list for middle income families. Indonesia has the highest rate of growth in milk consumption in the ASEAN at 4.8% per year over the period 2006-2010 (Morey 2011). This is presenting exciting opportunities for the private sector in both the upstream and downstream segments to make up the shortfall in milk supply as well to introduce new products that appeal to the growing health consciousness of the market.

One of the key challenges currently facing the industry is the lack of supply from local dairy producers and the quality of the milk being produced (GBG 2013). Indonesia has approximately 500,000 dairy cattle which are mainly found in small numbers and tended to by individual farmers who are members of their local dairy cooperative. The country’s demand for milk in 2011 stood at 3.5 million tonne/year with local producers supplying approximately 950,000 tonne. This figure is set to increase to 6 million tonne by 2020 in line with the current growth in demand.

Reliance on imports, mainly from EU, New Zealand and USA, are a concern given the country’s vast availability of land and labour for cattle farming. Only 30% of the raw materials for milk supply are produced locally with 70% coming from foreign imports to a total value of US$1.3 billion in 2011, up from US$750 million in 2010. The pricing and quality of the milk being produced by dairy farmers is holding back the further development of the domestic upstream dairy industry. Government subsidies for staple agricultural goods including milk in various OECD countries makes such products cheaper to import compared to locally produced fresh milk in Indonesia. Local, small scale producers implement suboptimal production methods such as for the feeding and nutrition of the cows as well as using domestic cattle breeds which produce inferior yields. Such producers are also failing to meet international industry standards in hygiene as they lack their own processing facilities and coordinated supply chain therefore only 12% of locally produced milk meets minimum industry standards and holds a significantly lower market value. Milk produced in Indonesia is therefore being used as a supplementary supply source in the production process as opposed to the main component of the supply chain. However, the last five to ten years has also seen local and international dairy producers make significant investments in their livestock capacity and production facilities in preparation for the sector’s further expansion.
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The Indonesian dairy industry tends to go against the consumer trends of other markets both in the region and globally. For example, over 90% of the dairy market is dominated by processed milk as opposed to fresh (pasteurised or ultra high temperature or UHT) milk and that in powdered or sterilised form. Consumption in liquid milk is forecasted to increase by 16% per annum, while sweet condensed milk is another highly popular dairy product with annual growth of 4.8%. Changes in retail habits and the shift towards modern retail such as grocery stores and supermarkets is opening up further opportunities for liquid milk and other fresh dairy products as previously such goods could not be stored correctly in traditional retail facilities. Improvements in transport infrastructure and the establishment of cold chain supply management are enabling dairy producers to reach beyond the traditional economic centres of Java to the country’s main and outer lying islands. Fresh cheese, yoghurt and probiotic yoghurt drinks are the key product segments that can benefit from this trend as they gain popularity among Indonesian consumers. However, both local and multinational downstream producers face the challenge of adjusting such dairy products to the local consumer tastes. For example, the preference for sweet tasting dairy beverages and the addition of more traditional ingredients to cream or cheese based products such as chilli is seeing the production of dairy products which are particular to the Indonesian market. This presents the opportunity for local dairy players to gain an inside track in crafting innovative products and brands, yet the technology, knowhow and downstream production facilities remain a hurdle to realising such potential.

Planning for the future

For the medium term, the Indonesian dairy industry must concentrate on building its capacity to ensure that the local upstream and downstream players are able to take advantage of the boom in dairy consumption. Large scale investment is required to import cattle from Australia and New Zealand in order to double the current number to reach over 1 million cows. Improved coordination among Indonesia’s 220 dairy cooperatives and 100,000 independent farmers to introduce modern production methods are also crucial to Indonesia’s dairy capacity. The successful implementation of such measures coupled with Indonesia’s wide availability of suitable land and labour for cattle farming could well see the country return to being a dairy exporter for both fresh milk and value added processed goods.

Dairy industry players are rightly focusing their investment and marketing efforts on the domestic consumer market given the scope for growth at over 4.8% annually to 2014 (Morey 2011). Local farmers and dairy producers must play a larger role in this trend given Indonesia’s potential in this area to limit its reliance on imports and thus insulate the industry against currency fluctuations and supply side shocks.

Indonesia therefore needs to increase the number of dairy cattle, introduce more productive cattle breeds and ensure that the cooperatives play a role in the socialisation of new methods of production to local farmers. Such areas are key opportunities for international dairy players and investors who are prepared to work with cooperatives for supply chain management and invest in processing facilities to elevate the standards of locally produced milk. Such investment is also required in the downstream industry to develop the capacity of local producers in creating unique products and successful brands that effectively combine quality with local tastes that in turn could appeal to export markets with similar diets beyond Indonesia’s borders.

The consumption of milk and dairy products continues to increase rapidly in Indonesia, creating an attractive market for local producers and foreign exporters (GBG, 2015). While inadequate road and rail links and a lack of cold storage facilities still pose logistical challenges
for overland transportation of perishable goods, the expansion of modern retail across the island nation is giving ever more consumers access to fresh dairy products. Indonesians' growing appetite for milk and its derivatives bodes well for dairy consumption going forward. The country's large market potential and westernising diets in the fast-growing Southeast Asian region could make Indonesia an attractive hub for dairy manufacturing, provided that sufficient raw materials can be sourced from local dairy farms. The widening gap between national farm output and dairy consumption reflects poor agricultural productivity, but also points to upstream business prospects.

The small scale and often poor equipment of local dairy farms are partly to blame for a low degree of efficiency and inferior milk quality by international comparison. Also, farmers tend to apply suboptimal production methods for the feeding and nutrition of the cows and use domestic cattle breeds that produce inferior yields. Upgrading farm equipment and importing high-yielding dairy cows are ways to address the situation, and the government supports such measures through tax and import policies aimed at boosting domestic production in the name of food security.

Farmers have become the weak link in the domestic dairy production chain. Indonesia's dairy farmers deliver around 1,800 tonnes of milk a day, which satisfies only about one third of national demand. The number of dairy cows (including calves) fell from around 420,000 in 2011 to 350,000 in 2013, and has fallen further since. Seeking to take advantage of high beef prices, many farmers sold off dairy cows to slaughterhouses in between 2011 and 2013, thereby exacerbating the shortfall in milk production. Rising animal feed prices have not helped either, and farmers often complain that the price they receive for milk barely – if at all – covers the costs of production.

As domestic output fails to meet the needs of the processing industry in terms of both quantity and quality, the bulk of milk used by local industries is shipped in from abroad. Imports are generally in the form of powder and mostly sourced from EU, New Zealand and the USA. Imports of milk amounted to a value of US$1.318 billion in 2013. The devaluation of the Indonesian rupiah in recent years makes it expensive for local industries to purchase milk from other countries. In addition, there is the bureaucratic burden of exporting food products to Indonesia, which includes sanitary and health certificates as well as tests from various government agencies and a halal certificate.

Not only are Indonesians increasingly turning to milk as a beverage, but also all of its downstream products. Cheese is becoming more popular, especially among middle and higher-income consumers in urban areas, who are more receptive to western food, such as bread and pizza. Yoghurt and sour milk drinks are likewise gaining in popularity, particularly for their propensity to aid digestion and weight loss. Demand for coffee whitener or creamer is increasing along with rising consumption of instant coffee (as opposed to the traditional Indonesian way of drinking black coffee) and cream is benefiting from the growing popularity of cakes and puddings.

**Investment opportunities**

Upstream investment is urgently needed to fill the milk supply gap and thereby support Indonesia’s dairy industries. Most livestock investment over the past years has gone towards meat production while milk production has made no headway despite rising consumption. Indonesia’s total dairy cow herd is far too small and productivity per animal averages at a relatively low 10-12 litres. The government is targeting to meet at least 50% of national milk demand domestically by 2020. This is a tall order given that per capita consumption is estimated to rise to 20 litres by then and to 30 litres by 2025.

Investment opportunities lie in scaling up production, introducing modern technology and improving farming methods. Greater capacity in cold storage and transportation is also needed to
transport dairy products across the archipelago. Teaming up with local dairy cooperatives, which have established sourcing and distribution networks, will generally be the easiest way for foreign companies to enter the market and get access to farmers. As they need to boost their efficiency to compete with imported milk, local farmers should be interested in cooperation that can help them become more competitive.

Meanwhile, the rapid increase in demand means Indonesia will remain heavily dependent on milk imports in the foreseeable future, which creates an attractive market for foreign-based companies.

**STRAATEGIES TO INCREASE DOMESTIC MILK PRODUCTION**

National levels of raw milk production can be increased in various ways. These include:

1. Placing the highest priority on increasing the number of dairy farmers in the country, without greatly changing their average milk outputs per cow or per farm.
2. Placing more emphasis on increasing per cow milk yields in association with increasing the population of dairy farmers.
3. Increasing the number of cows (that is the average size of each milking herd) on any one farm, without greatly changing the number of dairy farms or yields of their milking cows.
4. Combinations of increasing the number of farms, the size of the milking herds and per cow production.
5. Changing the type of dairy farm, from the small holder, but maybe part time, dairy farm (say with one to five cows) to a larger farm which is still privately owned (say with 20 to 100 cows) to a “mega farm” that is owned by investors or other well-resourced individuals or commercial enterprises (say with 500 to 1,000 cows).

The first option requires sourcing new areas for dairy farm development, a task which is often difficult because of competition for existing land use and the current high density of dairy farms in dairying regions. One such example would be sourcing new land for dairy farming on the island of Java in Indonesia, where 97% of the dairy industry is already based. Developing new regions for dairy farming, for example outside Java, is a slow process as it requires:

- finding suitable highland areas and providing alternative locations for current land holders
- building milk processing facilities near these new dairying regions
- sourcing adequate farm services such as water, electricity or gas
- sourcing suitable dairy animals to populate these new farms
- sourcing areas of fertile land to grow the required forages
- sourcing ample supplies of suitable by-products to provide the ingredients of concentrates for the dairy herd
- establishing a population of skilled workers who understand and can carry out the relatively sophisticated farm practices of successful small holder dairy farming

This last point is very important because increasing per cow daily milk yields from the current levels of say 8 to 10 kg/cow/day, to a potential 14 to 16 kg/cow/day (with existing genetic quality of most SHD milking herds) requires a set of skills rarely found in most small holder dairy farming populations.

The mention of cow milk yields in Asia of 30 or more kg/cow/day in high genetic merit herds is simply unrealistic because of the many production constraints in the humid tropical climate (Moran 2013), even in the highland areas. Dairy cows only produce milk to their genetic potential when these constraints are essentially overcome. In Asia we have taken a temperate species of
animal, the dairy cow, and expected it to be easily translocated to the foreign environments of high
temperature and humidity, often infertile leached soils and relatively constant day lengths.

Furthermore, low per cow milk yields are energetically highly inefficient because of
low nutrient outputs produced each day in raw milk relative to the high nutrient requirements
for maintenance in milking cows hence the inability to dilute these high maintenance energy
requirements with copious yields of high energy raw milk. Therefore mainly depending on
increasing per cow milk yields to satisfy the high national demands for raw milk is a very slow
and unreliable process.

The most obvious way to more rapidly increasing domestic milk supplies is through sourcing
more dairy stock, assuming the land, feed supplies and skilled labour force are also available or
can be developed. Natural increases of dairy cow populations cannot be relied upon to increase
national cow numbers because of the high mortality rates of young stock and the poor reproductive
performance of mature cows on most SHD farms in the tropics (Moran 2005). Granted some
countries may develop national breeding centres to address these issues, such as at Baturadden in
Central Java in Indonesia. However the only reliable way to increase dairy cow populations in
Asian countries is through importation of breeding heifers, either unjoined or in early pregnancy.
This is certainly occurring in many Asian countries. These stock are available from developed
dairy industries such as those in Australia and New Zealand. Some Asian countries, for example
Thailand, also have stock available to import into other Asian countries.

These animals are usually exotic heifers, either unbred or up to 5 months pregnant, in that
they originate from temperate dairy industries where they have been reared on pasture in a largely
climatically comfortable environment. Upon arrival, they then have to adapt to all the constraints
of tropical SHD farming, such as high temperatures and humidities, limited quantities of poor to
moderate quality feed and the vastly different rearing environment of a low investment system with
limited to no grazing and a small cow shed. Changes in animal behaviour clearly indicate that this
adaptation period can be quite traumatic and lengthy, up to six months according to experienced
small holder farmers. This is exacerbated by the often different standards of acceptable practices
of stock welfare on their new home farm.

To find the most suitable stock, tropically adapted stock or at least stock with some degree
of *Bos indicus* (Zebu) breeding are required or the temperate adapted heifers must be destined
for highland regions with fewer constraints to profitable milk production. Even when imported
into tropical highlands, they will be more susceptible to environmental and farm management
constraints than the indigenous dairy stock. In addition, because the imported heifers will be
invariably be of higher genetic merit than the local dairy stock, they require a higher quality of
post-arrival feeding and herd management than would the local dairy heifers. Therefore the higher
level of skills necessary for satisfactorily managing these imported heifers, means that the farmers
to which these animals are destined, need to be selected and/or trained in such herd management
skills.

**The range in size of the milking herd on dairy farms**

As already mentioned, most dairy farms in Asian countries only have relatively few milking
cows. In addition to actual milking cows, the farms would also contain a few replacement dairy
stock such as milk-fed calves or weaned heifers. Such farms often have other farming pursuits
hence dairy farming would not be a full time activity for these farmers. The definition of a small
holder dairy farmer may include farms with milking herd sizes up to ten or even twenty cows. In
countries such as Indonesia, these farms may not have additional land on which to grow forages so
the farmers would need to source the herd’s forage requirements from grasses and other herbage from the road sides, rice paddies or other areas (such as state forests or under cultivated cash crops) which is generally freely available during the rainy season. Another source of forage for the “landless” farmers would be from forage crops grown under the supervision of dairy cooperatives: in these cases they would not be free.

National governments, international aid agencies or benevolent governments or agencies from developed countries have and are still devoting a lot of resources to improving the productivity, profitability hence sustainability of the SHD industries throughout Asia. The success rate of such programs is very variable when assessing the achievements of their long term objectives.

Other dairy farms range in herd size from 20 to 50 to 100 milking cows, which can still be privately owned. However, there is increasing interest in developing much larger dairy farms, containing 200 to 500 to over 1000 milking cows. Such farms could be considered as corporate farms, with ownership of land, facilities and stock by investors or other well-resourced individuals or commercial enterprises. Such “mega dairies” are constructed for, and generally achieve, increased production of high quality milk. However they are often criticized because their emphasis is more on the yields and economics of domestic milk supplies rather than the social and economic development of the country or region in which they are based. However, employing many of farm workers on large farms will be of direct benefit to the local economy. In the long run, it is up to the particular Asian country to decide which is the higher priority, producing more, cheaper quality milk or facilitating the social development of the region.

THE PROS AND CONS OF LARGE SCALE DAIRY FARMS

Large scale corporate type dairy farming is not new in the developed world and is becoming more refined with increasing technical and commercial knowledge and experiences. Many of these current management practices can easily be transferred to the tropical, developing dairy industries, provided the management is made more fully aware of the constraints to high levels of per cow milk production and fertility in such hot, humid environments. They are certainly harder to manage in the tropics than in the temperate, developed dairying countries. Nevertheless, there is growing interest in establishing such “mega dairy” farms in virtually every SE Asian country. Therefore the design, construction and day to day management of such ventures justify closer investigation.

There are many “pros and cons” associated with increasing milking herd sizes from 20 to 500 to 1000+ cows. A total of 14 pros and 19 cons have been listed below:

**Pros**

- Allows for mechanisation hence reduced human error in everything from growing and sourcing forages to feeding and herd management to milk harvesting
- Provides enough cash flow for appointment of experienced farm manager and other professional onsite staff
- Provides enough cash flow to justify routinely testing all feeds for their nutritive values
- Provides large volumes of shed effluent that can either be sold as fertiliser or used to supply many of the essential nutrients for soils to grow quality forages on farm
- Potentially provides large numbers of bulls or steers for local dairy beef farming either by the dairy farm or by small holder beef farmers
- Supplies large volumes of high quality milk (or processed dairy product) which provide better bargaining and/or marketing opportunities
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- Allows for more consistency with forage crop agronomy hence more consistent forage quality
- Allows for bulk purchasing (hence cheaper) suitable by-products to provide the ingredients of concentrates for the dairy herd
- Requires investment in large numbers of livestock, which would have higher genetic merit and be more consistent than when sourcing local stock
- Mechanisation of milk harvesting reduces variation in milk quality
- Provides for opportunity for on-site milk processing to value add the raw milk
- Provides raw products of better consistent quality more suitable for milk processing
- Provides employment opportunities for locals as farm workers
- Provides opportunity to outsource some activities (such as contract growing of forages) and developing closer commercial and social relationships with the local population

Cons
- Requires access to large cash reserves to construct facilities and purchase farm equipment (such as for milk harvesting and preparing Total Mixed Rations or TMR)
- Requires access to large cash reserves to purchase livestock, generally in large numbers
- Requires specialist skills in land preparation, planting, maybe irrigating, harvesting and processing large quantities of forages
- Requires skills in design and construction of large sheds and other farm facilities
- Requires skills in ration formulation and other aspects of feeding management
- Requires skills in reproduction and other aspects of herd management
- Requires skills in addressing mastitis and lameness and other specific animal health issues
- Requires skills in animal health issues arising from heavy concentration of stock in one place
- Must improve local infrastructures (roads) to handle extra heavy traffic
- With poor effluent management, it could increase local pollution loads
- Need access to large quantities of suitable by-products to provide the ingredients of concentrates for the dairy herd
- Ideally requires access to year-round supplies of quality forages
- May require additional skills and infrastructure for forage conservation, specifically silage making
- Requires skills in information and communications technology (ICT) for capturing data from many sources (stock, feed reserves, HR management) on the farm
- Requires ensuring all staff develop animal welfare friendly herd management practices
- With such large numbers of stock, any small mistake in farm management can have large scale and expensive ramifications
- Bio security is of high priority for all equipment, livestock and staff
- Personality interactions between management, farm and administrative staff require close monitoring and if required, early intervention
- Integrity of management staff is paramount to set as best examples to farm and administrative staff

Other aspects of large farm management

It is more desirable to gradually increase herd (hence farm) size over a period of years to allow for the staff to become more familiar with the principles and practices of large herd management. This will also provide better opportunities to observe and address any unforeseen key issues in such a large scale intensive dairy enterprise.
Achieving the Key Performance Indicators (KPI) for cow performance (such as age at first calving, milk yields at different stages of lactation, herd fertility, mastitis & lameness problems) and others listed by Moran (2009) are essential to ensure the KPIs for farm and business performance (such as cost of production, gross profit, return on assets) can be achieved within predetermined time frames.

As in all countries, there are likely to be government (national, provincial or local) regulations and incentives related to developing a large scale dairy enterprise. It is essential to seek such information at an early stage of farm development.

It must be emphasized that large scale dairy farming requires large amounts of readily available liquidity (or cash). Cash flows are likely to remain negative for several years. If sourcing dairy heifers to populate the farm, they will also take several years to reach maturity hence attain adult levels of cow performance. For example, when developing a budget and projected cash flow on a farm with optimum feeding and herd management, it is best to gradually increase the predicted milk yields, even of high grade Friesians, over the first few years of farm operation from say 4000 to 5000 to 6000 to 7000 kg/cow/year consecutively for their first four lactations. Furthermore, it is always better to err on the pessimistic side of projected cash flows until you are certain that all the anticipated (including some of the unforeseen) constraints to cow and farm performance have been identified and addressed. Intensive large scale dairy farming is a long term program so profits will arise in the near not the immediate future.

CONCLUSIONS

Dairy farming in the humid tropics is fraught with problems. However once they are addressed, good profits can be made. For example in 2014, Seruni et al (2015) compared the financial performance of a large scale (with 1467 head) and a small, well managed farm (with 52 head) in the Chiang Mai highland region of northern Thailand, finding on both farms, positive profit levels. Although the capital costs were 65% higher per cow on the large farm, profits expressed as the income less costs as a percentage of costs, was 63% on the large farm versus 55% on the small farm. On the large scale farm, daily income was US$7.49/cow, daily costs (both variable and fixed) were US$4.59/cow thus providing a daily profit of US$2.70/cow.

REFERENCES


Nutritional Challenges of Lactating Dairy Cattle in a Tropical Climate

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ABSTRACT: Nutrition is frequently cited as the primary challenge for milk production in the tropics. The quality of tropical forages is typically low and forage production is uneven distributed throughout the year due to rainfall patterns. The higher fiber and lignin concentrations common to tropical result in lower than desired supplies of nutrient and energy limiting milk production and decreasing reproduction efficiency. To compensate, concentrates are frequently fed to improve nutrient balance. However, concentrate availability is limited in some areas and most concentrates are expensive compared with forage may limit or prevent their use by smaller producers. Utilization of improved grass varieties with lower lignin and fiber concentrations and higher digestibility would improve nutrient intake and supply which would support improved milk production. Legumes adapted to the tropics for grazing or as harvested forage often stimulate higher intake providing additional metabolizable energy and protein in support of higher milk production. Forage quality issues are compounded by heat stress which alters nutrient intake and metabolism of the dairy cow further limiting milk production and reproductive efficiency. Physical modification of the environment is an effective means of reducing the heat load of the cow. Providing supplemental forage to the animals under shade can improve intake and yield of milk and components. As the genetic potential for milk production increases, dry matter intake increases producing additional metabolic heat. Adjusting the composition of diets fed to compensate for decreased intake is necessary to maintain ruminal function and nutrient balance to support milk production and reproduction. Producer adoption of improved practices to address these challenges is also influenced by factors unrelated to actual nutrition such as cash flow, labor availability and facility or equipment requirements and must be considered when promoting new technologies for specific regions.

Keywords: Dairy production, nutrition, heat stress, forage

INTRODUCTION

Dairy products are recognized as a nutritious source of protein, minerals and vitamins, especially for growing children. Because of their nutrient value, many countries are working to promote dairy production and increase the availability of dairy products locally. As disposable income increases, people are consuming a greater proportion of calories and protein from meat and milk increasing demand. To meet the demand of projected population in 2020, annual milk production in Asia needs to increase at the rate of 3.2% per year relative to production in 1993 (Devendra, 2007). In addition to food production, dairy operations provide jobs and a steady income for families. As families generate income from the sale of milk, they are able to purchase supplies that in turn support the local economy.
There are numerous challenges to dairy production in the tropics. Nutrition is frequently cited as the primary challenge because the quality of tropical forages is typically lower than required to support moderate levels of milk production and production is unevenly distributed throughout the year related to demand. Compared with other regions of the world, concentrate feeds used to provide additional nutrients to support higher levels of milk production and improve reproduction efficiency are expensive and their availability is limited in some regions. These challenges are compounded by heat stress which alters nutrient intake and metabolism of the dairy cow further limiting milk production and reproductive efficiency, especially in herds managed for higher milk yield.

**FORAGE QUALITY**

Forages common to the tropics are characterized by relatively high concentrations of neutral detergent fiber (NDF) and lignin. Lignin limits fiber digestibility resulting in lower energy availability compared with forages grown in temperature regions (Aminah and Chen, 1989). Evitayani et al. (2004) evaluated the chemical composition and digestibility of seven tropical grasses and five legumes (Table 1). The grasses had higher concentrations of NDF and lower concentrations of crude protein (CP) and ether extract (EE) compared with legumes. Dry matter digestibility (DMD) and CP digestibility (CPD) were highest for legumes compared with grasses, but low relative compared with most temperate forages. The average metabolizable energy (ME) content of these grasses and legumes as calculated using 24 h gas production was 7.6 and 7.3 MJ/kg DM, respectively. These ME values are low and are not sufficient to support moderate milk yields without supplementation. Within the grass and legume varieties evaluated there was considerable variation in the chemical composition, nutrient digestibility and ME concentrations of individual species. Identification of forages with higher digestibility and ME concentrations that are adapted to the soils and climatic conditions is essential for improving nutrition of the dairy cow in order to support higher yields of milk, fat and protein.

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1Adapted from Evitayani et al., 2004.
Higher dietary NDF concentrations also limit dry matter intake (DMI) of the lactating dairy cow (Mertens, 1985), especially when diets are based on grass which has a slower passage rate compared with legumes. Forages with lower NDF concentrations that are more digestible could improve DMI and support improved nutrition supporting higher production and reproduction efficiency. One approach to improve forage quality and animal performance is to provide improved fertilization and use intensive grazing management. Danes et al. (2013) used crossbred Holstein x Jersey cows grazing pastures based on 70% elephantgrass and 30% Napier grass fertilized with 50 kg of N/ha after each grazing cycle to evaluate the effect of increasing the protein concentration of the concentrate fed from 8.7 to 18.1% of DM. Concentrate was fed at the rate of 1 kg/3 kg milk based on daily milk yield at the beginning of the 10 wk trial. The DMI from pasture averaged 15.9 kg/d and the average chemical composition of the pasture was 18.5% CP, 58.7% NDF and 75.9% in vitro DM digestibility. Pastures were rotationally grazed based on canopy height and cows were offered a new pasture each day and each cycled averaged 28 d. Animals with lower nutrient requirements grazed the pastures to remove additional herbage. No differences were observed in yield of milk, fat or protein (average 19.2 kg/d, 661 and 625 g/d, respectively. In regions where fertilizer is available, this could be an economical alternative to supplemental protein.

Another approach for improving nutrition is to feed supplemental higher quality forages. Nyambati et al. (2003) reported increased DMI when either mucuna or lablab hay was fed along with Napier grass to lactating cows. The DMI of Napier grass did not differ across treatments and the increase in DMI was due to the additional intake of the legume hay. These authors also reported increased DMD which they attributed to improved protein intake from the legumes. The protein content of the grass was low (6.84% of DM) which could limit ruminal fermentation. The additional protein from the legume hay provided additional rumen degradable protein that stimulated greater fiber fermentation by the ruminal microbes. There are many legume species that have been investigated for use in the tropics. One of the challenges for growing legumes in the tropics is the low soil fertility that reduces longevity or required additional inputs to improve soil fertility (Aminah and Chen, 1989). Identifying species suited to the soils and climatic conditions of a particular area is important for adoption by local producers.

**SUPPLEMENTATION**

To compensate for the lower forage quality, supplemental concentrates are often fed to provide additional nutrients to support higher milk yield and improve reproductive efficiency. Aguilar-Pérez et al. (2009) used suckling crossbred cows calving during the rainy or dry season and grazing stargrass irrigated pastures were fed supplemental concentrate at the rate of 0 or 0.9% of body weight (BW), total intake of DM, CP, and energy increased for cows fed concentrate. The improvements in total energy intake not only supported improved milk yield (7.8 compared with 11.1 kg/d for control and supplemented cows, respectively), but the 90 day in milk pregnancy rate was higher for control and supplemented cows (22% versus 47%, respectively). Aguilar-Pérez et al. (2009) reported that based on the price of milk and concentrate at the time of the trial, a positive return was realized for feeding the supplement at 0.5% of BW.

Another approach is to supplement the diet with higher quality forage. Nyambati et al. (2003) offered cows fed a base diet of Napier grass and supplemented with either mucuna or lablab hay or a commercial dairy concentrate. Improvements in total DMI and yield of milk and components were reported for feeding supplemental legumes along with the Napier grass, but highest total DMI and yield of milk and components was observed for cows fed the supplemental concentrate. These results suggest that improvements can be achieved by supplementing a low quality grass with higher quality legume hay which can be grown by the producers when concentrates are too expensive to purchase or not readily available.
HEAT STRESS

Heat stress results from the inability of the dairy cows to maintain homeothermy as the high temperature and humidity prevents the cows from dissipating body heat (West, 1999). Cows under heat stress have reduced milk yield and reproductive efficiency and greater health problems compared with cows maintained in a thermoneutral environment (West, 1999; Kadzere et al., 2002). Genetic selection for higher milk yield results in greater metabolic heat production as the cows must consume additional nutrients to support higher milk yield which compounds the problem (West, 1999). Methods used to reduce the negative impact of heat stress include: genetic selection for greater heat tolerance, adoption of heat abatement systems or structures, and dietary changes to provide improved nutrition and reduce heat stress.

Boonkum et al. (2011) reported that the effects of heat stress on Thai Holstein cross-bred cows increases greatly with parity and was greater for cows with higher percentage of Holstein genetics (≥93.7%. Holstein) as the temperature humidity index (THI) exceeded 80. The authors stated that Thai cattle were rarely fed to their genetic potential which would not generate as much metabolic heat production as those managed for higher milk yield which mediated the decline in milk yield. As producers breed for higher production, they will need to incorporate measures to alleviate heat stress to realize full benefit from the improved genetics.

Evaporative cooling systems are commonly used in developed countries to reduce heat stress, but these systems have a high initial cost for installing the system and relative high operating cost. Shade is often used to provide protection from solar radiation. In temperate climates, cows provided shade had reduced body temperature and higher milk yield compared to cows grazing pastures without shade (Kendell et al., 2006). These researchers reported that grazing behavior changed as cows with access to shade were not grazing during the midafternoon whereas cows without access to shade continued to graze. Total time grazing was not different among cows with and without access to shade. Granzin (2006) reported results of a trial in which cows were moved to a feeding pad equipped with shade and sprinklers when the THI ≥ 72 and were offered 0 or 3 kg DM/d of lucerne hay. Cows moved to the shaded feedpad with sprinklers with or without supplemental lucerne hay had lower body temperatures compared with those that remained on pasture. Yield of milk, fat and protein was highest for cows provided shade and sprinkler and fed 3 kg/d lucerne hay. The differences in yield were greatest when THI ≥ 82 compared with both cows that remained on pasture and those with access to shade and sprinklers without supplemental lucerne hay. Proving shade can reduce heat stress cows, but feeding supplement forage supports improved nutrient intake and maintains higher milk and component yield.

For higher producing herds, additional nutritional modifications are recommended to reduce the negative effects of heat stress and maintain or support higher milk yield (Staples, 2007). Diets should be formulated to maintain adequate dietary fiber concentrations to minimize ruminal acidosis. Concentrations of sodium, potassium and magnesium should be increased to compensate for increase losses from increased respiration, drooling, and sweeting. Dietary protein concentrations are typically increased to compensate for lower DMI and less rumen degradable protein is fed because of slower ruminal turnover. Some producers also feed supplemental B vitamin supplements as ruminal synthesis may not be adequate under heat stress conditions, especially for early lactation cows and high producing cows. The goal of these modifications is to maintain ruminal fermentation and increase nutrient density to compensate for reduced DMI that normally accompanies heat stress. Additional details of these modifications were previously described in greater detail by West (1999), Kadzere et al. (2002), and Staples (2007).
NUTRITIONAL TECHNOLOGY

Several technologies have been examined for improving ruminant nutrition including: ammonia-urea treatment of low quality forages and crop residues, feeding urea-molasses-multinutrient blocks, urea supplementation, enzyme treatment of forages and feedstuffs, forage fertilization, particle size reduction, etc. (Owen et al., 2012). While evidence supporting the potential of each of these technologies was presented to producers when introduced, the authors noted that adoption by small dairy producers are frequently lower than expected because of non-nutritional reasons including: additional cash required to purchase inputs, additional labor required to implement the technology, poor economic return for using technology, lack of facilities or equipment, or other issue. Larger facilities may be able to adopt these technologies as cash flow, labor, and other factors are not as limiting. It is also important to recognize the current limitation of some new technologies. For example much progress has been made identifying fibrolytic enzymes that can enhance fiber digestibility, but there is considerable variability among research trials with only 20% of trials summarized observing improvements in milk production compared with control diets (Adesogan et al., 2013).

CONCLUSIONS

Nutrition of dairy cows in tropical climates is challenging given the lower quality of grasses and legumes grown and cost and availability of concentrates. These challenges are compounded by heat stress conditions that further limit intake and alter nutrient metabolism. The adoption of higher quality grasses supplemented with legumes can improve the quality of native forages to provide improved nutrition in support of improved milk yield. Provision of shade and supplemental forage when cows are not grazing reduces heat stress and provides additional nutrients that can maintain milk yield as heat stress increases. Many improvements in the nutrition of dairy cows have been identified that could be implemented to improve the nutrition of lactating dairy cows and increase milk yield. As summarized by Owen et al. (2012), it is often difficult to determine which technologies will be adopted by dairy producers as other factors often influence adoption. Thus careful consideration should be given to the potential for successful implementation of technologies introduced to producers as well as the science behind them before introduction.

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Feed, Land, and Landscape for Sustainable Animal Production

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ABSTRACT: Livestock is the world’s largest user of land resources, with grazing land and cropland dedicated to the production of feed representing almost 80% of all agricultural land. For sustainable animal production, the discussion of the relationship between livestock, feed, land and land use systems is therefore inevitable especially in the face climate change and variability. Livestock consume pastures, cereals, legumes and by-products and directly impacts on lands through actions such as compaction. They also produce manure and urine that contribute to maintenance of soil fertility and therefore enhance land and land use systems. The livestock produce greenhouse gases and contribute to climate change. Sustainable use resources especially land to support animal production through production of feed is paramount. With the increase in human population and economic growth which has increased preference for animal products, the need for more animal products is higher than before. There is also intensification of monogastric animals which demand for more concentrates compared to pastures that are required for ruminant production. A balance of livestock feed production and land use systems are therefore important for sustainable livestock production. The papers suggest a holistic system in addressing the challenges facing the sector for sustainable animal production.
Food Safety Regulation and Halal Food Issues in Indonesia

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ABSTRACT: As the fourth largest populated country and the most populous muslim country in the world, Government of Indonesia pays high attention to fulfill the people’s demand on not only safe but also halal food. Halal is an integrated part in food safety according to Law No 18/2012 concerning Food. Some technical regulations and guidelines, including those specific for animal origin food product, are established to guarantee safe and halal food production, distribution, retail, and consumption in the country. In particular, National Development Agenda mentions halal and food safety as food attributes that may improve national food products’ added value thus strengthen SMEs and cooperatives competitiveness as well as food sovereignty. Implementation of regulation and guidelines on food safety and halal food assurance in Indonesia involves government, producer, and consumer. The presentation will share some practical experiences in handling halal food scandal in Indonesia in the past years to extract lesson learned so that constructive and corrective action can be made to strengthen the halal food assurance system in particular and food control system in general.

Keywords: food safety, halal food, regulation
Extension System for Livestock Development in Developing Countries: Knowledge Management Application

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Livestock Development in Developing Countries

Smallholder livestock farmers represent almost 20 per cent of the world population and steward most of the agricultural land in the tropics (McDermott et al., 2010). Two-thirds of the world’s domestic animals are kept in developing countries, where over 90 percent are owned by rural small holders. They dominate crop–livestock systems, with livestock playing an essential role in highly diversified livelihood strategies that typically combine crops and livestock with off-farm activities (Ellis and Freeman, 2004; Deshingkar et al., 2008). In Asia and large areas of Latin America and Africa, a major role of animal such as cattle and buffaloes are to provide draught power. The major constraints for improving livestock productivity, where production efficiency is only one-quarter of that in developed regions, include a devastating animal disease burden, a near-ubiquitous shortage of good-quality livestock feeds, rapidly diminishing forage and natural biodiversity, poor access to markets, and unresponsive policy environments.

In agriculturally-based economies, poor rural and urban people with low and slowly increasing incomes will provide much of the increasing demand for livestock products, largely from local informal and domestic markets, because livestock products are not widely traded over long distances (generally less than 10 per cent of livestock products are traded across borders (Staal, 2001)). Smallholder livestock farmers, however, need to be supported in order to be competitive as market forces cause these systems to become more intensive in response to market demands. In many situations, smallholders can be competitive primary producers compared to larger local producers or foreign importers. The competitiveness of smallholders versus the potential for economies-of-scale, tends to differ by commodity and stage of production. It will be argued that livestock production in developing countries must be a looked upon in much broader perspective which places equal, if not more, emphasis on sociological, ecological and political issues instead of being confined to parameters relating only to biological and economic efficiency.

Herrero et al. (2010) developed a typology of livestock systems that provides a measure of intensification potential. This typology integrates a system’s natural resource potential, population density, and market access. The major livestock systems resulting from this classification are: Agro-pastoral and pastoral systems, Extensive mixed crop–livestock systems, Intensive mixed crop–livestock systems, and Industrial systems

Contribution of Livestock to Rural and Sustainable Development

Although largely underestimated, livestock make a major contribution to rural development in developing countries. In traditional livestock systems, livestock contributes to the sustainable livelihoods and security of poor smallholders, giving rise to a variety of outputs in the form of Natural Capital; Financial Capital and Social Capital. They produce food, enhance crop production and provide additional economic goods and services as well as cash income. The inclusion of livestock diversifies and increases total farm production and income, provides year-round employment and disperses risks. Sales of livestock products provide funds for purchasing crop inputs and for financing farm investments. Livestock often form the major capital reserve of farming households.
and, in general, enhance the economic viability and sustainability of a farming system (Steinfeld & Mack, 1995). The manure from animals, particularly from large ruminants, serves as fuel which can be either used in the home or sold or bartered, and can also be used as fertilizer. In addition, animals provides a source of capital to be drawn on as required, especially following crop failure. Livestock, therefore, meet the multiple objectives that the poor thrive to meet.

In many development projects for the rural community, livestock is used as a mean for improving standard of living in rural areas. The importance of farm animals in household asset portfolios and the rapidly growing demand for livestock products in developing countries provide unique opportunities for using livestock as instruments for sustainable intensification and pathways out of poverty. It is, therefore, not a coincidence that the Integrated Sustainable Rural Development Strategy (ISRDS, 2004) identifies livestock farming as the agricultural enterprise with the most likely chance of improving household food security, alleviating poverty, and improving livelihoods in communal farming. The collective concept of livestock has special characteristics that enhance its potential to reduce poverty (World Bank, 2007).

The Role of Extension in Livestock Development

Today, most livestock extension services in Asia and the Pacific more over in developing countries are under the wings of the ministries or department of agriculture insofar as government services are concerned. The privatization of livestock extension service, however, has been in existence ever since in an informal way which means that distributors of veterinary products, feeds or day-old chicks have actually been performing extension work in the promotion of their products and/or services.

Extension methods, as they recognized today in the Asian context, come in three major approaches: individual, group, and mass. The individual approach involves extensionist’s visit to the individual farms usually by appointments or prearranged schedules. On the other hand, the group approach takes the other form of filed demonstrations, training courses, seminars, meetings, and group discussion. The mass aproach entails the production and dissemination of informational materials either through print, broadcast or computer media.

Four major paradigms of Agricultural Extension (Swanson, 2008): Technology Transfer, Advisory services, Non formal education, and Facilitation extension. These paradigms have an important role to play in helping achieve different livestock development objectives.

Technology Transfer – this extension model was prevalent during colonial times and reemerged with intensity during 1970s and 1980s when the Training and Visit (T&V) system was established in many Asian and Sub-Saharan African countries. This “top-down” model primarily delivers specific recommendations from research.

Advisory Services – both public extension worker and private-sector firms, in responding to specific farmer inquiries about particular production problems, still commonly use the term advisory system. In most cases, farmers are “advised” to use a specific practice or technology to solve an identified problem or production constraint.

Nonformal Education (NFE) – in earlier days of extension in Europe and North America, this paradigm dominated when universities gave training to rural people who could not afford or did not have access to formal training in different types of vocational and technical agriculture training. This approach continues to be used in most extension systems, but the focus is shifting more toward training farmers how to utilize specific management skills and/or technical knowledge to increase their production efficiency or to utilize specific management practices.

Facilitation Extension – this approach has evolved overtime from participatory extension methods used 20-30 years ago and now focuses on getting farmers with common interests to work
in direction from the traditional linear model of linking research to extension to farmers, to an emerging new innovative extension model as illustrated in Fig 2.

### Different Extension Models and Approaches

Over time, national governments and donors became increasingly concerned about the performance of national extension systems, and different models have been tried and tested. These approaches are: Technology transfer extension models (ex. Ministry-based agricultural extension or advisory services, Training and Visit extension), Participatory Extension approaches (Animation rural, integrated rural development, farmer-based extension organizations), Market-Oriented (commodity-based advisory systems, innovative, market-driven extension approaches), Non formal Education/Extension Approaches (Farmer field schools, University-based extension).

#### Table 1 Model/approaches of extension by various scholar

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<td>Project approach</td>
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### Alternative Perspectives on Knowledge

Knowledge is defined as a justified belief that increases an entity’s capacity for effective action (Huber 1991; Nonaka 1994). Knowledge may be viewed from several perspectives (1) a state of mind, (2) an object, (3) a process, (4) a condition of having access to information, or (5) a capability. Knowledge has been described as “a state or fact of knowing” with knowing being a condition of “understanding gained through experience or study; the sum or range of what has been perceived, discovered, or learned” (Schubert et al. 1998). The perspective on knowledge as a state of mind focuses on enabling individuals to expand their personal knowledge and apply it to the organization’s needs. A second view defines knowledge as an object (Carlsson et al. 1996; McQueen 1998; Zack 1998). This perspective posits that knowledge can be viewed as a thing to be stored and manipulated (i.e., an object). Alternatively, knowledge can be viewed as a process of simultaneously knowing and acting (Carlsson et al. 1996; McQueen 1998; Zack 1998).

Three major points emerge from the above discussion: (1) A great deal of emphasis is given
to understanding the difference among data, information, and knowledge and drawing implications from the difference. (2) Because knowledge is personalized, in order for an individual’s or a group’s knowledge to be useful for others, it must be expressed in such a manner as to be interpretable by the receivers. (3) Hoards of information are of little value; only that information which is actively processed in the mind of an individual through a process of reflection, enlightenment, or learning can be useful. (Alavi and Leidner, 2001).

Knowledge Management in Organizations

The recent interest in organizational knowledge has prompted the issue of managing the knowledge to the organization’s benefit. Knowledge management refers to identifying and leveraging the collective knowledge in an organization to help the organization compete (von Krogh 1998). Knowledge management is purported to increase innovativeness and responsiveness (Hackbarth 1998). In one survey, the majority of organizations believed that much of the knowledge they needed existed inside the organization, but that identifying that it existed, finding it, and leveraging it remained problematic (Cranfield University 1998). Such problems maintaining, locating, and applying knowledge have led to systematic attempts to manage knowledge. According to Davenport & Prusak (1998), most knowledge management projects have one of three aims: (1) to make knowledge visible and show the role of knowledge in an organization, mainly through maps, yellow pages, and hypertext tools; (2) to develop a knowledge-intensive culture by encouraging and aggregating behaviors such as knowledge sharing (as opposed to hoarding) and proactively seeking and offering knowledge; (3) to build a knowledge infrastructure—not only a technical system, but a web of connections among people given space, time, tools, and encouragement to interact and collaborate.

Knowledge management is the process of transforming information and intellectual assets into enduring value. It connects people with the knowledge that they need to take action, when they need it (Hawkins, 2000). Complementing what Bellinger (2004) stated, abed on Fleming’s as a basis for thought, with the phylsophy of extension, generates a more complex diagram (Fig. 3), to emphasize the position of knowledge management as the basis sub mix to extension and extension, revealing that extension is “maturation in knowledge management” in deed.

Fig.3. Position of extension comparing to knowledge management
Fig. 4. Agricultural extension and knowledge management mix (Mohammadi, 2008).

Fig 4 shows the road maps for voluntary change within the amalgamation of basic agricultural development mix and knowledge management mix.

**Technology-driven Development**

Technology transfer is a two-way flow of technical information and materials among the farmers, researchers and those who disseminate technologies. This definition extends the meaning of extension beyond association with the traditional public sector to involve services provided by other institutions such as non-governmental organisations (NGOs), private firms, educational institutions and producers’ associations. Our definition also implies that technologies are generated by all parties and diffused by all. There is a continuum with no hard boundaries.

Livestock development requires a mix of conditions. Although the precise nature of the mix depends on the context, it usually includes good infrastructure, access to credit, water, land, markets, input delivery, social organization, relevant technology and rewarding prices. As livestock develops, the need for this mix is increasingly met, giving farmers more control over their environment. The greater their control, the more important knowledge and technology become as the major determinants of development. In other words, technology development increasingly drives livestock development, as the other essential conditions are effectively provided for.

As technology-driven development occurs, many developing countries find it impossible to expand alternative employment fast enough to accommodate those leaving the land, moreover, their rapidly growing rural populations increase the pressure on land, reducing farm sizes, number of livestock raised, with each new generation.

**Linking research and technology transfer**

As the number of partners and stakeholders expands the effective linkage of livestock research and technology transfer is becoming more complicated. Greater coordination and synergy between research and technology development will also be required if technologies are to be transferred and impact achieved. The expanding global research system will need greater interaction with development agencies, including multilateral organizations such as FAO and UNDP, trilateral government agencies and NGOs. Developing country governments will also have an increasingly greater say in the research and development activities that take place within their borders. The framework for action must thus tackle the effective linkage of technology transfer with research. NGOs can also play an important role in transferring livestock technologies in developing countries.
They have close contact with producers and their potential to expand delivery of technical services to producers and to participate in field testing activities is high. Many donors are increasingly channeling development support through NGOs.

**Links between Extension and On-farm research**

In most developing countries, agricultural research and extension are separate public institutions with different mandates and different ways of operating. Topdown systems of this kind have functioned reasonably well to meet the demands of resource-rich farmers, as well as those of both large-and small-scale producers of high-value commodities. These farmers have been able to communicate their needs to researchers, either directly or through producers’ organizations, and to assess and adapt the recommendations which come to them through the extension system.

However, the lack of effective links between research and extension institutions has impeded the development and transfer of technology appropriate for small scale, resource-poor farmers, particularly those in low-potential, heterogenous agro-ecological areas. These farmers have no effective organizations through which to make their needs known. Farming System Research (FSR), and especially on-farm research, has been promoted as a way of developing appropriate technology and adapting to the specific agro-ecological and socio-economic conditions of small-scale farmers. Many national agricultural research systems have developed interdisciplinary programs of this kind, with two major objectives: to diagnose needs and constraints at the farm level, and to adapt technologies to the agro-climatic and socio-economic conditions of target producers.

Assessing the effectiveness of linkage mechanisms: The effectiveness of mechanisms linking on-farm research with extension will be assessed in terms of these questions (Ewel, 1990):

1. how well does the mechanism, or group of mechanism, facilitate the flow of informations on farmers’ conditions and needs to researchers – does it improve the system’s responsiveness to teh needs of its targeted clients?
2. How well does the mechanism facilitate the flow of information and techniques from the research system to resource-poor farmers – does it improve the system’s capacity to transfer relevant technology?
3. How sustainable is the mechanism, given the various institutions involved?

**CONCLUSIONS AND RECOMMENDATIONS**

Knowledge management involves distinct but interdependent processes of knowledge creation, knowledge storage and retrieval, knowledge transfer, and knowledge application. At any point in time, an organization and its members can be involved in multiple knowledge management process chains. As such, knowledge management is not a monolithic but a dynamic and continuous organizational phenomenon. Furthermore, the complexity, resource requirements, and underlying tools and approaches of knowledge management processes vary based on the type, scope, and characteristics of knowledge management processes. Agricultural Knowledge Management System and Research Extension Linkage along with on the ground experiences identified few basic benchmarks along with some common useful global principles applicable across nations as possible general framework for agricultural development. In order to be effective, extension organizations need revitalization, intrapreneurship development and being prepared for the foreseeing new changes to come. At the same time, extension agents need knowledge, expertise, and competency to create the right environment for desired changes to occur.

In doing so extension needs to change its mind map sp far, from; materialistic to realistic, participatory to partnership, authoritative to democratic, trickle-down to bottom-up, clientele to
partner, public to strategic, bureaucratic to dynamic, and passive to active. Major improvements in livestock productivity are possible and needed to assist economic growth in developing countries. Research can provide technologies to help achieve productivity increases but transfer of technology is needed to achieve impact. The global research and development community is expanding and new functional modes are required to ensure coordination of the use of resources. We should considers issues related to the role of research in the strategies making up an action framework to promote livestock development and especially effective linkage of research with technology transfer.

REFERENCES


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Structural development of livestock farms in a global perspective

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ABSTRACT: Structural development in agriculture has several international dimensions, and the topic is relevant and important for several reasons. There is a wide range of economic, structural and technological drivers that in a complex context both inhibits and promotes the structural development. The structural development in agriculture and in the livestock sector has obvious international trends, where number, size, concentration, specialization of farms and herds change. While rich countries have fewer and larger farms, the development is just the opposite in a number of developing countries. The rich countries have the lowest concentration and the greatest equality in the structure of ownership, and it illustrates that structural development towards increasing size does not necessarily mean an increasing concentration. In a global perspective a strong correlation between the concentration in the society as a whole and in agriculture is seen. The vertical integration in the form of contract production and cooperative ownership is increasing in several places in the world. Labor emigration from agriculture is also a general feature during economic development, and this will intensify labor productivity and unlock resources for other sectors.

INTRODUCTION

The structural development in agriculture and especially in livestock production has obvious international dimensions, and the topic is interesting and important for several reasons:

First, the structural development becomes increasingly important as an international competitive parameter as trade liberalization removes subsidies, import tariffs and other protective measures. With increasing international competition and fewer ways to protect domestic agriculture, it will be necessary to utilize the advantages within size and economies of scale which the structural development may cause.

Second, in some areas, there are large differences in the structural development between developed and developing countries. The structural pressure is completely opposite in the two areas when it comes to farm size measured as hectares per farm. The general picture is that the farms grow bigger in developed countries and smaller in developing countries.

Third, the structural development will be lagged from country to country. In some pioneering countries the structural development is several years ahead of the developments in other countries. This allows us to use the development of these pioneers to predict the future structural development in other countries. It can also be expected that developing countries at some stage will follow the structural development of developed countries.

Fourth, the structural development measured as the number of livestock per farm shows a relatively uniform international pattern. Farms are smallest in the poorest countries, but the trend towards more and more livestock per average farm is seen everywhere in the world. This means that in particular the livestock sector is a sector where developing countries have opportunities to utilize economies of scale and to gain from structural development.
Fifth, the structural conditions including size, specialization, types of ownership and vertical integration are increasingly important as a result of both technological progress and globalization.

Sixth, it is likely that globalization and liberalization in many ways lead to trends being more uniform seen in a global perspective. With still more consistent and liberal market conditions it can be expected that also farm structures across borders will be more uniform.

**Structural development in agriculture:**

**Definitions and dimensions.** The structural development in agriculture can be defined and described in many different ways. Structural development is more than just the size of the individual farm and the number of farms. Also factors such as specialization, concentration, types of ownership, vertical integration, globalization, etc. help to describe the structure.

In the recent years structural development in agriculture has become an even broader meaning. With a greater focus on vertical integration, structural development now covers all the links in the value chain from research and development, supply, agricultural production to processing, refining, distribution, marketing, retail and consumption. Thus, the entire food system is involved.

The changes now take place in new dimensions, where industrialization and business development are in focus.

A number of factors can be used to describe the structural development of farms:

- **The number of farms** is an important parameter in the structural development of agriculture. While the structural development within developed and within developing countries is rather similar, it is very different comparing developed and developing countries. The development in number of farms is also a trend, which is very visible to the rest of society.

- **Farm size** is also a very visible result of structural development. Although the average conceals a wide spread, and although size can be measured in several different ways, farm size is an important yardstick. Seen in relation to national regulations, farm size is one of the structural parameters which is regulated.

Size can be measured as:
- Land (owned or operated)
- Labor
- Livestock units
- Turnover
- Value added
- Capital

- **Specialization** describes the production setup of individual firms. The specialization is increasing if, for example, there is a shift towards less diversified production on the individual farms. Specialization in livestock production occurs also eg. when we have fewer farms with mixed livestock such as farming with both cows and pigs. Also here we are dealing with a very significant development.
An increasing **concentration** will take place if large farms are securing an increasing share of the total production. For instance one can see whether the 20 per cent largest farms accounts for an increasing share of total production. Similarly, one can see whether the small farms become relatively smaller.

In general, the concentration is becoming more widespread. Concentration takes place on individual farms where the big farms have an increasing share of total production.

Concentration also occurs **geographically**, where production becomes more concentrated in areas that have the greatest comparative advantage. Livestock production can develop very differently from area to area. It is thus characteristic that livestock density has been increasing very much in certain geographical areas.

**Form of ownership** is central as it describes the ownership of the farms. A distinction is made between different types of ownership; private ownership, tenancy, limited liability companies, cooperatives, fund ownership, etc.

**Vertical integration**, including specific contract production highlights the food industry’s connection and dependence on suppliers of raw produce (farmers) and buyers (retail). The entire value chain from research and development right through to the final end user is often involved. With increasing degree of vertical integration, farms more and more become a part of the industrial process, arising from consumers’ demand and traced back through the value chain to the farmers.

**Input factors** in agriculture are also rapidly changing and are also an essential part of structural development. Input factors in this context cover, labor, capital, education, etc. The change is visible by the share of respectively full and part time farms, non-farm earnings, etc.

**Globalization / internationalization** are also sometimes included in the description of structural development. The farms’ relative sales on the export markets often increase over time, and thus an important structural characteristic of the farms changes. Farmers investments in foreign agriculture, cooperation with farmers abroad can also be included in the description of structural development in agriculture.

**Framework for structural development on a global level**

Viewed in a comprehensive and global perspective the size of farms depends on the size of production and the production base (number of animals, hectares, etc.) and the number of farms and farmers. If production increases quickly or if the emigration of farmers from agriculture to other sectors is strong, it may create a development towards increasingly fewer but larger farms.

When it comes to the number of hectares per farm, it is characteristic that the world’s total agricultural arable land is relatively constant. Over the past 50 years, it has only grown by around 10 per cent. Thus, there is no growth or structural driver hidden in this trend of the total agricultural area. When growth in the agricultural population at the same time has been much greater, it will cause a smaller area per farmer and thus a smaller average size of the farms ceteris paribus.
The development is illustrated in figure 1.

When it comes to livestock farms, there has been a much stronger growth. The stock of pigs and cattle in the world has increased by 140 and 60 per cent in the period, and thus there is up front a greater contribution to the structural development of livestock farms. In the same period, the agricultural population in the World increased by 60 per cent. This means that the number of live stock has increased more than the agricultural population and this will ceteris paribus affect the structural development in the direction of increasing livestock farms.

The development of the economically active population in agriculture is very different from region to region. In developed countries there has for many decades been a strong emigration from agriculture to non agricultural industries, while in developing countries there is still an increasing number of farmers, see figure 2.

**Figure 1. Pigs and cattle (stock), rural population and arable land, world total. 1961 = 100**

**Figure 2. Total economically active population in agriculture, 1980-2015**

These two completely different developments are crucial for agricultural structural development in a global perspective. When the number of farmers increases, there will be a smaller agricultural area per farmer, and it will result in still smaller farms and that structural development goes backwards.

**Drivers**

In addition to the overall and global framework behind the structural development one can identify a number of economic, structural and technological conditions, which in a complex context both inhibits and promotes the structural development. Theoretically it is easy to set up a number of causes and drivers of structural change; however, it is much more difficult to demonstrate any statistical causality.
The driving forces behind the structural development are important:

**Firstly**, it will be interesting to clarify the options or instruments you may have to strengthen or restrict the structural development through the agricultural policy.

**Secondly**, it will also be interesting to see to what extent market conditions etc. affect structural development. In that way, you will better be able to explain and predict the agricultural structural development.

In practice it is difficult to identify and document the specific causes of structural development. A Danish research report (Wiborg, T. and Rasmussen, S. 1996) concludes that „it has not been possible to identify factors that particularly affect the structural development in agriculture“.

A study by Huffmann, W. E and Evenson, R.E. (2001) shows, however, that research and development, education, market conditions directly affect structural development, although the entire structure development cannot be explained.

All in all, it should be noted that it is very difficult to prove any causal relations behind the agricultural structural development. This also makes it difficult to detect significant effects of new initiatives, external shocks etc. on the structural development of agriculture.

**Firstly**, there are many permanent and many different impacts on agriculture, where it may be impossible to separate the individual effects and their consequences.

**Secondly**, often there is a long or short period between exposure and a visible consequence. Lags are important in the structural development.

**Thirdly**, agriculture and farms are in general so heterogeneous that responses to the impacts may be very different from farmer to farmer.

**Fourthly**, farmers may to some extend expand and buy farms from non-economic motives. It can be very difficult to incorporate these motives in a empirical explanation of agricultural structural development.

Finally, **fifthly**, a stimulus (e.g. an income increase) may have very different and perhaps opposing effects depending on the circumstances.

As the structural development covers several different conditions, there are also several reasons for this development. Contract production occurs of special reasons, while e.g. changes in forms of ownership or farm structures have other causes.

In the following different causes of structural development in agriculture are identified and analyzed theoretically and statistically.

Based on the theoretical and empirical assessments of the structural impacts on agriculture, a general overview of the causes of structural development in agriculture is given in **table 1**.
Table 1. Structural development in agriculture: Drivers and impacts

<table>
<thead>
<tr>
<th>Driver</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>Increasing emigration, Fewer farms, Larger farms, Increasing concentration, Increasing specialization, More part time farms, Vertical integration.</td>
</tr>
<tr>
<td>Economies of scale</td>
<td>Fewer farms, Larger farms.</td>
</tr>
<tr>
<td>Profit</td>
<td>Decreasing emigration, Increasing immigration, Existing farms grow bigger, Increasing specialization</td>
</tr>
<tr>
<td>Wage trends in non-agricultural sectors</td>
<td>Increasing emigration, Decreasing immigration.</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Increasing specialization, Increasing vertical integration, More part time farms.</td>
</tr>
<tr>
<td>Agricultural legislation</td>
<td>Decreasing vertical integration, Increasing specialization, Limits growth of farm size, Decreasing emigration.</td>
</tr>
</tbody>
</table>

Source: Own presentation

For example, the table shows that economies of scale stimulates the structural development towards fewer but larger farms. At the same time, increasing wages in non-agricultural sectors will result in increasing emigration from agriculture, and this will intensify the structural development. The list is hardly complete, and there will always be exceptions, special cases etc. where other conditions apply.

Number of farms
Structural development measured by the change in the number of farms is largely uniform within the economically developed countries. In developed countries, there is a relatively clear trend towards fewer and fewer farms from year to year, and the trend is seen in many countries. The number of farms in countries like Denmark, Sweden and the United States has thus evolved relatively the same way over the past little century, see figure 3.

As the figure shows, the development in the three countries has been rather uniform. It is also shown that Denmark had an almost constant number of farms up until the early 1960s. This was largely due to an agricultural policy regulation in the form of subdivision of land and public establishment of smallholdings, which slowed the structural development and maintained a relatively large number of farms.

The development was fastest in the United States, which can be explained by the agrotechnical development and mechanization, which was more advanced in the United States, as well as demand for labor in other sectors which pulled labor out of agriculture.
However, over most of the 20th century, the development of agricultural holdings in the three countries remained the same and ended with the same result: The number of farms is reduced to 20-30 per cent in Denmark, the US and Sweden. The industrialization and mechanization of agriculture in the 1950s and 1960s seems to have affected the structural development significantly.

In all EU countries the number of farms has been decreasing year by year. In the period 1990-2010 about 40% of all farms have disappeared, when looking at the EU as a whole, see figure 4.

**Figure 3. Development in the number of farms in selected countries.**

![Figure 3](image)

**Figure 4. Number of farms in the EU, 1975 to 2010.**

![Figure 4](image)

Source: Author's own presentation based on Statistics Denmark, Statistiska Centralbyråns (several issues) and USDA (several issues)

Source: European Commission (several issues)

Whether you look at the EU-9, EU-15 or EU-27, there is a clear trend towards fewer and fewer farms.

It is noteworthy that the development in recent years in particular has been rapid in the least developed countries - including the new EU countries - while the most developed countries have had a far weaker structural development. This is largely due to the fact that in the 1960s to the 1990s the rich countries already had a strong trend towards fewer farms, and therefore the structural pressure was weaker afterwards.

However, for all countries as a whole there has been significant decline in the number of farms in the period.

In a global perspective, the picture is not so clear. On the one hand we have countries which in a relatively uniform way have a development towards fewer and fewer farms a trend that has occurred since the mid1900s.
On the other hand we have the developing countries, where we see the opposite trend namely the emergence of more and more new farms so that the total number of farms is increasing. Demographics, the relatively little emigration away from agriculture and a very small growth in the agricultural area are the main explanations why the structural development is so different in most developing countries.

As an example, major countries like India, Egypt and the Philippines have had a significant increase in the number of farms, see figure 5.

The pattern towards more and more farms can be found in a number of developing countries, including for example Congo, Ethiopia, Kenya and Malawi. Thus, there is a very clear international pattern in which the number of farms is increasing in the poor countries, while falling in the richer countries, see figure 6.

**Figure 5. Number of farms1940 = 100.**

![Graph showing number of farms from 1940 to 2000 for different countries](image)

*Note: India 1950 = 100. Source: Own calculations based on FAO (2013).*

**Figure 6. Per cent change in number of holdings 1990-2000 and GDP per capit**

![Graph showing per cent change in holdings between 1990 and 2000](image)

*Note: Change 1990 2000 or last recent decade with available data. Source: Author’s own presentation based on FAO (2013) and World Bank (2015)*

As the figure shows, that the number of holdings in developing countries is increasing, while it is increasing in the more developed countries. The pattern and correlation can be explained by a number of factors, which are listed in table 1. The emigration of farmers to other sectors in developed countries is a major factor. There are both “pull and push factors”: Labor force is attracted by other sectors with labor shortages, and labor force is pushed out of agriculture because of low payment and use of technology. Utilization of economies of scale and mechanization are also important factors that could explain both emigration and structural development towards fewer and larger farms in the most developed countries.
Size of farms
The average size of farms - measured in several different ways - varies considerably from country to country - even within the EU. The farms in the Netherlands and Denmark, which have relatively high average sizes, is many times greater than in for example Romania - depending on how you measure the size, see table 2.

Table 2. Average farm size in individual countries in EU, 2010

<table>
<thead>
<tr>
<th>Country</th>
<th>Hectares</th>
<th>Dairy cows</th>
<th>Pigs</th>
<th>Output 1,000 €</th>
<th>Added 1,000 €</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>32</td>
<td>46</td>
<td>1,092</td>
<td>203</td>
<td>57</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>12</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>Czech rep.</td>
<td>152</td>
<td>123</td>
<td>477</td>
<td>212</td>
<td>59</td>
</tr>
<tr>
<td>Denmark</td>
<td>63</td>
<td>134</td>
<td>2,598</td>
<td>290</td>
<td>88</td>
</tr>
<tr>
<td>Germany</td>
<td>56</td>
<td>46</td>
<td>459</td>
<td>183</td>
<td>57</td>
</tr>
<tr>
<td>Estonia</td>
<td>48</td>
<td>27</td>
<td>251</td>
<td>47</td>
<td>19</td>
</tr>
<tr>
<td>Ireland</td>
<td>36</td>
<td>58</td>
<td>1,253</td>
<td>50</td>
<td>13</td>
</tr>
<tr>
<td>Greece</td>
<td>5</td>
<td>23</td>
<td>49</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>Spain</td>
<td>24</td>
<td>31</td>
<td>354</td>
<td>44</td>
<td>22</td>
</tr>
<tr>
<td>France</td>
<td>54</td>
<td>45</td>
<td>569</td>
<td>153</td>
<td>63</td>
</tr>
<tr>
<td>Italy</td>
<td>8</td>
<td>35</td>
<td>356</td>
<td>30</td>
<td>16</td>
</tr>
<tr>
<td>Cyprus</td>
<td>3</td>
<td>103</td>
<td>524</td>
<td>19</td>
<td>9</td>
</tr>
<tr>
<td>Latvia</td>
<td>22</td>
<td>6</td>
<td>21</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>Lithuania</td>
<td>14</td>
<td>4</td>
<td>14</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>60</td>
<td>57</td>
<td>598</td>
<td>199</td>
<td>58</td>
</tr>
<tr>
<td>Hungary</td>
<td>8</td>
<td>22</td>
<td>18</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Malta</td>
<td>1</td>
<td>48</td>
<td>543</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>Netherlands</td>
<td>26</td>
<td>75</td>
<td>1,743</td>
<td>370</td>
<td>119</td>
</tr>
<tr>
<td>Austria</td>
<td>19</td>
<td>11</td>
<td>86</td>
<td>49</td>
<td>20</td>
</tr>
<tr>
<td>Poland</td>
<td>10</td>
<td>6</td>
<td>39</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>Portugal</td>
<td>12</td>
<td>27</td>
<td>38</td>
<td>21</td>
<td>7</td>
</tr>
<tr>
<td>Rumania</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Slovenia</td>
<td>7</td>
<td>10</td>
<td>14</td>
<td>16</td>
<td>5</td>
</tr>
<tr>
<td>Slovakia</td>
<td>78</td>
<td>25</td>
<td>55</td>
<td>100</td>
<td>24</td>
</tr>
<tr>
<td>Finland</td>
<td>36</td>
<td>24</td>
<td>657</td>
<td>80</td>
<td>26</td>
</tr>
<tr>
<td>Sweden</td>
<td>43</td>
<td>62</td>
<td>894</td>
<td>92</td>
<td>27</td>
</tr>
<tr>
<td>U.K.</td>
<td>84</td>
<td>78</td>
<td>445</td>
<td>160</td>
<td>57</td>
</tr>
</tbody>
</table>

Source: Author's own presentation based on European Commission (2014)
There is a clear pattern in the direction of, that the largest farms are found in Northern and Western Europe, while the smallest are found in Eastern and Southern Europe. The general picture shows thus that the richest countries have come furthest in the structural development, while small average farms typically are found in the poorest countries. It is remarkable that there are so big structural differences in agriculture, even within the same region and in the same economic and political union. Agriculture operates in the same market and within the same overall market policy framework, yet it is possible to have very large structural differences. The explanation is that between countries there are also major differences in the economic level of mechanization, industrialization, rural emigration, etc., and these differences imply different drivers of structural change. With the current development however, the gaps will gradually be reduced.

The correlation between the size of farms and the countries’ level of economic development can also be found in a completely global perspective: In the poorest countries, farms are small, and they are generally getting smaller over time, while the opposite is seen in the richer countries. In the very global level there is a clear trend towards more and more farmers and others who are economically active in agriculture. As the agricultural land is not increasing much, the agricultural land per farmer is decreasing. This trend is particularly pronounced in the least developed countries, while the developments in the richer countries are going the other way: Here, the agricultural land per farmer is increasing, see figure 7.

Arable land per economically active person in agriculture is an overall way of illustrating farm structure. A more detailed analysis, which examines area per farm, however, provides an almost identical development: The farms become larger in developed countries and smaller in developing countries, see figure 8.

**Figure 7. Farm structure: Arable land per economically active person in agriculture**

![Arable land per person](image)

Source: Author’s own presentation based on Statistics Denmark, Statistiska Centralbyrån (several issues) and USDA (several issues)

**Figure 8. Farm structure: Average number of hectare per holding**

![Average number of hectare per holding](image)

Source: Author’s own presentation based on FAO (2013)
Figure 8 shows the average changes in farm size worldwide, in Europe and in Asia. It is clear that the farm size in Asia and Europe is developing in different directions. In the same period, the average number of hectare per holding in North America increased from 49 to 74, which also confirms the general trend towards larger and larger farms in the most developed countries.

By comparing the countries’ level of economic development and their farm size calculated as both land size and number of livestock per farm - one can see that there is a clear correlation: Farm size and herd size increase with increasing economic development, cf. figure 9.

**Figure 9. Size of farms and herds and GDP per capita**

Note. Data for 2010 or last year with available data. Some countries with deviant position are indicated. Logarithmic scale on both the X and Y axis.

Source: Author's own presentation based on FAO (2013) and World Bank (2015)
Figure 9 shows the size of farms and herds as a function of GDP per capita for up to 140 countries. As the figures show, in particular for livestock there is a clear correlation between countries’ economic welfare (GDP per capita), and the herd size. A few countries deviate from the pattern, but here it is often due to political conditions, which contributes to regulate the structural development.

The figures also show that the correlation is highest for livestock, and that there seems to be no clear correlation for the poorest countries, i.e. countries with GDP <5,000 USD per capita. The correlation seems to be lowest for pig holdings in the poorest countries.

Although use of cross section data, a dynamic interpretation is possible, and we can assume that the development in each country over time will follow the pattern shown in figure 9, as the countries get richer and richer. This dynamic interpretation can be supported by the development, which the size of farms and livestock herds have shown for a long period in developed countries.

In the Western world in general, there has been a very consistent trend towards larger and larger farms - a development that particularly has accelerated in recent decades, see figure 10-12.

**Figure 10. Farm sizes (hectare per farm) in Denmark, USA, Sweden and Canada.**

Index 1920 = 100

Sources: Author’s own presentation based on Statistics Denmark (several issues), Statistics Canada (2009 + 2015), USDA (several issues) and Statistiska Centralbyrån (several issues)

Figure 10 shows that the four countries have had a very uniform development when considering the whole period. The farms have become about 3-4 times as large, although movements in the 20th century have been somewhat different.

When it comes to the developments of the livestock farm size, an almost uniform international
patterns can be observed, see figure 11 and 12.

Figure 11. Number of pigs per herd in Canada, the Netherlands and Denmark.

Figure 12. Number of dairy cows per herd in USA, New Zealand and Denmark.

The figures underline unanimously that countries apparently follow a relatively uniform pattern, when it comes to structural development of livestock farms in a global perspective.

Especially during the last few decades structural changes have taken place, but even over a longer period structural changes in for example pig production has been almost exponential.

The figure has a logarithmic scale on Y axis, and we see that there is an almost straight curve for all three countries over the last decades.

Specialization

The specialization in agriculture - and in many other industries - has been increasing in recent years. Specialization in this context is specialization on the individual farms, whereby production is less mixed, and whereby farmers focus on one single branch of production.

The increased specialization is due to the technological developments that increasingly create economies of scale. Furthermore, the increasing demand for specific knowledge will mean that farmers will focus on fewer and perhaps only a single branch of production.

One example is poultry production, which previously took place on almost all farms. With increasing specialization and division of labor poultry production is now occurring on fewer and fewer farms. The remaining poultry production now takes place on larger and often very specialized farms. The development is not an indication that the poultry production loses importance, but rather an indication of industrialization and specialization.
The development is seen in many places. As an example, **figure 13 shows** the share of farms with poultry in the United States, Sweden and Denmark over a longer period.

The increasing share after 2000 is mainly due to several very small farms with a relatively small number of animals. The general pattern shown in figure 13 can be found in many places in the Western world. Also here there is the trend towards more specialization and less diversified agriculture.

**Concentration**

The concentration can be illustrated by calculating the share of the total production, which the 5 percent or 20 percent largest farms produce. If these largest farms have an increasing share, it is evidence of increasing concentration. The concentration - or rather inequality - can also be measured by the Gini coefficient, see e.g. Hansen (2013).

Increasing concentration in agriculture is a phenomenon in many countries. In the United States 3.8 per cent of farms accounts for 66 per cent of all farms sales, and 37 per cent of the land is owned by 1 per cent of the farmers. In 2012 5 per cent of farms produced 45 million pigs, equivalent to 68 per cent of the total pig production in the US (USDA, several issues).

In these examples, there is a very skewed distribution in which a small part of the farmers have a relatively large share of the total production.

**Figure 14 shows** an example of concentration and inequality in agriculture in different EU countries.

**Figure 13. Share of farms with poultry**

**Figure 14. Concentration and inequality in EU agriculture in terms of land size, 2005**

Note: USA: With chickens, Denmark: With hens, Sweden: With hens, without chickens

Sources: Author’s own presentation based on Statistics Denmark (several issues), USDA (several issues + 1999) and Statistiska Centralbyrån (several issues)

First, the figure shows the concentration and the share of the agricultural land by the 20 per cent...
largest farms. As can be seen, these farms have 45-95 per cent of the agricultural land. Second, the figure also shows the equality in farm size distribution - measured by the Gini coefficient. A small value indicates that agricultural land is distributed fairly equally among farms, while a large value means a great inequality.

The figure shows that there are significant differences in both concentration and inequality among countries in the EU. There is, however, also a relatively significant pattern: The rich countries have the lowest concentration and the greatest equality, whereas the opposite is the case of poorer countries, i.e. in Eastern and Southern Europe.

It also means that structural development towards increasing size does not necessarily cause an increasing concentration. On the contrary, countries with average small farms have the most concentrated structure.

The concentration varies among countries and among continents. You cannot conclude that the concentration depends on the level of countries’ economic welfare. The relationship between concentration and the GDP per capita indicates that concentration is lowest in the very poor and the very rich countries, while the concentration is highest in the middle group, see figure 15.

**Figure 15. Concentration in agriculture (share of 5 per cent biggest farms) and economic welfare per capita in the country**

![Figure 15](image)

Source: Author’s own calculations based on FAO (2013)

Countries with the lowest concentration are Finland, Luxembourg, Switzerland, Norway and Denmark. Nordic countries are characterized by a very equal and unconcentrated agricultural structure.

In a global perspective, Europe - along with Asia and Africa - is characterized by a low concentration, while especially South America has a highly concentrated agricultural structure.

Concentration in agriculture in different continents is shown in table 3.
Tabel 3. Concentration in agriculture

<table>
<thead>
<tr>
<th>Region</th>
<th>Gini</th>
<th>C-50</th>
<th>C-20</th>
<th>C-5</th>
<th>Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>0.51</td>
<td>83</td>
<td>55</td>
<td>28</td>
<td>10</td>
</tr>
<tr>
<td>Asia</td>
<td>0.53</td>
<td>84</td>
<td>58</td>
<td>29</td>
<td>10</td>
</tr>
<tr>
<td>Europe</td>
<td>0.58</td>
<td>87</td>
<td>61</td>
<td>34</td>
<td>10</td>
</tr>
<tr>
<td>North and Central America</td>
<td>0.75</td>
<td>93</td>
<td>79</td>
<td>57</td>
<td>10</td>
</tr>
<tr>
<td>Oceania</td>
<td>0.75</td>
<td>93</td>
<td>79</td>
<td>57</td>
<td>10</td>
</tr>
<tr>
<td>South America</td>
<td>0.80</td>
<td>99</td>
<td>83</td>
<td>62</td>
<td>10</td>
</tr>
</tbody>
</table>

Note: Unweighted average. Obs. = number of observations
Source: Author’s own calculations based on FAO (2013)

Peru, Paraguay and Venezuela are among the key countries with very high concentration in agriculture in South America.

It is obvious that in countries with a very significant agricultural sector, distribution of assets throughout society will depend on the concentration in agriculture. If a very small part of the population owns a large part of the agricultural land, they will also own a significant share of the country’s total assets.

Therefore, for the poorest countries you can expect to find a certain correlation between the concentration and equality on the one hand in agriculture and on the other hand in the total economy.

As figure 16 shows, there is for every country a remarkable strong correlation between the concentration in total society and in agriculture.

Figure 16. Concentration in agriculture and in total society: Distribution of agricultural land in agriculture and of the income of the total society

Note: Gini coefficient for agriculture: Distribution of agricultural land among farmers. The Gini coefficient for society: Income distribution among all the inhabitants.
Source: Author’s own calculations based on FAO (2013) and World Bank (2015).
There must be taken into account that the Gini coefficients for agriculture are calculated based on distribution of agricultural land among farms, while the Gini coefficients for the whole society is calculated based on income - or in some cases on consumption - among all the inhabitants. Despite these methodological differences, there is a remarkable strong correlation.

Even for developed countries, where agricultural incomes and assets only have a very small share of society’s total earnings, there is a close correlation.

**Vertical integration: Cooperatives and contract production**

Cooperatives play an important role in livestock business in many parts of the world. Cooperatives differ from other companies as the owners and users in cooperatives are the same. In the agricultural and food sector, cooperatives are especially prominent amongst dairies and slaughterhouses, i.e. livestock based industries.

The degree of cooperative organization in agriculture and the food industry varies significantly from sector to sector and from country to country, which can partly be explained by the different market conditions, which to a greater or lesser degree stimulate cooperative organization. In the case of cooperatives in agriculture and the food sector, a pattern is apparent in that cooperatives are most widespread in North America, Northern and Central Europe and in Japan and Korea.

Generally, cooperatives – of the formal kind – are most important in the most economically developed countries. Here, cooperatives have a relatively large market share and most farmers are members of one or more cooperatives. Figure 17 illustrates the link between farmers’ membership of cooperatives and the countries’ level of economic development.

*Figure 17. Number of memberships of agricultural cooperatives as a percentage of the agricultural population*

![Graph showing the relationship between GDP per capita and agricultural cooperatives membership as a percentage of the agricultural population.](image)

Note: Farmers can be members of several cooperatives at the same time which is why the percentage can be over 100.

Source: Author’s presentation on the basis of Zeull and Cropp (2004).

The figure shows a relatively clear trend: Cooperatives are less common in the poorest countries, while their prevalence increases concurrently with economic growth.
An important explanation is that the establishment of cooperatives requires a certain level of infrastructure, education and organization, which is not always present in the least developed countries.

It is also noteworthy that the cooperative organization is particularly prominent in the processing activities which are close to agricultural production in the value chain, or where agricultural goods account for a large proportion of total costs.

Contract production, as a common example of vertical integration, regulates the relations between, on the one hand, farmers, on the other, private, cooperatively-owned or public companies, so that it replaces the usual spot market. A contract usually includes price, quantity, quality, credit, etc.

The development during recent decades has shown a tendency towards more and more contract production, see figure 18.

*Figure 18. Agricultural contracts (% of total agricultural production) in USA and EU*

As seen in figure 18 the extent of contract production in agriculture in both EU and US agricultural has increased significantly in the recent decades. The level varies considerably from product to product and from country to country. In the EU, contract production is most widespread when it comes to sugar, peas and poultry production.

For example, in Finland, 80 and 90 per cent of hogs and dairy farms respectively use contracts and this share has been rising (Vavra, P., 2009)

Also in countries outside the EU, the extent of contract production varies widely from country to country and especially from product to product. According to Martinez, S. W. (2007) 70 per cent all pigs in USA were sold through contracts in 2006.
In the US, nearly 90 percent of chicken production was covered by contract production already in the mid-1950s (Martinez, SW, 1999 and USDA, 1999), and the proportion had risen to 97 per cent in 2011, cf. MacDonald, M. (2014). As for turkey production the extent of contract production has increased from 4 per cent in 1955 to 30 per cent today.

The development of contract production in agriculture in a completely global perspective is more difficult to demonstrate, partly because contract production can take many forms, partly because the extent of contract production in many cases cannot be measured statistically. Studies from the US and the EU, however, show a significant increase. In a literature study from Prowse, M. (2012) it was concluded that the expansion of contract farming has taken place in all regions of the world. It was also concluded that contract farming in developing countries has become widespread, and this is due to both supply and demand changes.

On the one hand, contract production is positive because it can reduce transaction costs, improve the efficiency of supply chains, and improve farmers’ access to markets and customers. In particular, it can be beneficial in developing countries where infrastructure and access to markets may be limited.

On the other hand, the use of contracts in a concentrated market with significant market power in favor of the processing industry can be problematic. In these cases, contracts will mostly benefit one part, which will not encourage development of the overall value chain.

Kunkel; Peterson and Mitchell (2009) thus show a number of benefits and disadvantages of contract production in agriculture.

**Specialization between agriculture and the food industry**

The specialization between on one hand agriculture and on the other hand the downstream activities in the value chain is changing in line with economic development in a society: The specialization in the agroindustrial sector will increase.

In a developing country, a significant portion of the supply and processing activity occurs in primary agriculture. In line with economic development, a larger division of labor occurs, so that supply and processing industries take over a significant portion of both the household and agriculture’s food processing.

As can be seen in figure 19, there is a clear tendency for the food industry to take over a greater and greater percentage of the value added in the agro-industrial complex.

This development will also contribute to reduce the direct significance of the agricultural sector as a result of economic development. However, it must be noted, that in developed countries the role of agriculture increasingly occurs as a secondary effect or spin-off in related sectors.

When primary production and processing takes place in two different sectors, it is important to have a strong and coherent value chain, and an effective market for their products. Thus, there is a considerable need for structural development in the form of vertical integration.
Although the food industry will capture an increasing share of the employment and value added from primary agriculture during economic development, also the food industry will normally have a relatively decreasing importance during economic development. This is due to the fact, that increased processing in the food cannot compensate the negative effect of the low food demand growth etc.

The connection between economic development and the importance of the food industry is shown in figure 20. The figure shows that the food industry share of total value added in industry in the poorest developing countries typically accounts for 20-60 per cent, while in the richer part of the world it is typically 5-25 per cent.

**Figure 19. Distribution of value added in agriculture and food industry in OECD countries.**

**Figure 20. The food industry share of total value added in industry as a function of GDP per capita (2010 or latest year with available data)**

Note: Weighted average of 22 OECD countries. Source: Author’s own calculations based on OECD (2015) and World Bank (2015).

Source: Own calculations based on World Bank (2015)

The figure shows the correlation between the level of economic development and the relative importance of the food industry. As shown, there is a clear negative correlation, where the relative importance of the food industry decreases during economic development.

**Input factors**

Input factors in agriculture are rapidly changing, and they are also an essential part of the structural development. It is characteristic that the agricultural labor force has dropped much over many decades, and there is a uniform international pattern where the importance decreases with increasing economic and industrial development.

As seen in figure 21, there is a very clear correlation between economic development and the importance of agriculture in relation to employment.
As the figure shows, the importance of agriculture for employment is declining relatively in line with increasing economic development.

The emigration of labor from the agricultural sector results in provision of labor to other industries. The role of agriculture is thus to make resources available that can create value in other sectors.

Furthermore, the emigration of labor also means, that fewer and fewer people in agriculture can produce an ever increasing amount of agricultural products. Growth of labor productivity, the amount produced in relation to the work effort, is relatively high in agriculture, and it is particularly high in the rich countries with a well-developed agriculture, see figure 22.

**Figure 21.** Agricultural employment’s share of total employment as a function of GDP per capita (2010 or latest year with available data)

**Figure 22.** Agricultural productivity as a function of GDP per capita

The figure shows for each country the relationship between the level of economic development (GDP per capita shown in logarithmic scale) and the agricultural added value (gross factor income shown in logarithmic scale) per labor unit.

As the figure shows, added value in agriculture per labor unit increases sharply with rising economic welfare. This estimate of labor productivity is also an indication of increasing farm sizes in line with economic development.

The very unique correlation is remarkable, since many factors other than just economic development helps to explain labor productivity, added value and structural development in agriculture, see e.g. Huffmann, W. E. and Evenson, R. E. (2001).
Conclusion and concluding remarks

Structural development in agriculture and in the livestock sector is driven both by some overall global conditions (agricultural land, livestock number and rural population) and some more specific factors such as economies of scale and mechanization. Focusing on the land per holding, the structural development is completely opposite in developed and developing countries, as the farms have an increasingly smaller area in developing countries. Looking at the structural development in terms of the average number of livestock per holding, the development is generally more uniform in developed and developing countries.

Industrialization, emigration of labor from rural to urban areas, specialization between agriculture and the food industry, vertical integration in the value chain and high productivity seem to be important drivers of structural change in a global perspective.

In the long run it is expected that the structural development in agriculture in the developing countries will largely follow the same pattern as in developed countries. In parallel with their increasing wealth, industrialization, increasing agricultural productivity and economic development and in parallel declining population growth - emigration from agriculture is enhanced, and it will intensify structural development in agriculture.

Transfer of knowledge and capital from the Western world can significantly contribute to facilitate this development. To the extent that this development can unlock labor for better salaries in other industries and at the same time produce sufficient and cheaper food, it is a positive socio-economic development.

The risk is that the unlocked labor is inapplicable in other sectors and that there is a very unequal and concentrated structure of ownership. This may cause an underclass of landless former agricultural workers who are left over in farming, and who cannot get jobs in the other sectors. It implies that a restrictive land legislation may be needed from both a social and a regional point of view.

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ABSTRACT: Heat stress is a major problem in dairy cattle world-wide. Heat stress has been shown to decrease dry matter intake (DMI), milk production and reproductive success. It has also been shown to increase cull rate and death loss. In hot, humid areas of the United States, the monetary loss for all of these production parameters has been shown to be approximately $676 to 698 per cow per year. Heat stress has also been shown to involve more than just simply decreased DMI leading to decreased milk production. The total metabolism of the animal changes so that amino acids become more important for energy use by the animal. Monitoring of heat stress can be simplified by computing a temperature-humidity index (THI) using data for the area in which you live. Based on current research, cows begin to exhibit stress when that number exceeds 68 and the effect is greater the more hours per day the animal experiences this stress. Historically, we have focused on lactating cows, but new research is beginning to show that dry cows and calves can be affected; sometimes to a greater extent. For example, heat stress of calves has shown effects as much as two years later. Developing a whole-farm plan and prioritizing animals that require intervention is important for minimizing the impact of heat stress. Clean, fresh water that is constantly available is absolutely essential. In addition, a combination of shade, fans and soakers are suggested order to achieve maximal success. Making necessary nutritional changes should be considered. While it is true that you can’t change the weather, you can intervene and create a climate where dairy animals can be comfortable and in return be productive and profitable.

INTRODUCTION

Heat stress is a major problem in dairy cattle world-wide. Heat stress is a physiological condition where the ambient environmental conditions exceed an animal’s ability to dissipate heat effectively. The animal has to use energy to bring its temperature back to a thermoneutral condition. This diverts nutrients away from production and causes health problems. The economic losses due to heat stress in the United States alone were almost a billion dollars for just dairy in 2003 (St-Pierre, 2003). In hot, humid areas of the United States, the monetary loss for all of these production parameters has been shown to be approximately $676 to 698 per cow per year.

Many reviews have been written on the subject (Bernabucci, et al., 2010; Collier, et al., 2006; Collier and Zimbelman, 2007; Kadzere, et al., 2002; Silanikove, 2000; West, 2003). Heat stress has been shown to decrease dry matter intake (DMI), milk production, lying time (Cook, et al., 2007), rumen pH, and reproductive success. Heat stress increases respiration rate, body temperature, time spent drinking, standing, lameness (Cook, et al., 2007), and cull rate and death losses (Vitali, et al., 2009).

Monitoring of heat stress has been assessed using a variety of environmental factors to determine how much stress an animal is experiencing (Mader, et al., 2010). One easy, and well researched, way is by computing a temperature-humidity index (THI) using data for the area in which you live. This is a mathematical equation that takes into account not only temperature, but humidity. There are versions of the equation that use additional variables such as wind speed. In
hot, humid climates, the THI is about 3 units higher than the ambient temperature (Harner, 2015). New research has lowered the level at which a cow shows heat stress from 72 to a daily average of 68 or a minimum daily THI of 65 (Zimbleman, et al, 2009). The effect is greater the more hours per day the animal experiences stress or as milk production increases (Batista, et al., 2015). The interesting thing is that reproduction is compromised at a lower THI of 65 (Garcia-Ispierto, et al., 2006).

Historically, we have focused on lactating cows, but new research is showing that dry cows and calves can be affected; sometimes to a greater extent. This paper will focus on newer developments in heat stress.

**Lactating cows**

Lactating cows experiencing heat stress will decrease DMI, decrease milk production, increase respiration rate and body temperature, have decreased rumen pH and show compromised reproduction.

It has long been assumed that decreased DMI was the major reason for the decreased milk production. Work from the University of Arizona has shown that decreased DMI accounts for only about 50% of the decrease in milk production (Baumgard and Rhoads, 2012; Bernabucci, et al., 2010). Under heat stress conditions, energy metabolism of the cow drastically changes. They found that body fat mobilization is decreased as an energy source and glucose and amino acids from muscle are used for energy (Baumgard, et al., 2006; Baumgard and Rhoads, 2012).

In addition to changes in energy metabolism, increased respiration rate and panting causes decreased –HCO in the blood (Bernabucci, et al., 2010). This leads to further –HCO decreases as saliva is lost to panting. The net effect is less buffering capacity and decreased rumen pH; creating a condition known as acidosis.

**What can you do?**

1. Make plenty of clean water available at all times – emphasis on clean. An article in Feedstuffs (Kertz, 2014) talked about the ratio of water to DMI. It is interesting that the ratio of 4:1 (water to DMI) seems to be a good “rule of thumb” for calves, heifers and cows. Summer heat will increase water needs above this level for all three groups of animals. For example, as ambient temperature increased from 7.2 oC to 18.3 oC and 29.4 oC, water intake for lactating cows increased by 13% and 26%, respectively. Do not short change animals in terms of having clean water available at all times. It is the cheapest nutrient and can have huge impacts on production. If you milk cows in a parlor, then have additional water available as they come from the parlor. Water troughs tend to get very dirty, especially in the hot, humid months. At the very minimum, they should be dumped, scrubbed and cleaned once a week. More often would be better. This is a weak point for many dairy producers.

2. Provide shade for all animals. Be aware of height and orientation to get maximum utilization of this necessary item. Roof height can have an effect on radiant heat load of the animal (Berman and Horovitz, 2012). This point plus point #1 are bare-basic requirements for any type of heat abatement. Provide plenty of space under the shade so that animals have space between them to lie down. Inter-animal heat can have a negative impact on lying cows (Berman, 2014).

3. Provide heat abatement as your budget and circumstances will allow. In hot, humid climates it is recommended that fans and soakers be used together (Berman, 2009; Berman, 2010). Misters will probably not help enough to make them useful; they will increase the humidity of the animal environment. If you have a holding pen for milking cows as groups, this is a key area for reducing heat. Having adequate and reliable water and electricity is important for heat abatement systems to function properly.
There is a cost to implement these systems, but most economic analyses show that the technologies pay for themselves (Horner and Zulovich, 2008), if properly installed and used. Recent research looked at the costs of installing a heat abatement system in a hot, humid area of sub-Saharan Africa (Kawonga and Bewley, 2015). They showed a positive benefit to cost ratio when calculated using local costs and using the net present value (NPV) for a 100-cow dairy, and a 10 year investment horizon. The NPV for investing in heat abatement systems was double that of a low humidity area. This suggests that investing in heat abatement equipment pay for itself.

4. Consider making ration changes that take advantage of high quality forages without using higher concentrations of concentrates (high starch feeds). High starch diets can make the acidosis problem worse. Consider feeding supplements that may help (i.e., yeast products or maybe niacin (Hansen, 2013a; Zimbelman et al., 2010)), but always ask to see the research that supports their claims.

5. Be aware that new technologies are being developed that may work in your situation. For example, there is currently an active area of research looking at using thermal heat exchangers under the freestall bed (essentially a radiator under the freestall bedding). This is a way of cooling cows as they lay in their stalls. Work to this point has shown very positive results in decreasing the temperature of the cow and increasing lying time (Mondaca, et al., 2013; Ortiz, et al., 2015; Perano, et al., 2015).

Dry cows

Heat stress is a bigger problem for cows in late pregnancy than we have given credit to in the past (Tao and Dahl, 2013). Alleviating heat stress during the dry period can have positive impacts.

Cooling heat stressed dry cows results in higher milk production in the subsequent lactation (do Amaral et al., 2009; do Amaral et al., 20011; Tao et al., 2011). Cooling cows during the dry period in Florida, USA, increased production by about 5 to 7 kg (11 to 15 lb) more milk per day for the first 40 weeks postpartum (the study ended at 40 weeks). They also reported that the full effect was seen if cooled for the complete dry period, but cooling for only the last 3 weeks of the dry period showed some improved production. Using $0.44/kg ($20/cwt) as a milk price and an average of 6 kg (13 lb) milk/day for just the 40 weeks of the study, cooling a cow during the dry period would increase income an additional $740 due to milk sales compared with a cow not cooled. For 100 cows that is $74,000.

Cows that are cooled during the dry period eat almost 1.8 kg (4 lb) dry matter per day more than heat stressed cows (Tao et al., 2011) and maintained body weight and condition. Heat stressed dry cows had reduced bodyweight gain and body condition score.

Heat stressed dry cows had reduced immune function or the ability to combat disease/infections and cows that were cooled had improved (stronger) immune function. The improvement was with white blood cells, neutrophils, and immunoglobulin G (Tao and Dahl, 2013). In one study (Thompson, et al., 2012), a group of cows heat stressed and cooled during the dry period were injected during lactation with S. uberis, a mastitis-causing organism. The cooled cows had a greater immune response to the challenge and less problems than the heat stressed cows.

Recently it was found that heat stressed cows at early dry off had a reduced ability to undergo mammary involution, which they suggested leads to lower milk production in the next lactation (Ramirez-Lee, et al., 2015).

What can you do?

The same list as for lactating cows should be considered. Some experts feel that if you can only afford one group of cows for heat abatement, maybe you should consider this group.
Calves

Calves born to heat stressed cows were smaller at birth, and were still smaller a year later (Tao and Dahl, 2013). Part of this may be because heat stressed cows gave birth earlier than cooled cows. Calves that are heat stressed also have lower rates of gain (personal experience; Tao and Dahl, 2013). Heat abatement for calves has positive effects on daily growth (Das, et al., 2011).

Heat stressed calves had lower milk production and decreased reproductive success when they began to lactate 2 years later (Monteiro, et al., 2013; Tao and Dahl, 2013). Compared with cooled cows, calves from heat stressed cows left the herd at higher levels before puberty, needed more services per conception to get pregnant and produced less milk during their first lactation (about 4.54 kg (10 lb) per day less).

Calves born to cooled cows had increased blood concentrations of IgG and greater apparent efficiency of absorption of Ig’s from colostrum (Tao, et al., 2012). Calves born to heat stressed cows had decreased immune functions (Tao, et al., 2012).

What can you do?

Provide access to shade and clean water at all times. If calves are in hutches, prop up a corner to increase air flow through the hutch. Provide heat abatement for their dams before the calf is born.

Reproduction/Bulls

Reproduction is compromised during heat stress (Hansen and Arechiga, 1999; Jordan, 2003). Conception rates decreased as the THI increased (Morton et al., 2007). Heat stress increases the number of inseminations required before an animal conceives. Heat stress at conception can also decrease milk production and reproduction once the animal begins to lactate two years into the future (Pinedo and DeVries, 2015). Cooling heifers using sprinklers and fans for a short time before insemination has been shown to increase pregnancy by 33% (Moghaddam, et al., 2009).

Bulls used for natural service are also affected by heat stress. Heat stressed bulls have decreased fertility and spermatozoa which leads to decreased pregnancy rates (Bernabucci, et al., 2010). The situation is worse because it may take 6-8 weeks (assuming he is cooled sufficiently) before fertility returns (Shinde, et al., 2014). If you use bulls, do not neglect to cool them during the summer or fertility will be compromised.

One reproductive technology that seems to work during heat stress is embryo transfer (Hansen, 2013b). Oocytes are susceptible to heat stress for several days after ovulation and will not develop. However, by day 6 to 8 after ovulation, oocytes have developed heat tolerance and can be collected, fertilized and put back into cows with good pregnancy rates. This is not always an option for many dairy producers, but it is a technology that does work under high heat and humidity.

CONCLUSIONS

The data strongly suggests that cooling all animals on the dairy (lactating and dry cows, calves and bulls) will result in increased production, decreased health issues, and improved calf production. Developing a whole-farm plan and prioritizing animals that require intervention is important for minimizing the impact of heat stress. While it is true that you can’t change the weather, you can intervene and create a climate where dairy animals can be comfortable and in return be productive and profitable.
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Antimicrobial Peptides Expression for Defense System in Chicken Gastrointestinal and Reproductive Organs

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ABSTRACT: Maintenance of animal health is essential to obtain their maximum productivity and safe products. Avian β-defensins (AvBDs) are the member of antimicrobial peptides, and Toll-like receptors (TLRs) are the primary receptors that recognize pathogen-associated molecular patterns (PAMPs) of microbes. The aim of this study was to characterize the innate immune system with the focus on the expression of AvBDs in the gastrointestinal tract and reproductive organs for the strategy to enhance the disease resistance of chickens. The proventriculus and cecum of broiler chicks expressed TLRs and AvBDs. It is suggested that a variety of PAMPs of microbes are recognized by different TLRs, probably leading to regulate the synthesis of innate immune factors including AvBDs. In laying hens, TLRs and AvBDs were expressed in the theca and granulosa layers of ovarian follicles and in the oviduct. In vivo LPS challenge increased the expression of several AvBDs in the theca tissue. In contrast, in the cultured theca tissue, LPS upregulated the expression of IL1β and IL6, but did not affect the AvBDs expression; whereas IL1β upregulated the expression of the AvBD12 gene and protein. It suggests that LPS of Gram-negative bacteria are recognized by TLR4 to induce the IL1β expression, and then IL1β upregulates the AvBD expression in the infected tissues. The expression of AvBDs, IL1β and IL6 in the vagina was upregulated by Salmonella and LPS challenge. Meanwhile, the AvBD1 and 3 expression was upregulated by IL1β, suggesting that the synthesized IL1β may participate to induce AvBDs. The results of this study suggest that innate immune system with TLRs and AvBDs is developed in the chicken gastrointestinal tract and reproductive organs. Improvement of innate immune functions by AvBDs in chickens may be one of the important strategies for enhancing the disease resistance in chickens.

Keywords: Immunodefense, Gut, Reproductive organs, Antimicrobial peptides

INTRODUCTION

Maintenance of animal health is essential to obtain their maximum productivity and safe products. The intestine and reproductive organs could be susceptible to various bacterial and viral pathogenic agents. Salmonella organisms in feed that may enter the chicken gastro-intestinal tract are one of the most common risk factors responsible for food-borne diseases in humans. They may be incorporated by macrophages in the intestinal mucosa, and may be transferred to the ovary and oviduct. The contamination of eggs by Salmonella typhimurium may also lead to vertical infection and increase the mortality of embryo and chicks. The tropical environment may cause heat stress that affects the immune functions of animals through the endocrine system of the hypothalamus, pituitary and adrenal gland. Global warming may facilitate this problem in animal production. The usage of antibiotic agents must be regulated for the food safety. We expect the enhancement of innate immune functions by AvBDs in chickens may be one of the important strategies for enhancing the disease resistance of animals.

Avian β-defensins (AvBDs) are the member of antimicrobial peptides involved in the innate immune system. Fourteen AvBD genes have been identified in chicken (AvBD1 to AvBD14) (van Dijk et al., 2008), and they are believed to kill a wide spectrum of microorganisms including Gram-
positive and Gram-negative bacteria, protozoa as well as some fungi and enveloped viruses. Thus, they may have efficacy to protect the tissues from infection by unforeseen pathogenic microbes. The innate immune response including expression of AvBDs and cytokines is initiated by the interaction of pathogen-associated molecular patterns (PAMPs) of microbes with their recognition receptors (PRRs). Toll-like receptors (TLRs) are the primary receptors that recognize PAMPs. In chickens, the TLR1 to -5, -7, -15 and -21 have been identified (Brownlie and Allan, 2011). TLR2 forms a heterodimer with TLR1 and recognizes peptidoglycan, lipoteichoic acid and lipoprotein of the Gram-positive bacterial cell wall. TLR3 and TLR4 recognize the double-stranded RNA of infectious viruses and lipopolysaccharide (LPS) of Gram-negative bacteria such as *Salmonella* and *E. coli*, respectively. TLR5 and TLR7 interact with bacterial flagellin and single-stranded RNA of viruses, respectively. TLR15, a unique chicken TLR, recognizes the non-secreted, heat-stable component of both Gram-negative and Gram-positive bacteria, and secreted virulence-associated fungal and bacterial proteases. TLR21 recognizes unmethylated CpG oligo-DNA of microorganisms.

The aim of this study was to characterize the innate immune system with the focus on the expression of AvBDs in the digestive and reproductive organs for the future strategy to enhance the disease resistance of chickens.

**Identification of TLRs and AvBDs expressed in the gastrointestinal tract of broiler chicks**

The expression of all TLRs (TLR1.1 and 1.2, TLR2.1 and 2.2, 3, 4, 5, 7, 15, and 21) was identified in both the proventriculus and cecum of Chunky broiler chicks. A total of 7 AvBDs (AvBD1, 2, 4, 6, 7, 10, and 12) were identified in the proventriculus and 8 AvBDs (AvBD1, 2, 4, 5, 6, 7, 10, and 12) were in the cecum, respectively. Thus, it is suggested that a variety of PAMPs of microbes are recognized by different TLRs, probably leading to regulate the synthesis of innate immune factors including AvBDs. The immunoreactive (ir)-AvBD12 was localized in the surface epithelium and the cells in the connective tissues of proventricular glands. In the chicks given with probiotics for 2 weeks, the expression level of AvBD12 in the proventriculus was not different between probiotics group and control chicks, whereas the ir-AvBD12 density in the surface epithelium was significantly lower in probiotics chicks than in control chicks. These results suggest that, although probiotics-feeding does not affect the gene expression of AvBDs, it may stimulate AvBD12 secretion from the surface epithelium of the proventriculus in broiler chicks.

**Expression of TLRs and AvBDs in the hen ovary**

We have identified the expression of TLR2, 4, 5 and 7 in the theca layer, and TLR4 and 5 in the granulosa layer of hierarchal follicles of laying hens. In the study of Michailidis *et al.* (2010), the hen ovary expressed TLR1.2, 2.1, 3 to 5, 7, 15 and 21. We have shown that experimentally inoculated *Salmonella enteritidis* were localized in the theca and granulosa layers. It is possible that the LPS, flagellin and CpG-ODN of *Salmonella* bacteria are recognized by these TLR4, 5 and 21 in the ovarian and follicular tissues. We have also identified the expression of 6 AvBDs in the theca and 4 AvBDs in the granulosa layer of follicles. Injection of birds with LPS increased the expression of several AvBDs in the theca tissue. In contrast, LPS upregulated the expression of IL1β and IL6, but did not affect the expression of AvBD10 and -12; whereas IL1β upregulated the expression of the AvBD12 gene and protein in cultured theca tissue. It is assumed that LPS of Gram-negative bacteria are recognized by TLR4 to induce the expression of IL1β, and then IL1β upregulates the AvBD expression in the infected tissues. Thus our results suggest that innate immune system to recognize PAMPs through TLRs and to synthesize proinflammatory cytokines and AvBDs are developed in the ovarian follicles. This innate immune system may play roles in the local immunodefense against infection by Gram-negative bacteria including *Salmonella* bacteria in the follicles.
Expression of TLRs and AvBDs in the hen oviduct

Salmonella organisms phagocytized by macrophages in the intestine may be transported not only to the ovary but to the oviduct through the blood stream and colonize there. Also, microorganisms colonizing the cloaca may ascend the oviduct through the vagina and uterus. Thus, the immune system in the vagina play important role to protect the oviduct from infection. The studies of our group and Michailidis et al. (2011) identified the expression of all types of TLR in the oviduct of laying hens.

The expression of 11 AvBDs was identified in the oviduct of laying hens. The expression of AvBDs, IL1β and IL6 in the vagina was upregulated by Salmonella infection and by LPS challenge. Stimulation by poly(I:C) (viral dsRNA), flagellin (flagellum of bacteria) and CpG-ODN (microbial DNA), which are the ligands of TLR3, 5 and 21, upregulated the expression of IL1β and IL6, but not AvBDs in the cultured uterus or vaginal mucosal cells. Meanwhile, the expression of AvBD1 and 3 was upregulated by IL1β in the cultured vaginal cells. Thus, the synthesized proinflammatory cytokine, IL1β, may participate to induce AvBDs. It is suggested that the innate immune system composed of TLRs, proinflammatory cytokines and AvBDs plays roles in the mucosal defense against pathogenic microbes in hen oviduct.

We have identified the ir-AvBD3 on the surface of fibers forming the outer layer of the eggshell membrane, and ir-AvBD3, -11 and -12 in the eggshell matrix. These AvBDs are probably secreted from the cells in the isthmus or uterus to the eggshell membrane and eggshell. It is assumed that these AvBDs play roles also in protection of eggs from invading microbes.

CONCLUSION

Pathogenic microbes often appear in the poultry farm, and appearance of unforeseen microbes may be increased under the global warming environment. Improvement of innate immune functions by AvBDs in chickens may be one of the important strategies to prevent the infection by them since AvBDs are believed to have antimicrobial activity to a wide spectrum of microbes. The current study confirmed the AvBDs synthesis in the gastro-intestinal and reproductive organs, whereas they could be expressed in the other organs. Breeding and feeding management such as probiotics may be considered for the strategy to improve their expression.

ACKNOWLEDGEMENTS

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Improving Technology Adoption and Sustainability of Programs to Increase Bali Cattle Productivity in West Nusa Tenggara Province, Indonesia

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ABSTRACT: Programs to increase productivity of Bali cattle should be based on results of research projects conducted locally, as they have been proven to better suit the socio-economic and biophysical conditions. There have been many research projects conducted on improving productivity of Bali cattle in West Nusa Tenggara Province. These research outcomes provide options for local government authority to develop evidence-based programs that better suit local conditions and can be expected to have greater impacts. Unfortunately, these readily available options have not been seriously explored by local authority due to limited understanding of the comparative advantages of the innovations, hence there were no adequate support from national government. Some outstanding innovations have been demonstrated in small and medium scale in the farmer situation has proven to improve the cattle production capacity. An integrated village management system (IVMS) was introduced to match local biophysical conditions with biological cycle of the cattle and succeed in increasing the cattle productivity (Panjaitan 2008; Dahlanuddin et al, 2011; Sutaryono, 2008; Dahlanuddin et al, 2014). Key to the success is the simplicity of the innovation so it can be adopted easily by the farmer to solve complex problem (Poppi et al, 2011). These innovations have not been widely exposed to the beneficiary stakeholders because has not been incorporated into government program. There were some innovation incorporated into local government programs such as Bali cattle breeding programs in NTB, Mass leucaena planting program in Sumbawa, Master Plan for pasture improvement in Sumbawa, but none of the innovations were implemented as a complete package, hence it is fail to produce as an expected outcome. Incorporating of the innovations into local government programs so far is not effective because local authority is unable to make local programs as part of the national program so the scale out of the innovation is limited. Engaging farmers with private sectors is proposed to be an option to improve beef cattle production, farmer income and sustainability of the industry.

Keywords: Bali cattle, innovation, government program, adoption

INTRODUCTION

Improving productivity of Bali cattle (Bos javanicus) is a strategic national program as Bali cattle is one of the most important native cattle of Indonesia. Martojo (2012) suggests that Bali cattle are the most suited cattle breed for the smallholder farmers in Indonesia.

Programs to improve productivity of Bali cattle should be based on results of research projects conducted locally as they have been proven to better suit the socio-economic and biophysical conditions. These local specific innovations also built upon local wisdoms and practices so they can be easily adopted by the farmers as they solve limitations and barriers to improving cattle productivity in the region.

In the last 15 years, there have been many research projects conducted on improving productivity of Bali cattle in West Nusa Tenggara Province (Nusa Tenggara Barat, NTB) involving
many national and international agencies and funding bodies. These research outcomes provide options for local government authority to develop evidence based programs that better suit local conditions and can be expected to have greater impacts. Unfortunately, these options have not been optimally utilised due to limited understanding of the local government on the comparative advantages of the innovations.

At demonstration level, the innovations have changed farmer practices towards better cattle management systems that resulted in increased productivity. Due to simplicity of the innovations farmers do not necessarily require more inputs and dramatic changes from the common farming practices.

To scale out and sustain these practice changes, there is a need to identify incentives of each stakeholder to improve adoption of these innovations and build them inherently into government programs. A multi-stakeholder approach needs to be established to develop business enabling environment so that all parties can gain benefits from beef cattle industry.

This paper discusses opportunities and challenges in improving adoptions of appropriate innovations and sustainability of programs to improve Bali cattle productivity in west Nusa Tenggara Province.

1. Local specific innovations on improving Bali cattle productivity in NTB

Since 2000, there have been a series of research projects conducted to improve Bali cattle productivity in NTB. These projects have been reported to significantly improve Bali cattle productivity and consequently farmer incomes. An integrated village management system (IVMS) was introduced to match local biophysical conditions with biological cycle of the cattle to increase efficiency of available resource utilization to optimize cattle productivity. They components of this innovation are controlled mating and early weaning of calves. Its supporting components include mating of cows with selected bulls, stimulating cows to shorten post partum anoestrous and better feeding for newly weaned calves. Panjaitan et al (2008) reported that implementation of the IVMS markedly improved Bali cattle productivity in Kelebuh village central Lombok, indicated by high rate of conception (70-80 pregnancy rate per mating), calving to conception interval averaged 70 days, 80% of first lactation heifers and 90% of mature cows reconceived by the end of the controlled mating period. This enables 80% of cows to wean a calf and improve the weaning weight of 6 months old by 20 kg.

Similar improvements have also been reported by Dahlanuddin et al (2011) when the IVMS concept was scaled out to 36 farmer groups in central Lombok district. In this scale out project, the calving rate was recorded at 87%, calf birth weight averaged 16 kg, the mean calf mortality was 4.8% and the mean weaning weight was 90 kg. These records are much better that the corresponding values of 52% for calving rate, 12.7 kg for birth weight and 15% for calf mortality reported by Talib et al. (2003).

The combination of improved reproduction and feeding management enabled male Bali cattle to reach slaughter weight 6 months earlier. Panjaitan et al (2008) reported weight of Bali cattle at 18 months of age in Sukadamai Dompu reached 185 kg. In addition Sutaryono (2008) elaborated that farmers adopted the use of tree legumes such as Gliricidia sepium and Leucaena leucocephala that cow liveweight increased steadily from mid-late wet season to mid dry season in response to availability of adequate supplies of good quality forage of shrub legume such as G. sepium and L. leucocephala as both dry season fodder banks and “living fences”. Further use of Leucaena tree legume for cattle fattening in Sumbawa (Panjaitan et al., 2013) and Sesbania grandiflora in Lombok (Dahlanuddin et al, 2014) has successfully doubled growth rate male Bali cattle. This improvement was due to adoption of a participatory farming
systems approach (Lisson et al., 2010), which is easily adopted by farmers because it relies on simple technology to solve complex problems (Poppi et al., 2011). These examples demonstrate a huge opportunity to improve Bali cattle productivity and farmer income but this practice has not been incorporated into government program that limit the scale out of the practice.

2. The development of local government programs based on research outcomes

To enhance the effectiveness of local government programs on cattle development, appropriate innovations were communicated to the local government to be incorporated into their development programs. The expected outcomes of this initiative are a) government have suitable programs that can be effectively implemented by relevant institutions to support cattle development programs (change in functioning), b) farmers are motivated to improve cattle productivity and quality (change in circumstances) and c) farmers use recommended technology in cattle production and benefit from increased cattle price due to improved quality (change in attitude). Below are some examples of programs developed based on research outcomes.

2.1. Bali cattle breeding programs

West Nusa Tenggara province is the most popular source of Bali cattle breeding stocks because Bali cattle in NTB are free from contagious strategic diseases especially Anthrax, Brucellosis and Septicaemia Epizootica (Anonymous, 2009). The supply of Bali cattle breeding stocks in NTB have never been able to fulfill the increasing demands. Innovations to increase productivity and quality of Bali cattle breeding stocks are available to increase production but these innovations have not been incorporated into government programs. An approach on how to develop government policy and program based on research outcomes has been facilitated by an AusAID funded initiative (Dahlanuddin et al., 2010). This project successfully produced; a) Strategic plan for Bali cattle breeding in NTB province, b) Governor decree on Bali cattle breeding program, c) Recommended price for Bali cattle breeding stocks based on grade and d) Central Lombok Bupati decree on collective housing system for cattle development. These local government policies were established to ensure that programs to improve Bali cattle productivity can be implemented to improve farmer income.

This initiative is an incentive tool to motivate farmers to produce high quality Bali cattle breeding stocks and create business enabling environment to attract private sectors to invest in Bali cattle breeding industry. The price incentive based on cattle quality was regulated to stimulate farmers to implement better management practices. Conducive business environment is expected to attract private sector investment, to improve the industry scale, to create jobs and significantly increase economic impact.

These programs and policies have not been effectively implemented because the local government authority unable to incorporate these regional programs as part of national program. Most of local government programs on cattle development are funded by national government and only a small proportion of the budget come from the local government. Consequently, local government programs will only be funded if they are listed in the national budget.

2.2. Mass leucaena planting program in Sumbawa

Successful demonstration of leucaena based cattle fattening system attracted Sumbawa district government to launch the mass leucaena planting program to overcome feed scarcity in the region especially during the dry season. The local government expected
that this will encourage the community to plant leucaena especially in the less utilized dry land. The ultimate objective of this program is to increase live weight gain of Bali cattle and eventually improve farmer incomes from cattle production.

In the implementation, however, this program failed to adopt the complete package which consists of improving awareness of the farmers on why we need to plant leucaena, technical capacity building for leucaena nursery, seedling transplanting, plant management and the use of leucaena as cattle feed. This program has been merely a leucaena seed distribution program and most of the seeds distributed did not planted properly resulting in a poor survival and growth of leucaena.

This program also has lack of resource because it is not sufficiently budgeted costs for capacity building of staff (trainers) to properly train farmers how to establish cattle fattening system based on leucaena.

2.3. Master Plan for pasture improvement in Sumbawa

A Master Plan to develop a cattle production in Limung area of Sumbawa district has been established to improve cattle productivity. This area has been supported by national government to be developed as a model for extensive cattle production system in Sumbawa.

The starting point to develop this program was lack of feeds and drinking water for cattle. Programs and activities were developed based on participatory approach and utilizing documented best practices exist in the area. To improve cattle productivity, proven management and feeding practices have been use as the basis for developing activities. To ensure availability of high quality feeds all year round, it was recommended that drought tolerant tree legumes and grasses to be established and to conserve excess forages for use in dry season when feeds are scarce. This approach followed by improving the awareness of the farmers and strategic capacity building activities.

However, most of the resources were spent on building infrastructure such as deep well pump, feed barn, compos processing unit which are not effectively functioning. Not enough resources are spent on establishing tree legume forages as recommended and to improve awareness and capacity of the farmers to implement good management and feeding practices.

3. Future option - A market-led approach to improve technology adoption by Bali cattle farmers

The NTB government is highly motivated to create added values from beef cattle within the region. The priority of the local government is to stimulate processing of beef cattle that require cattle to be slaughtered locally and sell end products. This means reducing export of live beef cattle to other provinces. This is a very good initiative as price of beef cattle in Jakarta (the biggest market) is sometimes similar to the price of live cattle in NTB so there is no margin for the traders. However, selling boxed beef to Jakarta is equally difficult as beef from NTB has to compete with imported beef.

The only opportunity for NTB beef to be competitive in Jakarta market is to make it a special beef that has competitive advantages over exported beef. A Jakarta based beef company has been successfully marketing Sumbawa beef as being natural, healthy and halal. The sale volume is restricted by availability of suitable beef cattle to be slaughtered. Therefore this company has the motivation establish mutual partnership with the farmers to adopt appropriate
technologies to improve productivity and quality of local beef Bali cattle.

To synergise the needs of the farmers, private sector and the government, a multi-stakeholder program to improve beef cattle productivity and beef quality will be carried out using outcomes of various research activities conducted in the region. The main focus of the program is to improve farmer capacity to adopt technology and innovations, and to ensure market and pricing transparency through the engagement of farmers with private sector.

The cattle price will be developed to take into account of the quality aspects of beef cattle such as live weight (higher price per kg live weight for heavier cattle) and weight for age (higher price for cattle which reach slaughter weight at younger age) and higher price for cattle with higher dressing percentage. This pricing system should be supported by good recording system at farmer group level. This pricing system is expected to motivate farmers to improve quality of their beef cattle and to maintain good partnership with the company. Successful implementation of this farmer-private sector engagement will increase sale volume (and profit) of this company. Selling this special beef at premium price will enable the company to buy beef cattle from farmers in cash and at a competitive price.

The government roles in this partnership providing necessary facilities that can not be provided by the private sector and the farmers. This may include slaughter house, road, transportation and electricity. The government should also develop regulations that ensure mutual benefit of farmers and the private sector to sustain the industry.

**CONCLUSIONS**

Local specific innovations based on proven long term research are available to be used for improving Bali cattle productivity in NTB. However these innovations have not became the basis to develop regional programs to boost cattle production. Incorporating of the innovations into local government programs so far is not effective because local authority is unable to make local programs as part of the national program so the scale out of the innovation is limited. Engaging farmers with private sectors may be regarded as an option to improve beef cattle production, farmer income and sustainability of the industry.

**REFERENCES**


Martojo, H. (2012), Indigenous Bali Cattle is Most Suitable for Sustainable Small Farming


The Role of Family Poultry Systems in Tropical Countries

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ABSTRACT: Family farming includes all family-based agricultural activities, and it is linked to many areas of rural development in tropical countries. It is the predominant form of agriculture in the food production sector in both developing and developed countries. The term “Family poultry” used to describe the full variety of small-scale poultry production systems that are found in rural, urban and peri-urban areas in tropical countries. Whereas, the term “Poultry farming” refers to the raising of domesticated birds such as chickens, turkeys, ducks, and geese for the purpose of farming meat or eggs for food. Poultry are farmed in great numbers with chickens being the most numerous around the world. Chickens raised for eggs are usually called layers while chickens raised for meat are often called broilers. Chickens are also the most frequently commercialized of all these birds. Family poultry farming makes a significant contribution to poverty alleviation, food security, HIV/AIDS mitigation, empowerment of women and wildlife conservation in many countries. In most tropical countries which mainly dominated by developing countries, indigenous poultry genotypes constitute up to 80 percent of the poultry populations that are kept in villages. The birds largely subsist on scavenging in gardens, village alleys and surroundings of the farms by feeding on crop residues, insects, worms and green forage. While for the poor members of society this system provides a subsidiary income, the present dimensions of traditional backyard poultry production have changed drastically and crossed the boundaries of the economically weaker sectors.

Keywords: Family poultry farming system, Tropical countries

INTRODUCTION

Family farming includes all family-based agricultural activities, and it is linked to many areas of rural development in tropical countries. It is a means of organizing agricultural, forestry, fisheries, pastoral and aquaculture production which is managed and operated by a family and predominantly reliant on family labour, including both women’s and men’s. It is the predominant form of agriculture in the food production sector in both developing and developed countries. It is an integral component of the livelihoods of poor rural households, and is likely to continue playing this role for the foreseeable future. It makes a substantial contribution to food security and poverty alleviation in many countries around the world and thus represents a major contribution towards achieving Millennium Development Goal (MDG) (halve the number of poor people in the world by 2015). It also contributes to achieving the MDGs with respect to gender equity and women’s empowerment and promoting the well-being of rural populations.

In particular, the term “Family poultry” used to describe the full variety of small-scale poultry production systems that are found in rural, urban and peri-urban areas of tropical countries which mainly dominated by developing countries. The term is used to describe poultry production
that is practised by individual families as a means of obtaining food security, income and gainful employment. Being called ‘Family poultry’, ‘Smallholder poultry’, ‘Scavenging poultry’, or “Village poultry” the different systems of poultry rearing with various levels of intensification are now adopted by poor, marginal as well as richer members of the society with intensification according to their economical status and requirements. It is also well known that the term “Poultry farming” refers to the raising of domesticated birds such as chickens, turkeys, ducks, and geese for the purpose of farming meat or eggs for food. Poultry are farmed in great numbers with chickens being the most numerous around the world. Chickens raised for eggs are usually called layers while chickens raised for meat are often called broilers. Chickens are also the most frequently commercialized of all these birds (Henuk, 2015). The role of family poultry systems in tropical countries are described in the following sections.

Characteristics of the family poultry farming system

There are four broad well recognized family poultry farming system as identified from Henuk (2015) are (1) Free-range extensive system, (2) Backyard extensive system, (3) Semi-scavenging system, and (4) Small-scale intensive system (Tables 1 and 2). Family poultry farming makes a significant contribution to poverty alleviation, food security, HIV/AIDS mitigation, empowerment of women and wildlife conservation in many countries. They makes up to 80 percent of poultry stocks in low-income food-deficit countries of developing countris where owners raise poultry in small numbers ranging from single birds up to a few hundred. In general, for a husbandry system to be considered as less intensive or ‘alternative system’, it should be: (1) less confining – birds kept in cages should have more room to get up and lie down fully; (2) less crowded – birds in pens should be kept in smaller groups and with more floor area per bird; and (3) better able to meet the bird’s food and perching requirements. In other words, free range poultry can also be considered as less intensive or ‘alternative system’ (Figure 1; Bailey et al., 2010; Henuk, 2015).

![Figure 1. Housing systems for ‘alternative systems’ of poultry husbandry (from Henuk, 2015: 251).](image)
Table 1. The four broad well recognized family poultry farming system (from Henuk, 2015: 250).

<table>
<thead>
<tr>
<th>Production systems</th>
<th>General description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free-range extensive system</td>
<td>The birds are not confined and can move over a wide area for scavenging. Shelters may or may not be used. The birds usually roost in trees and nest in the bush. It is nowadays getting less common.</td>
</tr>
<tr>
<td>Backyard extensive system</td>
<td>Poultry are housed at night and are allowed to scavenge during the day. Farmers usually provide grains, grain by-products and kitchen waste etc. in the morning and/or evening to supplement scavenging. This is the most widely followed by farmers of Asia, Africa and Latin America.</td>
</tr>
<tr>
<td>Semi-scavenging system</td>
<td>Birds are confined to a certain area with access to shelter. They are allowed a part of the day, for instance, 6 – 8 hours for scavenging. Supplementary feeding is a must which is usually carried out with homegrown grains, grains by-products, kitchen waste etc. It has become an issue for debate since achieving biosecurity of the birds reared under the system is difficult and they may contribute to the spread of diseases like Avian Influenza (AI).</td>
</tr>
<tr>
<td>Small-scale intensive system</td>
<td>Birds are totally kept confined under this system. Home-made feeds or commercial feeds are supplied in the poultry house. Small scale commercial layers and broilers are produced within this system. In some countries, productive native breeds or cross-breeds are reared. This system is important for self-employment, maintenance of livelihood and to ensure food and nutrition security. The number of birds to be raised (flock size) in this system varies depending on perception and priorities, financial capacity and facilities of the poultry producers.</td>
</tr>
</tbody>
</table>

Chickens are found everywhere around the world; every culture knows them and how to husband them. They are the world’s major source of eggs and are a meat source that supports a food industry in virtually every country. They are extremely useful on a worldwide basis because they offer great potential for improving the nutritional levels of all the world’s peoples. They have been utilized for so many centuries that in most societies their use is ingrained (Henuk and Bailey, 2014; Henuk, 2015). In most tropical countries which dominated by developing countries, indigenous poultry genotypes constitute up to 80 percent of the poultry populations that are kept in villages. The birds largely subsist on scavenging in gardens, village alleys and surroundings of the farms by feeding on crop residues, insects, worms and green forage. While for the poor members of society this system provides a subsidiary income, the present dimensions of traditional backyard poultry production have changed drastically and crossed the boundaries of the economically weaker sectors (Table 2; Henuk, 2015).

In many developing countries are beset with many problems including unemployment and malnutrition. The majority of these countries boost their meat and egg production to meet an increasing “protein gap” in human food as their population growth rates continue to increase. The food and agriculture production of these countries however can not meet the increasing demand for these nutritious foods because their economy continues to be strangled by various economic and political crises. Their import bill for food grains is currently increasing, leading to heavy loans and depleting foreign exchange reserves. These countries are carrying huge foreign debts of billions of US dollars to be settled by future generations. Fortunately, the poultry sector has been of
great help in easing the food situation amongst many poor nations in developing countries (Bailey et al., 2010).

**Table 2. Characteristics of the four family poultry farming system (from Henuk, 2015: 252).**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Small intensive scavenging</th>
<th>Extensive scavenging</th>
<th>Semi-intensive</th>
<th>Small-scale intensive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production/farming system</td>
<td>Mixed, poultry and crops, often landless</td>
<td>Mixed livestock and crops</td>
<td>Usually poultry only</td>
<td>Poultry only</td>
</tr>
<tr>
<td>Other livestock raised</td>
<td>Rarely</td>
<td>Usually</td>
<td>Sometimes</td>
<td>No</td>
</tr>
<tr>
<td>Flock size (adult birds)</td>
<td>1 – 5</td>
<td>5 – 50</td>
<td>50 – 200</td>
<td>&gt;200 broilers &gt;100 layers</td>
</tr>
<tr>
<td>Poultry breeds</td>
<td>Local</td>
<td>Local or crossbreed</td>
<td>Commercial or crossbreed or local</td>
<td>Commercial</td>
</tr>
<tr>
<td>Source of new chicks</td>
<td>Natural incubation</td>
<td>Natural incubation</td>
<td>Commercial DOC or natural incubation</td>
<td>Commercial DOC or pullets</td>
</tr>
<tr>
<td>Feed source</td>
<td>Scavenging; almost no supplementation</td>
<td>Scavenging; occasionally supplementation</td>
<td>Limited scavenging; regular supplementation</td>
<td>Commercial balanced ration</td>
</tr>
<tr>
<td>Poultry housing</td>
<td>Seldom; usually made from local materials or kept in the house</td>
<td>Sometimes; usually made from local materials</td>
<td>Yes; conventional materials; houses of variable quality</td>
<td>Yes; conventional materials; good quality houses</td>
</tr>
<tr>
<td>Access to veterinary services and veterinary pharmatics</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Mortality</td>
<td>Very high &gt;70%</td>
<td>Very high &gt;70%</td>
<td>Medium to high 20% to &gt;50%</td>
<td>Low to medium &lt;20%</td>
</tr>
<tr>
<td>Access to reliable electricity supply</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Existence of conventional cold chain</td>
<td>No</td>
<td>Rarely</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Access to urban markets</td>
<td>Rarely</td>
<td>Rarely or indirect</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Products</td>
<td>Live birds, meat, eggs</td>
<td>Live birds, meat, eggs</td>
<td>Live birds, meat, eggs</td>
<td>Live birds, meat, eggs</td>
</tr>
<tr>
<td>Time devoted each day to poultry management</td>
<td>&lt; 30 minutes</td>
<td>&lt; 1 hour</td>
<td>&gt;1 hour</td>
<td>&gt;1 hour</td>
</tr>
</tbody>
</table>
CONCLUSIONS

Family poultry farming makes a significant contribution to poverty alleviation, food security, HIV/AIDS mitigation, empowerment of women and wildlife conservation in many areas of tropical countries. They make up to 80 percent of poultry stocks in low-income food-deficit countries of many tropical countries where owners raise poultry in small numbers ranging from single birds up to a few hundred.

REFERENCES


The Marl and Kaolin in Broiler Diet: Effects on the Bone Weight and the Cutting Yield

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ABSTRACT: In order to assess the effects of two clay types on bone mineralization and cutting yield, 3% of marl or kaolin were introduced in the diet of broiler chickens during a rearing cycle of 56 days. Two hundred forty old chicks, ISA 15 strain were affected to three groups of 80 chicks and four repetitions (control group without clay, 3% marl group and 3% kaolin group). Results of this experiment showed that both clay types, significantly promote an increase of bone weight of 10.4% and 8% and reduce the abdominal fat of 32.5% and 25.7%, respectively for the marl and kaolin. The cutting yield was statistically interesting in broilers fed with marl, particularly for breast yield (+ 8.3%) and an improvement of around 6% of Chicken ready to cook, of thigh and drumstick.

Keywords: Marl, Kaolin, Broiler, Cutting yield, Bone

INTRODUCTION

The clay is a natural product that can be economically used to achieve healthy digestive tract and to optimize poultry performances (Ouachem et al., 2015). Indeed, it is naturally abundant, cheap and so widely voluntarily used by the free range hens or through ingestion of earthworms and insects of soil fauna. Soil ingestion may have some therapeutic value. In fact, there is a hypothesis established by Engel (2002) which states that soil ingestion by hens is akin to self medication. The spontaneous consumption of clay has been shown in other situations, especially in cases of digestive disorders or for reducing a state of unrest (Andrews and Horn, 2006). As an indication, it was observed that the dry matter of soil matrix intake by free-ranging hens mainly contains 10g of soil, 7g of plants and 20g of earthworms. Clays are also recommended for their nutritional properties and healthy digestive tract and for their antitoxic capacity to many undesirable substances in the gut. It is well established that genetic progress in poultry production continuously improves muscle growth. Nevertheless, bone development fail to keep pace with overall growth, thereby generating excess physical load and predisposing bone to deformity and fragility (Rath et al., 2000). However, the most relevant factor for the bone weakness is nutrition. Calcium and Phosphorus are primary inorganic nutrients because they form 95% of the mineral matrix (Rath et al., 2000). Considering their specific absorption capacities of ions, clays are considered like a real molecular sieve. The Marl and kaolin are two clay types available in Algeria, positive effects on poultry performance, digestive efficiency and dropping moisture were reported (Ouachem et al., 2015). However, comparative studies and scientific reports describing their effects on cutting yield and bone quality are not sufficiently documented. Therefore, the aim of this study was to evaluate over a rearing cycle of 56 days, the effects of 3% of marl or kaolin on the carcass cutting yield and tibia bone of broiler chickens.
MATERIALS AND METHODS

Diets and clay

During this trial, three treatments were compared: Control group without supplementation (C) and two experimental diets group supplemented with 3% of Marl (M) or 3% of Kaolin (K). The diets were prepared according to the nutritional requirements recommendations of NRC (1994). The marl matrix basically contains 68% of clay, 13% of sand, low rate of organic matter (0.6%) and its physicochemical composition (in milli equivalent/100g of soil) is: (Ca$^{2+}$ = 4.6); (Mg$^{2+}$ = 2.87); (Na$^{+}$ = 0.33); (K$^{+}$ = 0.1); (Cation Exchange Capacity = 20.5). The kaolin matrix granulometry consists of 64% of kaolin, 25% of micaceous materials and other clays, 8% of quartz and 3% of feldspar. The Cation Exchange Capacity of kaolin is 14 and it contains (in percent): SiO$_3$ = 49.30; Al$_2$O$_3$ = 33.00; Fe$_2$O$_3$ = 2.50; TiO$_2$ = 0.24; CaO = 0.08; MgO = 0.40; K$_2$O = 2.90; Na$_2$O = 0.1; Organic Matter = 0.48; H$_2$O = 11.00. Foods consist mainly of corn and soybean-meal 48, the chemical composition and nutritional characteristics of startup and growth diets are respectively: (3000 Kcal ME/kg; 21% of crude proteins; 1.20% of Ca; 0.75% of total P and 1.10% of lysin); (3100 Kcal ME/kg; 19% of crude proteins; 0.75% of Ca; 0.55% of total P and 0.8% of lysin).

Animals, methods and analysis

This experiment was conducted in the poultry research farm of the Agronomic and Veterinary Sciences Institute of Batna University (Algeria). A total of two hundred forty 1-d old ISA15 commercial strain broiler chicks, were individually weighed, identified and randomly allotted to three groups (C: control group; M: marl group; K: kaolin group) with four replicates per treatment and 20 birds per replicate. Chicks of all treatments (3 x 80) had free access to feed and water. At slaughter age (d56), body weight (BW) was determined and subsequently, per treatment, 32 broilers weighing a mean weight similar to that achieved by the group were slaughtered, tapered and eviscerated in order to assess the yield of chicken ready to cook (CRC), the breast and the thigh - drumstick. To recover as much abdominal fat, fat was removed from carcasses after cooling for 12h at 2°C. The right tibia of each slaughtered broiler was removed. Tibia bones were boiled for approximately 10 min in deionized water and all soft tissue was removed; then, the bones were dried for 12h at 105°C and weighed. The analytical methods adopted were those described by AOAC (1995). Statistical analysis was carried out using t-Student test. Values represented in the table are the means ± standard error and the statistical significance was set to P< 0.05.

RESULTS AND DISCUSSION

The effects of dietary treatments on body weight, carcass ready to cook, abdominal fat, tibia weight and the cutting yield data obtained are presented in Table 1.

Results of growth performance show that marl significantly improves slaughter body weight (+6.6%; P = 0.04). Both clay types have improved significantly the yield of chicken ready to cook (+6% and +2.8% respectively for marl and kaolin) and reduces the rate of the abdominal fat. The cutting yield was statistically interesting in broilers fed with marl, particularly for breast yield (+8.3%) and it should be noted an improvement of around 6% of thigh and drumstick. Furthermore, data of Table 1 indicate that both clay types, significantly promote an increase of bone weight of 10.4% and 8% and reduce the abdominal fat of 32.5% and 25.7% (P = 0.001) respectively for the marl and kaolin.
Overall, the marl effects on growth performances, carcass yield and abdominal fat observed in this study confirms our previous findings attended by 3% of marl (Ouachem, 2011; Ouachem and Kaboul, 2012). The response on body weight agree those of Ouhida et al. (2000b) and Hadj Ayed et al. (2011) with sepiolite and those of Xia et al. (2004) with montmorillonite. This results can be attributed to the discribed clay effects on gut efficiency and the intestinal health of broilers receiving clay diets (Ouachem et al., 2015). According to Hadj Ayed et al. (2011), increased digestive performances by chicken might be explained by the fact that the specific physical structure of clay may lengthened transit of nutrients, enhances digestibility and mineral absorption.

The positif effect of marl may be also attributed to its high cation exchange ability and the sand contents into the marl matrix. Indeed, Travel et al. (2014) found that addition of sand to a matrix composed of kaolin and earthworm compost, increases laying hens performance and enhances the organic matter retention. Van Der Meulen et al. (2008) reported that the retention coefficient of energy varies from 0.69 to 0.78, respectively, when 0 and 30% of sand-clay matrix were introduced. The significant effect of marl and kaolin on the quality of tibia bone observed in this experiment can partially be explained by the richness of clay in minerals. The clays are considered as a regulator and can be assimilated to a real efficient molecular sieve upon transfer and cations exchange (Ouachem et al., 2015). Similar finding was reported with zeolite by Roland et al. (1993) and Uulu et al. (2007) in Eleroğlu et al. (2011). According to these authors, the beneficial effects may be related to the Al, Si, Zn, Na or K concentrations of zeolite, because these minerals have been shown to influence mineral metabolism and electrolyte balance, leading to an increased formation of bone. Although several studies cited by Eleroğlu et al. (2011) claimed that the addition of zeolite increased Ca utilization and the rate of bone ash deposition during growth.

Table 1. Results of body weight (BW), carcass ready to cook (CRC), abdominal fat (AF), tibia ash and the cutting yield.

<table>
<thead>
<tr>
<th>Diets Performances</th>
<th>Control (C)</th>
<th>Marl (M)</th>
<th>Kaolin (K)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BW (g)</td>
<td>2900 ± 356</td>
<td>3090 ± 388</td>
<td>2906 ± 404</td>
<td>P = 0.04</td>
</tr>
<tr>
<td>CRC (% BW)</td>
<td>69.05 ± 1.24</td>
<td>73.4 ± 3.6</td>
<td>71.0 ± 1.02</td>
<td>P = 0.02</td>
</tr>
<tr>
<td>AF (% CRC)</td>
<td>1.44 ± 0.38</td>
<td>0.97 ± 0.25</td>
<td>1.07 ± 0.11</td>
<td>P = 0.001</td>
</tr>
<tr>
<td>Tibia (g)</td>
<td>24.60</td>
<td>28.13</td>
<td>26.97</td>
<td></td>
</tr>
<tr>
<td>Tibia (% BW)</td>
<td>0.8579 ± 0.09</td>
<td>0.9474 ± 0.06</td>
<td>0.9265 ± 0.1</td>
<td>P = 0.001</td>
</tr>
</tbody>
</table>

Cutting Yield (% CRC)

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast</td>
<td>25.2b ± 2.08</td>
<td>27.3a ± 1.45</td>
<td>25.6b ± 1.9</td>
<td>P = 0.01</td>
</tr>
<tr>
<td>Thigh</td>
<td>7.74b ± 0.35</td>
<td>8.24a ± 0.60</td>
<td>7.77b ± 0.51</td>
<td>P = 0.06</td>
</tr>
<tr>
<td>Drumstick</td>
<td>7.36b ± 0.27</td>
<td>7.83a ± 0.20</td>
<td>7.32b ± 0.14</td>
<td>P = 0.03</td>
</tr>
</tbody>
</table>

The means affected of different letters in the same column are statistically different.

CONCLUSION

This experiment shows that the effects of marl is not so different than that reported with other clay types. We can therefore conclude that marl used in rate of 3% provides an overall positive effect on broiler performances and bone quality. However, the kaolin effect, remains lower, probably due to the higher cation exchange capacity and the presence of sand in the marl
matrix. It is also important to specify that, through nutritional supply of marl and kaolin, it may be possible to enhance bone quality and to make it less brittle. Further studies under other experimental conditions are however necessary to bring further information making it possible to validate these results.

REFERENCES


The Effect of Liquid Nanocapsule Level on Broiler Fat Quality

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ABSTRACT: This research investigated the effects of liquid extract turmeric nanocapsule levels in drinking water on abdominal and subcutaneous fat and meat fatty acid of broiler chickens. Eighty-four Lohmann broiler chicks MB-202 were randomly divided into 7 treatments with 3 replications, each completing 4 broilers. Seven treatments were: drinking water (DW) + 12 mg/1000 ml additive bacitracin (P1), DW only (P2), DW + 2% liquid nanocapsule (P3), DW + 4% liquid nanocapsule (P4), DW + 6% liquid nanocapsule (P5), DW + 8% liquid nanocapsule (P6) and DW + 10% liquid nanocapsule (P7). The analyzed variables covered level and weight of abdominal fat, subcutaneous fat level and meat fatty acid composition of broiler chickens. The data were subject to one way ANOVA analysis followed by Duncan’s test in case of significant effect. The results showed that the liquid nanocapsule levels had non significant (P>0.05) effects on weight and level of abdominal and subcutaneous fat. However, liquid nanocapsule provided a positive influence on fatty acid composition and the ratio of omega-3 and omega-9 in broiler chicken meat. The use of liquid nanocapsule at low level (2%) equivalent to 1.73 mg/100 ml curcumin resulted in the lowest weight of abdominal and subcutaneous fat level. While liquid nanocapsule at medium level (6%) equivalent to 4.31 mg /100 ml curcumin had complete composition of meat fatty acid with EPA/DHA and 5:1 omega-3 and omega-6 as a functional food.

Keywords: liquid-nanocapsule, turmeric-extract, fat, fatty-acids, broiler.

INTRODUCTION

Fatty acids commonly found in broiler meat are oleic, palmitic and stearic. This is in accordance with Piliang and Djojosoebagio (2000) that animal products generally contain large amounts of saturated fatty acids e.g. palmitic and stearic, unsaturated fatty acids for example oleic and a small proportion of polyunsaturated fatty acids (PUFA). Balance ratio of omega-3 and omega-6 is essential because the poultry body is constituted of membrane lipid composition, metabolic and physiological function. The increasing absorption of omega-3 is always with the role of other fatty acids in feed, especially the balance of omega-3 and omega-6 can be utilized optimally in the body that plays a role in physiological functions. Zuheid (1990) reported that body fat resulted from the composition of ration and consumption of excess energy is stored in body tissue in form of intramuscular, subcutaneous and abdominal fat. Excess energy in chickens will produce a carcass that is high in fat, but low energy consumption causes fat and carbohydrates stored in low glycogen.
MATERIALS AND METHODS

The research was subject to one-way completely randomized design, rationing 84 broilers aged 2 - 6 weeks into seven treatments each with three repetitions. The seven groups were given additive in drink water namely: drinking water + bacitracin 12 mg/1000 ml (P1), drinking water only (P2), drinking water + 2% nanocapsule (P3), drinking water + 4% nanocapsule (P4), drinking water + 6% nanocapsule (P5), drinking water + 8% nanocapsule (P6) and drinking water + 10% nanocapsule (P7). Feed and drinking water were given ad-libitum.

In this study, 400 g of turmeric was blended in 500 mL of aquadest (equivalent to 5 g turmeric extract with ethanol). Five g chitosan was dissolved in 400 mL of 2.5% citric acid concentrate and mixed with a blender for 20 minutes, then the 2.5 g STPP was dissolved in 100 mL aquadest and mixed with blender for 20 minutes. Nanocapsule was supplied to the drinking water of experimental animals in each treatment level during week 2 - 6. Broilers were fed with commercial diet BR1 from Japfa Comfeed ® from the age of 0 to 2 week, then fed with basal rations. The variables included percentage (relatively) of meat fatty acids and level of abdominal and subcutaneous fat. The data obtained were subject to analysis of variance (ANOVA), followed by Duncan’s test in case of significant effect using SPSS-16.

RESULTS AND DISCUSSION

Table 2. Relatively percentage of meat fatty acids (%)

<table>
<thead>
<tr>
<th>Type of fatty acids</th>
<th>Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P1</td>
</tr>
<tr>
<td>Lauric acids (C12:0)</td>
<td>-</td>
</tr>
<tr>
<td>Miristic acids (C14:0)</td>
<td>0.26</td>
</tr>
<tr>
<td>Palmitic acids (C16:0)</td>
<td>6.68</td>
</tr>
<tr>
<td>Stearic acids (C18:0)</td>
<td>9.57</td>
</tr>
<tr>
<td>Palmitoleic acids (C16:1)</td>
<td>0.98</td>
</tr>
<tr>
<td>Oleic acids (C18:1)</td>
<td>-</td>
</tr>
<tr>
<td>Linoleic acids (C18:2)</td>
<td>3.36</td>
</tr>
<tr>
<td>Linolenic acids (C18:3)</td>
<td>0.19</td>
</tr>
<tr>
<td>EPA</td>
<td>-</td>
</tr>
<tr>
<td>DHA</td>
<td>-</td>
</tr>
<tr>
<td>SAFA</td>
<td>16.51</td>
</tr>
<tr>
<td>MUFA</td>
<td>0.98</td>
</tr>
<tr>
<td>PUFA</td>
<td>7.55</td>
</tr>
<tr>
<td>n6/n3 ration</td>
<td>17.68</td>
</tr>
</tbody>
</table>
Table 3. Percentage of abdominal and subcutaneous fat

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Parameter</th>
<th>Abdominal fat weight(^{m}) (g)</th>
<th>Abdominal fat percentage(^{m}) (%)</th>
<th>Subcutaneous fat percentage(^{m}) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1 (positive control)</td>
<td></td>
<td>20.76 ± 1.56</td>
<td>2.05 ± 0.13</td>
<td>49.73 ± 18.16</td>
</tr>
<tr>
<td>P2 (negative control)</td>
<td></td>
<td>24.66 ± 3.10</td>
<td>2.53 ± 0.22</td>
<td>58.45 ± 8.52</td>
</tr>
<tr>
<td>P3 (2% nanocapsule)</td>
<td></td>
<td>14.55 ± 2.09</td>
<td>1.45 ± 0.55</td>
<td>45.74 ± 10.31</td>
</tr>
<tr>
<td>P4 (4% nanocapsule)</td>
<td></td>
<td>15.36 ± 4.75</td>
<td>1.61 ± 0.36</td>
<td>47.47 ± 13.26</td>
</tr>
<tr>
<td>P5 (6% nanocapsule)</td>
<td></td>
<td>17.06 ± 5.27</td>
<td>1.88 ± 0.73</td>
<td>48.31 ± 14.15</td>
</tr>
<tr>
<td>P6 (8% nanocapsule)</td>
<td></td>
<td>19.05 ± 2.02</td>
<td>1.98 ± 0.40</td>
<td>51.84 ± 11.52</td>
</tr>
<tr>
<td>P7 (10% nanocapsule)</td>
<td></td>
<td>24.89 ± 3.92</td>
<td>2.24 ± 0.68</td>
<td>46.24 ± 5.34</td>
</tr>
</tbody>
</table>

ns Non-significant

Results in Table 2. demonstrated that treatment of liquid nanocapsule turmeric extract influenced the ratio of omega-3 and omega-6. Balance ratio of omega-3 and omega-6 is essential because the poultry body is constituted of membrane lipid composition, metabolic and physiological function. Meliandasari et al. (2015) reported that the imbalance concentrations between omega-3 and omega-6 is obvious from high concentration of omega-6 that can inhibit the formation of omega-3 in the bird’s body and vice versa. Sundari et al. (2014) reported that 0.4% nanocapsule could improve meat protein and fatty acids containing EPA/DHA because curcumin feed inhibited the metabolism of arachidonic acid and increased the synthesis of EPA and DHA in broiler meat (Calder, 1998). Coetzee and Hoffman (2002) supported that fatty acids in the diet is absorbed by monogastric animals (broilers) so fatty acids in feed is a viable alternative to manipulate fatty acid profile of body tissue.

Table 3. presented weight-abdominal and subcutaneous fat content of broiler research. The statistical results of abdominal fat weight and subcutaneous fat level showed no significant differences across treatments (P>0.05). The lowest and the highest level of abdominal and subcutaneous fat was on P3 and P6, respectively. The percentage of abdominal fat ranging from 1.08 to 2.16% in this research was consistent with and even better than that of previous studies. Leeson and Summers (1980) suggested that abdominal fat level of live weight of male and female broiler was 1.4 to 2.6% and 3.2 to 4.8%, respectively. According to North (1984), abdominal fat percentage of 6-week-old male broilers was 2.62% while Yuniza (2002) is 2.85% of live weight. The use of turmeric extract caused a decrease in broiler abdominal fat (Al-Sultan, 2003). The decrease of abdominal fat levels by increasing supplemented levels of turmeric extract curcumin compound is suspected to cause immunostimulatory effects to stimulate the gall bladder wall to increase the secretion of bile in fat breakdown process (Wijayakusuma, 2005). Rations plus 0.4% nanoparticles could reduce levels of subcutaneous fat much more significantly (P<0.05). Nanocapsule granting higher level did not automatically reduce subcutaneous fat because the antioxidant properties of curcumin worked on the low level (Sundari, 2014) and turned into pro-oxidant at high level (Lopez and Lazaro, 2008).
CONCLUSIONS

The use of liquid nanocapsule at low level (2%) equivalent to 1.73 mg / 100 ml curcumin resulted in the lowest weight of abdominal and subcutaneous fat level. While liquid nanocapsule at medium level (6%) equivalent to 4.31 mg/100 ml curcumin had complete composition of meat fatty acid with EPA / DHA and 5: 1 omega-3 and omega-6 as a functional food.

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REFERENCES

Production and Egg Quality of Quail Layer Given Diets Containing Different Levels of Crab (Portunus pelagicus) by-Product Meal


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ABSTRACT: Crab (Portunus pelagicus) by-product is by-product of fishery industry considered to be source of Ca, protein and chitin. The objective of this experiment was to evaluate effect of different levels of crab by-product meal (CPM) in quail feed on egg production and quality. A thousand of two-month-old quail layer (Coturnix coturnix japonica) in their first two week laying period were randomly allocated into five dietary treatments in which each treatment consisted of five replicates with 40 birds each. The dietary treatments were P₀, P₁, P₂, P₃, and P₄ containing 0%, 2%, 4%, 6% and 8% CPM respectively, in combination with rice bran, ground yellow corn, crude palm oil, broiler starter diet, premix, and concentrate. Feed was provided ad libitum, mixed with 1:1 water to reduce dustiness and drinking water was always available. Feed consumption and egg production were recorded daily. Observation was done in 30 days period. Three eggs from each replicate were taken at the last day of observation for quality assessment. Feed consumption were 23-26 g/bird/d, and did not affected (P > 0.05) by dietary treatments. Inclusion of 6% CPM maintained high (80-87%) egg production with weight of 10.22 – 10.61g/egg. But egg weight and production reduced (P<0.05) for the bird given diet containing 8% CPM. The yolk color was not affected but Haugh Unit (HU), increased as the levels of crab by product increases. These results indicate that 6% CPM can be included in quail layer diet without affecting egg weight and production, and improve the egg internal quality.

Keywords: crab by-product, quail, egg production, egg quality

INTRODUCTION

Poultry feed industry in Indonesia is highly dependent upon imported raw materials, as local production is insufficient, seasonally available, and typically located far from feed mills. Consequently around 50-80 percent of raw feed materials are imported, leading to an increase in feed price. Many small poultry farmers ceased their farming activities because of their inability to survive with high feed cost. So, the potency of locally available and cheaper feed materials needs to be explored.

Blue swimming crab (Portunus pelagicus) production in Indonesia steadily increases each year and the by-product has not been properly utilized, even some of it pollutes the environment. In West Nusa Tenggara province (NTB) for example, crab production in 2014 was 418.6 tons (BPS, 2015) and the by-product was around 314 tons (+60% x fresh weight). Proximate analyses in our laboratory showed that crab by-product meal (CPM) contained approximately 21% protein, 1.5% fat, 55% ash, and 12.5% fiber. Haryati (2005) reported that this by-product contains significant amount of mineral especially Ca (19.97%) and P (1.81%). Besides, it contains chitin which can reduce cholesterol formation (Warsono dkk, 2004). Chitin in CPM may play important role in reducing cholesterol content of quail egg because cholesterol content of quail egg is higher than those of chicken and duck (Aziz et al. 2012). Therefore the objective of this study was to evaluate the effect of different levels of CPM in diets on production and quality of quail eggs.
MATERIALS AND METHODS

Feeding trial was conducted at a quail farm in Kawo village, central Lombok, and the observation of egg quality was done at the Laboratory of Nutrition and Feed Science, the Faculty of Animal Science, University of Mataram.

A thousand of two-months-old quail layer (Coturnix coturnix japonica) in their first two week egg production period were randomly allocated into five dietary treatments according to completely randomized design in which each treatment consisted of five replicates with 40 birds each. The composition of control diet (P0) was similar to diet usually formulated by quail farmers in Kawo village. The ingredients used include; rice bran, ground yellow corn, crude palm oil, broiler starter diet, premix, and concentrate (Table 1).

Table 1. Composition of the dietary treatments

<table>
<thead>
<tr>
<th>Feed materials (%) as fed</th>
<th>P0 (control)</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPM</td>
<td>-</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Ground yellow corn</td>
<td>21</td>
<td>21</td>
<td>26</td>
<td>26</td>
<td>31</td>
</tr>
<tr>
<td>Rice bran</td>
<td>26</td>
<td>26</td>
<td>27</td>
<td>27</td>
<td>26</td>
</tr>
<tr>
<td>Broiler starter diet</td>
<td>25</td>
<td>25</td>
<td>20</td>
<td>19</td>
<td>15</td>
</tr>
<tr>
<td>Crconcenrate</td>
<td>24</td>
<td>22</td>
<td>19</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Crude Palm Oil</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Premix*</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analyzed chemical composition (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
</tr>
<tr>
<td>Ash</td>
</tr>
<tr>
<td>OM</td>
</tr>
<tr>
<td>CF</td>
</tr>
<tr>
<td>CP</td>
</tr>
</tbody>
</table>

*Mineral B12 produced by Eka Farma, per 1 kg contains Ca 48-50%, = 13-15%, Fe + 40.000mg, Mn=27.500mg, Iodium = 500mg, Cu= 2000mg, Zn=25000mg, Vit B12= 4.50mg, Vit D3 =500.00 IU.

The dietary treatments were formulated using similar feed materials with 2%, 4%, 6% and 8% CPM for P1, P2, P3, and P4 respectively. Feed was provided ad libitum, mixed with 1:1 water to reduce dustiness, and drinking water was always available. Feed consumption and egg weight and production were recorded daily for 30 days. Three eggs from each replicate were taken at the last day observation period for external and internal quality assessment. Haugh Unit was determined based on Haugh (1937) formula, and yolk color was measured using standard yolk color fan. The cholesterol content was measured using standard method of AOAC (1980).

Data was analyzed using PROC GLM procedure of Sas (1990) and differences between treatment means were separated using Duncan multiple range test.
RESULTS AND DISCUSSION

Health condition of all quails was relatively good, although 12 birds (1.2%) were noted dead because they stacked between pens and beaten by rat. Feed consumption, egg production, egg weight and quality are presented in Table 2.

Table 2. Feed consumption, feed conversion, egg weight and quality of laying quail given diet containing different levels of CPM.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Levels of CPM</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>2%</td>
<td>4%</td>
<td>6%</td>
<td>8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed consumption (g/bird/d)</td>
<td>24.49a</td>
<td>25.46a</td>
<td>24.71a</td>
<td>25.43a</td>
<td>23.77a</td>
<td>0.632</td>
<td>NS</td>
</tr>
<tr>
<td>Hen day egg Production (%)</td>
<td>86.80a</td>
<td>85.60a</td>
<td>79.80ab</td>
<td>80.60ab</td>
<td>76.80b</td>
<td>0.025</td>
<td>0.0495</td>
</tr>
<tr>
<td>Feed conversion ratio (g feed/g egg)</td>
<td>2.65c</td>
<td>2.78bc</td>
<td>2.95ab</td>
<td>3.05a</td>
<td>3.04a</td>
<td>0.071</td>
<td>0.0021</td>
</tr>
<tr>
<td>Egg weight (g/egg)</td>
<td>10.61a</td>
<td>10.62a</td>
<td>10.41ab</td>
<td>10.22b</td>
<td>10.17b</td>
<td>0.080</td>
<td>0.0013</td>
</tr>
<tr>
<td>Egg cholesterol (mg/dL)</td>
<td>50.44b</td>
<td>51.31b</td>
<td>51.39b</td>
<td>49.71b</td>
<td>60.84a</td>
<td>1.622</td>
<td>0.0005</td>
</tr>
<tr>
<td>Haugh unit (HU)</td>
<td>86.20b</td>
<td>87.84b</td>
<td>89.45b</td>
<td>96.09a</td>
<td>97.30a</td>
<td>1.337</td>
<td>0.0003</td>
</tr>
<tr>
<td>Yolk color score</td>
<td>6.67</td>
<td>5.87</td>
<td>6.62</td>
<td>5.74</td>
<td>5.40</td>
<td>0.437</td>
<td>NS</td>
</tr>
</tbody>
</table>

Note: Different superscripts in the same row were significantly different (P<0.05); SEM = pooled standard error; NS = non significant; CPM = crab by-product meal

Feed Consumption. Inclusion of 2 – 8% CPM in diets of laying quail did not significantly (P>0.05) affect feed consumption. Daily feed consumption of laying quail in this study was 23-26 g/bird/d. Many factors may affect feed consumption (North and Bell, 1992) such as types of feed and quality, production period, body weight of the bird and environmental temperature. Non significant differences observed in this study might be due to similar age and production period of the birds, relatively similar feed composition, and similar environmental temperature. Feed consumption recorded in this study were much higher (15-16 g vs 23-26 g) than those reported by Amo et al. (2013). Indonesian feeding standard (SNI) for laying quail recommends the diet to contain 20% protein, while the protein content of dietary treatments were only 14 – 15%. The birds ate more feed to meet their protein requirement to maintain high level of egg production.

Egg Production. The hen house production of laying quail for all treatments were between 72 and 87% and statistical analyzes showed that quail received diet containing 8% CPM produced 14% less egg (P<0.05) than control, but egg production of quail given diets containing 2 %, 4% and 6% were not different (P> 0.05) from control. This indicates that CPM can be incorporated up to 6% in quail layer diet. Lower egg production and higher feed conversion ratio of quail received diet containing 8% CPM might because of too high level of dietary Ca, leading to reduction of digestibility of nutrients and availability of other minerals, especially mineral P (Wilkinson et al, 2014).
**Egg weight and Quality.** Normally, weights of quail eggs are around 8-10 g (Yuwanta, 2010). Egg weight in our study was slightly higher (Table 2). Statistical analyses showed that weight of egg produced by quail received diet containing 8% CPM was significantly lower (P<0.01) than control. However, yolk color was in a range of 5.4-6.7 and did not affected (P>0.05) by levels of CPM in quail diets.

**Haugh Unit (HU)** is an indicator of albumen condition which is useful for determining egg quality. The higher height of condensed albumen, the higher the HU values, and the better the quality of the egg (Stadelman dan Cotterill, 1995). The average values of HU for egg produced by quail given diet containing 8%, 6%, 4%, 2% and 0% CMP were 97.3, 96.09, 89.45, 87.84 and 86.20 respectively. These results indicate that the higher the levels of CPM in quail diet the better the internal quality of the egg. According to Nort and Bell (1990) all fresh eggs observed in this study were belong to grade AA (very good quality) with HU values >72.

**Egg cholesterol.** The concentrations of cholesterol in yolk of quail egg observed in this study were between 49.71 – 60.84 mg/dL. There was no significant difference in level of cholesterol in egg produced by control group and groups given diet with 2%, 4% and 6% CPM. However, level of cholesterol in yolk from quail given diet with 8% CPM was significantly (P<0.01) higher than other treatments. This was in contrast to hypothesis that feeding higher level of CPM would result in lower cholesterol. The reason was not clear yet. The concentration of chitin in CPM might not high enough to reduce lipid digestibility. Shahidi et al., (1999) failed to reduce plasma cholesterol concentration after feeding diet containing 2% chitin to rabbit, laying chicken, and broiler. Gallaher et al. (2000) showed that feeding dietary fiber such as chitosan to rat increased excretion of bile acid and reduce cholesterol absorption, and at certain level will increase again. Therefore, further study is still needed since results of feeding dietary fiber in order to reduce level of cholesterol in poultry are still inconsistent.

**CONCLUSIONS**

Feeding laying quail (*Coturnix coturnix japonica*) a diet containing up to 6% crab (*Portunus pelagicus*) by-product meal maintain high (80-87%) egg production with egg weight of 10.2-10.6g, and did not affect yolk color and concentration of egg cholesterol. However, egg weight and production reduced (P<0.05) for the bird given diet containing 8% CPM. The results indicate that 6% CPM can be included in laying quail diet.

**ACKNOWLEDGEMENTS**

This research was funded by DIPA BLU University of Mataram 2014. Quail farmer group in Kawo village were thanked for providing their birds to be used in this study. Khairil Azmi, and Yusfi Al Ayuni are thanked for their assistances in management and data collection, and Lalu Sumber for laboratory analyses.

**REFERENCES**


A Preliminary Study on the Use of Enzyme and Organic Acids in Rice Bran-containing Diet at Two Levels of Dietary Protein for Rabbit

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ABSTRACT: Rice bran has long been used as an ingredient for animal diet in Indonesia. It has moderate content of protein, digestible energy and crude fiber. In monogastric animal, including rabbit, rice bran is moderately used due to its rather low digestibility. The use of enzyme that is able to improve nutrient digestibility of the feedstuff is well known. This experiment was carried out to study the inclusion of enzyme and organic acids in a diet containing high level of rice bran on the performance of rabbit. A factorial 2 x 4 design applying 2 levels of dietary protein (14 and 18 %) and addition of enzymes and organic acids in each protein level was carried out. Basal diet contained 45 % rice bran. Treatments at each level of dietary protein were (i) basal without addition, (ii) basal + 0.03 % multienzyme, (iii) basal + 0.03 % multienzyme + 0.03 % propionic acid and (iv) basal + 0.03 % multienzyme + 0.03% sodium butyrate. Each treatment consisted of 5 replications of 3 Rex rabbits. Parameters measured were feed consumption, daily bodyweight gain (BWG), feed conversion (FCR) and dry matter digestibility in adult and young rabbits. No interactions were detected among treatments on parameters measured. No significant differences were also observed with the treatments on the inclusion of enzymes and organic acids for all parameters. There were however, better performances on rabbit fed higher protein level, regardless of the additives inclusion. Corresponding values for those parameters at 14 vs 18 % dietary protein were 93 vs 86 g/h/d for consumption, 13 vs 15 g/h/d for BWG, and 7.4 vs 6.0 for FCR, respectively. Dry matter digestibility in adult (56 vs 58 %) and young (54 vs 58 %) animals were also higher for diet with 18 %. Bodyweight of rabbits on the digestibility trial were also higher in adult (2666 vs 2443 g/head) and young (1621 vs 1557 g/head) fed 18 % protein. It is concluded that higher protein levels gave better performance for rabbit, including its digestibility. Inclusion of enzymes and organic acids did not give significant effect on the Rex performances.

Keywords: enzyme, organic acids, protein levels, rabbit

INTRODUCTION

A rabbit is small herbivore whose feed depends on forage and agricultural by-product. It utilizes crude fiber less efficiently as compared to the large herbivores (Maynard et al., 1979). It is generally known that the feed is the largest cost component in the production of a commercial intensive livestock business, so utilization should be optimum. Efforts to improve feed efficiency among others, by the accuracy of the determination of nutrient requirements among the various components of nutrition, protein, are the most expensive component. Nowadays, supply of protein and amino acids are essential to meet the needs of rabbits for the production, which is used in feed formulation. The use of higher fiber and reduce the starch content is expected to avoid digestive problems that required a higher protein content than recommended (> 15%) (Carabano, et al., 2008). High incidence of diarrhea in weanling rabbits caused high rate of mortality. Diarrhea or
enteritis problem in rabbits is usually triggered by the increased population of pathogenic bacteria in the caecum. This population may, however be controlled by high dietary level of indigestible fiber, and low protein and carbohydrate, and also by some feed additives that have bacteriostatic and peristaltic regulation properties, including herbal.

Agricultural by-products such as rice bran which is relatively inexpensive has great potency for feeding rabbits. However rice bran is nutritionally poor in quality due to its high fiber contents and low digestibility. Lately, it has done a variety of techniques to improve the quality of feed ingredients of agricultural by-products, such as by the addition of enzymes. The use of enzymes in animal feeds are becoming more common, in order to obtain maximal benefits from enzyme inclusion in animal feeds, it is necessary to ensure that the enzymes are chosen on the basis of the feed composition.

The organic acid is routinely used in monogastric animal diets in Europe as a preservative and acidifier, to replace antibiotics as a growth promoter and to prevent or control pathogens.

In recent years, the occurrence of digestive disorder was prevented by inclusion of antibiotics as growth promoters in conjunction with restrictions on price and authorized law the product is the reason search alternative materials.

A Study on the use of enzymes in rabbits have been long conducted (Remoïs et al., 1996; Fernandez et al., 1996; Pinheiro and Almeida, 2000; Falcão - e - Cunha et. al, 2004; Garcia et al., 2005) show results that are not significant effect on rabbit performance, except for reductions of mortality in the use of proteases and proteases + xylanase (García et al., (2005) that probably due to a decrease in the flow of protein to the cecum.

Makled et al., (2005) the use of multiple enzymes in feed rabbits showed that supplementation of 0, 500 and 750 mg Kemzyme/kg feed can improve (P>0.05) in live weight at of 6, 8, 10 and 12 weeks age due to addition of Optizyme 500 mg/kg of rabbit feed. In contrast, rabbits supplemented with hight level of Optizyme (750 mg/kg feed) showed a significant reduction of body weight at 8 weeks age. Feed consumption did not significantly increase during the period from 6-8 and 8-10 weeks.

Growing rabbit that suplemented with Superzyme at the rate of (0.25 g and 0.5 g/kg feed), Natuzyme (at a rate of 0.35 g and 0.5 g/kg feed) were not significantly their final body weight (10.09% and 12.3%, 7.2% and 9.9% respectively) compared to control (basal diet without enzymes addition (El-Katcha et al., 2013). Supplementation of Citric acid up to 2% in diet can improves performance, digestibility of nutrient and immune status of growing rabbit (Debi et al., 2001).

The purpose of this research is to investigate the possibility of using enzymes, organic acids in the right level of protein in the ration of Rex Rabbits.

MATERIALS AND METHODS

This experiment was carried out at rabbitry complex of Research Institute of Animal Production, Bogor, Indonesia. One hundred and twenty of unsexed Rex rabbits were allocated randomly to a factorial 2 x 4 design applying 2 levels of dietary protein (14 and 18 %) and addition of enzymes and organic acids in each protein level was carried out. Basal diet contained 45% rice bran. Treatments at each level of dietary protein were (i) basal without addition, (ii) basal + 0.03 % multienzyme (natuzyme), (iii) basal + 0.03 % multienzyme + 0.03 % propionic acid and (iv) basal + 0.03 % multienzyme + 0.03% sodium butyrate. Each treatment consisted of 5 replications of 3 rabbits. Treatment were carried out for 6 weeks and parameters measured were feed consumption, daily bodyweight gain (BWG), feed conversion (FCR) and measurement for
dry matter digestibility in adult and young rabbits were carried out for 7 days. Collected data were subjected to statistical analysis by 2X 4 factorial design (Steel and Torrie, 1980).

**RESULTS AND DISCUSSION**

The evaluation of consumption, daily growth and feed efficiency showed that difference between the treatment (Table 1). There were no differences of daily consumption among treatment, eventhough the lower protein content diet tend have higher consumption. The highest consumption is the treatment with addition of enzyme and organic acid mixture.

**Tabel 1.** Performance of rabbit in 6 weeks raising.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Consumption (g/h/d)</th>
<th>BWG (g/h/d)</th>
<th>FCR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14%</td>
<td>18%</td>
<td>14%</td>
</tr>
<tr>
<td>1</td>
<td>92</td>
<td>84</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>90</td>
<td>81</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>92</td>
<td>91</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>97</td>
<td>86</td>
<td>14</td>
</tr>
</tbody>
</table>

All treatments were not different with control basal. Basal rabbit feed usually contain approximately 14% of fiber and mostly from grass or cane shoot, but in this experiment grass or cane shoot were substitute with 45% of rice bran which mostly contain undigestible fiber. The feed treatment formulated with higher rice bran content than control, with the addition of a number of enzymes, organic acids or a mixture of both can comparable with control.

Treatment 2, 3 and 4 with the use of higher protein content (18 %) showed a better feed efficiency. Haryati et al., (2013) recorded that the higher protein level increase the feed efficiency, feed with > 16% protein resulting better FCR, this value consistent with DM digestibility, feed with higher protein levels can be digested and adsorbed better. Therefore, the optimal level for crude protein in a diet depends on its digestibility and the DE content. A recommended ratio of 23.5 kcal DE/g DP (or 10 g DP/MJ DE) was suggested to optimize the growth rate and the mortality (Trocino et al., 2009). Digestibility of feed with level protein 16, 18 and 20 % were better than the lower level, DM digestibility is depends on the diet composition.

Dry matter digestibility of young or adult rabbits were no different in almost treatment, eventhough the treatment which used 18% of protein content tend to have better digestibility.

**Tabel 2.** Dry Matter Digestibility of young rabbits

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Body weight 0 (g)</th>
<th>DMD (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14</td>
<td>18</td>
</tr>
<tr>
<td>1</td>
<td>1640</td>
<td>1505</td>
</tr>
<tr>
<td>2</td>
<td>1537</td>
<td>1579</td>
</tr>
<tr>
<td>3</td>
<td>1476</td>
<td>1727</td>
</tr>
<tr>
<td>4</td>
<td>1574</td>
<td>1674</td>
</tr>
</tbody>
</table>
**Table 3.** Dry Matter Digestibility of adult rabbits

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Body weight 0 (g)</th>
<th>DMD (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14</td>
<td>18</td>
</tr>
<tr>
<td>1</td>
<td>2435</td>
<td>2837</td>
</tr>
<tr>
<td>2</td>
<td>2454</td>
<td>2759</td>
</tr>
<tr>
<td>3</td>
<td>2330</td>
<td>2609</td>
</tr>
<tr>
<td>4</td>
<td>2551</td>
<td>2457</td>
</tr>
</tbody>
</table>

Age differences associated with decreased activity include gastric lipase and urease in the cecum and colon in adult rabbits. Gastric lipase activity is positively correlated with the daily fat intake in rabbits in the experiment of Borel et al. (1991).

Diet with 18% of protein content resulted in higher DMD either in young or adult rabbit. Young and adult animals capable of digesting feed ingredients well.

The higher protein level increasing the feed efficiency, feed with > 16% protein resulting in better FCR, this value consistent with DM digestibility, feed with higher protein levels can be digested and adsorbed better. Therefore, the optimal level for crude protein in a diet depends on its digestibility and the DE content. A recommended ratio of 23.5 kcal DE/g DP (or 10 g DP/MJ DE) was suggested to optimize the growth rate and the mortality (Trocino et al., 2009). Digestibility of feed with level protein 16, 18 and 20% were better than the lower level, DM digestibility is depends on the diet composition.

The addition of enzymes will selectively degrade the fiber in the diet which will help the digestion of fiber because of the lack of enzyme activity in the digestive tract hemicellullolytic rabbit. So that enzyme supplementation would improve digestibility of feed.

The result showed that when Rex rabbit received a diet with protein 14% and 18% of protein which supplemented with enzyme and organic acids have good DM digestibility, eventhough there were not significat different. Its probably because of the quality of the rice bran. The addition of enzyme or organic acids did not affected to the digestibility, it may be due to the the addition has not been optimum or not suitable.

**CONCLUSIONS**

The result showed that inclusion of enzymes and organic acids did not give a significant effect on the Rex performances. A higher protein levels gave better performance for rabbit, including its digestibility. Results of this study can be used as a basic for the use of enzymes or organic acid in the next study.

**REFERENCES**


Efficacy of Toxin Binder in Reducing Induced Aflatoxin B₁ and Ochratoxin A in Broiler Feed

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ABSTRACT. The object of present study was to investigate the efficacy of toxin binder (Bentonite-montmorillonite + Sepiolite; TXB) at different levels of Aflatoxin B₁ (AFB₁) and Ochratoxin (OTA) in broilers. Eight iso-caloric/iso-nitrogenous experimental feeds i.e. A: standard feed/control + zero toxin + zero TXB; B: Feed + zero toxin + TXB @ 1g/kg of feed; C: feed +100 ppb of AFB₁ + TXB @ 1g/kg; D: feed + 200 ppb AFB₁ + TXB @ 1g/kg; E: feed + 100 ppb of OTA + TXB @ 1g/kg; F: feed + 200 ppb of OTA + TXB @ 1g/kg; G: Feed + 100 ppb of AFB₁ + 200 ppb of OTA + TXB @ 1g/kg; H: Feed + 200 ppb of AFB₁ + 100 ppb of OTA + TXB @ 1g/kg, were prepared following NRC standards (1994) for commercial broiler. The each experimental feed was randomly assigned to 60 birds with 20 birds per replicate for 42 d. The data on feed intake (g), body weight gain (g), FCR, mortality, toxin binding ability, dressing %, keel and shank length, giblet weight (g), bursa, spleen and thymus weight (g), were recorded. Statistical analysis of data under Completely Randomized Design through One-way ANOVA revealed non-significant differences for feed intake, weight gain and FCR. Significantly higher dressing %, thymus and bursa weight was observed in birds fed 1g/kg TXB followed by 220ppb OTA + 1g/kg TXB and 200ppb AFB₁ + 100 ppb OTA + 1g/kg TXB, respectively. It was concluded from the present study that TXB had significant effect in reducing AFB₁ and OTA in broilers due to toxins binding and their excretion through excreta. The economic analysis showed 7% increase in profit with addition of TXB.

Keywords: Broiler, Toxin binder, Mycotoxin, Production

INTRODUCTION

Mycotoxins are unavoidable contaminants in feed resources and considered as a major problem of the feed industry all over the world (Wood, 1992). Aflatoxins, deoxynivalenol, ochratoxin A (OTA), fumonisins, zearalenone, patulin, and T-2 toxin are most important mycotoxins that may cause breakdown in vaccinal immunity and occurrence of diseases even in properly vaccinated flocks (Pier, 1992). The ingestion of Aflatoxins increases the severity of infections caused by coccidiosis and salmonellosis in chicken (Kubena et al., 2001). Similarly OTA has also been described to increase the susceptibility of chicken to coccidiosis (Stoev et al., 2002), salmonellosis (Fukata et al., 1996) and colibacillosis (Kumar et al., 2003). Poultry producers all over the world are in need of latest techniques and methods to assist them in the protection of their flocks against these toxins. It is important to adequately test a potential mycotoxin adsorbent, not only for its in-vitro binding capabilities, but also for its in-vivo ability (Bailey et al., 1998). It is claimed that Bentonite-montmorillonite and Sepiolite effectively prevent digestive absorption of feed-borne mycotoxins, ensuring animal health and food safety. The objective of present study was assessing the efficacy of toxin binder composed of Bentonite-montmorillonite and Sepiolite in broilers.
MATERIALS AND METHODS

Research plan was divided into two phases. In phase I Aflatoxin B₁ (AFB1) and OTA was produced in Microbiology laboratory. In phase II deleterious effect of AFB1 and OTA was studied through biological trial. Eight iso-caloric/iso-nitrogenous experimental rations i.e. A: standard feed/control + zero toxin + zero TXB; B: Feed + zero toxin + TXB @ 1g/kg of feed; C: feed +100 ppb of AFB1+ TXB @ 1g/kg; D: feed + 200 ppb AFB1+ TXB @ 1g/kg; E: feed + 100 ppb of OTA + TXB @ 1g/kg; F: feed + 200 ppb of OTA + TXB @ 1g/kg; G: Feed + 100 ppb of AFB1+ 200 ppb of OTA + TXB @ 1g/kg; H: Feed + 200 ppb of AFB1+ 100 ppb of OTA + TXB @ 1g/kg, were prepared following NRC standards for commercial broiler. Each dietary treatment was randomly assigned to 60 birds (3 replicates of 20 birds each) for 42 d experimental period. Data regarding production performance [feed intake (g), body weight gain (g), FCR, mortality], toxin binding ability (fecal sample), and carcass characteristics (dressing %, keel and shank length, giblet weight, bursa, spleen and thymus weight), were collected. The experimental chicks were kept on littered (rice husk) under standard management conditions with free access to clean and fresh drinking water.

The data obtained were analyzed under Completely Randomized Design through one-way ANOVA technique. The differences among treatment means were worked out using Duncan’s (1955) Multiple Range Test. All the analyses were done using SAS 9.1.

RESULTS AND DISCUSSION

Production Performance

The results of present study indicated that in the presence of BS, with increasing levels of AFB1 and OTA in diet, the feed intake, weight gain and FCR, did not decrease significantly (Table 1), which could be attributed that toxin binder worked efficiently and didn’t let the AFB1 and OTA to exert detrimental effects on the digestive tract of birds. The addition of toxin binder helped binding the toxins from feed and then their excretion from body. In agreement to current findings, the positive effects of toxin binder have also been reported by previous studies in broilers (Mangoli et al., 2011; Kubena et al., 1997).

Carcass Characteristics

Dressing %, thymus and bursa weight significantly increased with the addition of toxin binder (Table 1). The toxin binder inhibited the absorption of toxins in the gut and increased its excretion though feces. Non-significant differences among various control and toxin induced feed fed groups regarding keel and shank length, liver, gizzard, heart and spleen weight also show the overall efficiency of toxin binder and producing comparable results (Table 1). Similar findings have been documented previously (Wang et al., 2006).

Toxin binding Ability (Fecal sample)

In groups where toxin binder was added fecal samples had significantly higher amount of toxins (Table 2), showing overall increased efficiency in binding the toxins.
CONCLUSION

Comparable weight gain and FCR in control group and the groups fed toxins induced feed showed the overall toxin binding efficiency of the product, hence; concluded that toxin binder had significant effect on reducing AFB1 and OTA toxicity in broilers due to decreased absorption in gut and increased excretion through feces.

REFERENCES


### Table 1. Effect of different levels of toxin binder and mycotoxins on broiler production performance and carcass characteristics

<table>
<thead>
<tr>
<th>Treatment</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed intake (g)</td>
<td>372.26±10.96</td>
<td>356.38±20.23</td>
<td>358.89±76.56</td>
<td>364.14±54.05</td>
<td>361.86±157.20</td>
<td>366.88±165.26</td>
<td>370.39±197.65</td>
<td>369.74±191.48</td>
</tr>
<tr>
<td>FCR</td>
<td>1.77±0.03</td>
<td>1.79±0.04</td>
<td>1.87±0.03</td>
<td>1.90±0.01</td>
<td>1.82±0.06</td>
<td>1.85±0.02</td>
<td>1.81±0.07</td>
<td>1.88±0.03</td>
</tr>
<tr>
<td>Dressing % (cm)</td>
<td>57.40±1.51ab</td>
<td>62.49±1.57a</td>
<td>59.70±2.41ab</td>
<td>58.22±1.40ab</td>
<td>61.46±1.15ab</td>
<td>59.76±1.26ab</td>
<td>55.29±0.85b</td>
<td>58.29±2.65ab</td>
</tr>
<tr>
<td>Keel length (cm)</td>
<td>14.33±0.33</td>
<td>14.66±0.88</td>
<td>14.66±0.33</td>
<td>15.33±0.33</td>
<td>15.00±0.57</td>
<td>14.33±0.33</td>
<td>15.33±0.33</td>
<td>14.33±0.66</td>
</tr>
<tr>
<td>Shank length (cm)</td>
<td>6.90±0.10</td>
<td>6.83±0.16</td>
<td>6.13±0.31</td>
<td>6.90±0.30</td>
<td>6.93±0.06</td>
<td>7.00±0.0</td>
<td>6.80±0.11</td>
<td>6.80±0.10</td>
</tr>
<tr>
<td>Liver weight (g)</td>
<td>50.66±2.18</td>
<td>49.00±3.31</td>
<td>52.00±1.73</td>
<td>54.33±2.18</td>
<td>47.66±2.66</td>
<td>47.66±1.45</td>
<td>51.66±3.28</td>
<td>52.33±2.33</td>
</tr>
<tr>
<td>Gizzard weight (g)</td>
<td>44.00±1.00</td>
<td>39.66±0.66</td>
<td>40.33±1.76</td>
<td>43.66±2.96</td>
<td>44.33±0.66</td>
<td>42.33±6.17</td>
<td>40.33±2.02</td>
<td>44.00±2.08</td>
</tr>
<tr>
<td>Heart weight (g)</td>
<td>13.33±0.88</td>
<td>13.33±1.66</td>
<td>14.00±0.57</td>
<td>14.33±0.66</td>
<td>13.00±1.15</td>
<td>13.66±0.88</td>
<td>14.00±1.00</td>
<td>14.66±0.33</td>
</tr>
<tr>
<td>Bursa weight (g)</td>
<td>2.40±0.30bc</td>
<td>2.50±0.05bc</td>
<td>2.26±0.06ab</td>
<td>2.06±0.08ab</td>
<td>2.23±0.12ab</td>
<td>2.10±0.11b</td>
<td>2.33±0.17ab</td>
<td>2.70±0.15a</td>
</tr>
<tr>
<td>Thymus weight (g)</td>
<td>5.13±0.14ab</td>
<td>4.63±0.08bc</td>
<td>5.20±0.15bc</td>
<td>5.20±0.10bc</td>
<td>5.36±0.08bc</td>
<td>5.60±0.05a</td>
<td>5.13±0.17ab</td>
<td>4.93±0.13cd</td>
</tr>
<tr>
<td>Spleen weight (g)</td>
<td>2.36±0.03</td>
<td>2.50±0.05</td>
<td>2.26±0.08</td>
<td>2.40±0.10</td>
<td>2.36±0.03</td>
<td>2.20±0.20</td>
<td>2.53±0.23</td>
<td>2.36±0.03</td>
</tr>
</tbody>
</table>

Means with different superscript were different significantly at P>0.05

### Table 2. Effect of different levels of toxin binder and mycotoxins on broiler fecal collection

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Aflatoxin B1 (ppb)</th>
<th>Ochratoxin OTA (ppb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Group (A)</td>
<td>0.0±0.0</td>
<td>0.0±0.0</td>
</tr>
<tr>
<td>Toxin binder@ 1 g/kg (B)</td>
<td>1.75±0.55</td>
<td>0.75±0.75</td>
</tr>
<tr>
<td>100ppb AFB1+TXB @ 1 g/kg</td>
<td>36.50±4.70</td>
<td>0.0±0.0</td>
</tr>
<tr>
<td>100ppb OTA+ TXB @ 1 g/kg</td>
<td>0.0±0.0</td>
<td>47.30±1.90</td>
</tr>
<tr>
<td>200ppb AFB1+ TXB @ 1 g/kg</td>
<td>59.72±6.02</td>
<td>0.0±0.0</td>
</tr>
<tr>
<td>200ppb OTA+ TXB @ 1 g/kg</td>
<td>0.0±0.0</td>
<td>72.00±5.60</td>
</tr>
<tr>
<td>100ppb AFB1+200ppb OTA+</td>
<td>41.20±7.70</td>
<td>75.05±4.45</td>
</tr>
<tr>
<td>TXB @ 1 g/kg (G)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200ppb AFB1+100ppb OTA+</td>
<td>75.55±8.15</td>
<td>40.45±2.65</td>
</tr>
<tr>
<td>TXB @ 1 g/kg (H)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Means with different superscript were different significantly at P>0.05
Evaluation of Local Feed in Broiler Diets in Small Scale Farm in Palu Central Sulawesi

Hafsah1, Hidayat2, Fatmawati2, M. Sagaf2, Mappiratu4, and T. Sapan3

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3) Balitbangda, Central Sulawesi Province, Palu
4) Faculty of Basic Science, Tadulako University, Palu

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ABSTRACTS: Feed is the basic component that plays an important role in poultry industry. The cost of feed were taken more high cost than other aspects. Poultry feed companies are required to provide feed at a cheaper price with the use of local feed ingredients as a base feedstuffs in the preparation of the diets formula. Besides, feed manufacturers also are expected to produce good quality feed at affordable prices. The main objective of this research was to evaluate the use of diets by used local feedstuff as an ingredients of base material feed on growth performance, feed efficiency, and carcass yield of broiler chickens. The experiment was conducted in small scale farm in Pengawu Tatanga District Palu Central Sulawesi. The experiment was used 360 day old chicks (DOC) broiler strain CP 909. That chicks was reared in small scale farm with divided in two blocks treatment i.e. treatment with applied local feed (block 1) and treatment with applied commercial feed (block 2) as a control diets. Each treatment was used 180 chicks that placed in 6 plots stages with 30 chicks for each plot and its were reared up to 5 weeks old. Observed variable were growth performance (body weigh, gain, feed intake, and feed conversion ratio), feed efficiency (efficiency utilization of feed, income over feed and chick cost), carcass yields (carcass dressed, carcass components, abdominal fat pad). Data were calculated and analyzed by t-test in SPSS 17 program. Results of the experiment was shown no significant effects on growth performance (body weight, gain, feed intake, feed conversion ratio), feed efficiency, and carcass yields. However, the treatment was affected significantly different (P <0.05) on slaughter weigh and wings components parts. Influenced also in highly significant (P <0.01) different on abdominal fat and income over feed and chick cost of the two treatments. The use of local feed as a basic ingredients of ration in broiler small scale farm resulted relatively the same response with the use of commercial diets. An excess of use local feed is more cheaper than commercial diets, available all years needed, and increasing income farmer as a results of a declined the feed prices.

Keywords: broiler, carcass, feed efficiency, growth performance, local feed

INTRODUCTION

Feed is one of the basic components of the poultry farm industry that play an important role to produce animal protein. About two-third production cost is feed. The increase price of feed stuffs often becomes a problem. There is an alternative methods to solve that problem by using the local feedstuffs in that area. The use of local feed ingredients as a poultry feed still facing the problem of varying quality nutrients and the presence of harmful contaminants such as mycotoxins contamination. To overcome this problem needed the right technology to increase the value of nutrients and reduce the effects toxic effects. Application of the technology associated with the availability of feed technology that is easy, cheaper and can be adopted by users.

Feed manufacturers are expected to produce good quality feed with the low prices. Feed development policy geared to the provision of feed (feed security) and improving the quality of feed (feed safety) based on local resources. It means that the farmers can produced their own
animal feed without depending on imported materials. This can be realized by taking the 3 main strategies to reduce dependence imported feed ingredients, ensure the safety and quality of feed, improve the development of feed science and technology to the local feed processing (Agus, 2011). In the future, farmers should be able to utilize local feedstuffs as an alternative feed sources that is more profitable farm business. Cheap source of feed that can be obtained by utilizing a wide variety of agricultural wastes, plantation, home industry and other materials potentially.

This study aimed to evaluate the use of basic feed ration with local feedstuffs compared with commercial feed fed on the growth, feed efficiency, income over feed and chick cost, and carcasses yield.

METHODS

Research has been conducted in Pengawu Village, District of Tatanga Palu, Central Sulawesi Indonesia. Implementation of this experiment was evaluated in March 15 to November 9, 2013. It were used 360 DOC broilers strain CP 909 as animal experiment. The experiment was applied two treatments as a local feed ingredient (LD) and commercial feed concentrate as control diets (CD). Diets and water were given ad libitum.

Feed ingredients used are locally available raw feedstuffs in the city of Palu, such as corn, soybeans, rice bran, fish meal, minerals, vitamins and amino acids. Feed manufacturers are used for comparison produced by Charoen Pokphan as call BR1 concentrate.

Supporting equipment used is the feed mill, mixer (mixing machine weft), digital scales, where food, drinking water, brooder, water reservoirs, modified pipes, pumping water dap, plastic buckets etc.. Cage experiment used as 24 plots slat base with a height of 1 m from the ground. At the bottom of the enclosure to accommodate a given pedestal stool chaff that fell to the floor. Each unit of plots by walls made of wire ram.

This study was designed to use two treatment groups: the group using the feed manufacturers and local groups who have been using formulated feed with the same protein content (isoprotein) and iso-energy. Starter ration composition formula contents with 23.46% protein and metabolizable energy 3090 kcal/kg, while the finisher ration formula with a protein content of 21.46% and 3034 kcal metabolizable energy/kg (NRC, 1994). The composition of the ration of local diets listed in Table 1 and commercial diets (CD) shown in Table 2.

<table>
<thead>
<tr>
<th>No.</th>
<th>Feedstuffs</th>
<th>Feed Composition (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Starter</td>
</tr>
<tr>
<td>1.</td>
<td>Corn milled</td>
<td>50</td>
</tr>
<tr>
<td>2.</td>
<td>Rice bran</td>
<td>11</td>
</tr>
<tr>
<td>3.</td>
<td>Soyabean milled</td>
<td>17</td>
</tr>
<tr>
<td>4.</td>
<td>Fish meal</td>
<td>18</td>
</tr>
<tr>
<td>5.</td>
<td>Tofu waste</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>Mineral mix</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Protein, %</td>
<td>23.26</td>
</tr>
<tr>
<td></td>
<td>Fat, %</td>
<td>6.49</td>
</tr>
<tr>
<td></td>
<td>Crude Fiber, %</td>
<td>4.01</td>
</tr>
<tr>
<td></td>
<td>ME, kcal/kg</td>
<td>3148</td>
</tr>
</tbody>
</table>
Table 2. Composition of feed used as a basic formula of the commercial diets (CD)

<table>
<thead>
<tr>
<th>No.</th>
<th>Feedstuffs</th>
<th>Feed Composition (%)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Starter</td>
<td>Finisher</td>
</tr>
<tr>
<td>1.</td>
<td>Corn milled</td>
<td>0</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Concentrate BR1</td>
<td>100</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Protein, %</td>
<td>23.50</td>
<td>21.33</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fat, %</td>
<td>5.00</td>
<td>4.86</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crude Fiber, %</td>
<td>3.00</td>
<td>2.88</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ME, kkal/kg</td>
<td>3000</td>
<td>3054</td>
<td></td>
</tr>
</tbody>
</table>

At the end of the experiment, two chicken for each plot were weight individually prior to slaughter. After slaughter, feather were removed by dipping the chicken into the warm water (app. 60-70 °C). Carcass yield was weight of the dead chicken without feathers, head, neck, legs, and digestive organs. The chickens were cut into the parts according to the standard procedure of dissection (Jensen, 1989).

Variables Observed

Variables determined were growth performance (weigh gain, feed intake, feed conversion ratio) and carcass yields (slaughter weight, carcass percentage, carcass component (breast meat, drumstick, tight, back, wings), and abdominal fat pad, economic value of ration (feed efficiency, income over feed and chick cost) Abdominal fat can be defined as the fat surrounding the gizzard and lay between the abdominal muscles and the intestines.

Data Analyzis

Data for all variables were subjected to analyzed by using t-test in SPSS 17 (Supardi, 2013; Hanafiah, 2005).

RESULTS AND DISCUSSION

Growth Performance

The effects of the treatment on the average value of growth performance i.e. body weight, gain, feed consumption, feed conversion ratio as shown in Table 3.

Table 3. Average body weight, gain, feed intake, feed conversion ratio during the experiment

<table>
<thead>
<tr>
<th>Growth Performance</th>
<th>Treatments</th>
<th></th>
<th></th>
<th>t-test value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LD</td>
<td>CD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body weight, g</td>
<td>1551.67±160.55</td>
<td>1612.50±88.59</td>
<td>0.120ns</td>
<td></td>
</tr>
<tr>
<td>Weight gain, g</td>
<td>1515.77±159.57</td>
<td>1577.83±86.46</td>
<td>0.216ns</td>
<td></td>
</tr>
<tr>
<td>Feed intake, g</td>
<td>3776.63±43.97</td>
<td>3821.66±69.33</td>
<td>0.119ns</td>
<td></td>
</tr>
<tr>
<td>Feed conversion ratio, g/g</td>
<td>2.46±0.25</td>
<td>2.38±0.12</td>
<td>0.255ns</td>
<td></td>
</tr>
</tbody>
</table>

note: ns Non significant different from the two treatments (LD and CD) with Confidence Level 95%  
LD = Local diets; CD= Commercial diets
Results of \textit{t-test value} was shown no significant effects (P> 0.05) on body weight, gain, feed intake, feed conversion ratio during the experiment. This gives an indication that the use of local feed ingredients in broiler ration has relatively the same quality with commercial feed sold in the market. The real body weight resulted from the experiment as slightly different with the CD= 1612.50±88.59 (commercial diets based) and LD= 1551.67±160.55 (local diets based). This is probably caused by the nutrient content of the ration consumed relatively similar, although different base materials. Palatability of feed ingredients is one of the factors that determine the level of household consumption in livestock rations. Amrullah (2003) stated that the palatability of the ration influenced by the shape, smell, taste, and texture of the feed.

Although did’n show statistically significant but generally treated with a commercial feed showed body weight gain propensity score is higher. This is consistent with feed consumption values are relatively higher. North and Bell (1990) found that an increase in body weight gain is influenced by feed consumption, if consumption of both the body weight gain would also be good. Rombe (2012) states that the factors that influence weight gain is feed consumption. This opinion is also supported by Ichwan (2003) which states that the overall weight gain is influenced by the amount of feed intake and nutrient content contained in the feed.

In feed conversion ratio also did not found differences between the two treatments. This is caused by the feed intake and weight gain between treatments was also not significantly different. Means the use of local feed ingredients in the ration formulation can still cause biological benefits compared to commercial ration.

Feed conversion ratio is a reflection of the ability of animal to utilize rations consumed to produce body weight. The low value of the feed conversion ratio will not provide high gain if not supported by the high body weight gain. Pachkam (1981), found that the lower the number the more efficient feed conversion ratio in use. Another experiment was found that the weight gain and feed conversion ratio of broiler on 6 weeks old fed by local feed as 1501-1722 g and 1.69-2.02 (Winanto, 2014), 1206-1455 g and 2.43 (Harmanto, 2013), 1407-2159 g and 1.76-2.05 (Trisnayanti, 2014). Further experiment was done by Olugbemi et.al. (2010), repoted that there is a positive correlation between feed intake and weigh gain, the increasing in feed conversion value means that the feed consumed were not effisien in conversion feed to meats or eggs in poultry farm.

\textbf{Carcass Yield}

The effects of the treatment on the carcass yield that consist of slaughter weight, carcass, component carcass, and abdominal fat as shown in Table 3.

\textbf{Table 3.} Average slaughter weight, carcass, component carcass, and abdominal fat of broiler at 5 weeks old

<table>
<thead>
<tr>
<th>Carcass Production</th>
<th>LD</th>
<th>CD</th>
<th>\textit{t-test value}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slaughter weight, g</td>
<td>1391.67 ± 208.37</td>
<td>1791.67 ± 195.08</td>
<td>0.012*</td>
</tr>
<tr>
<td>Carcass , %</td>
<td>72.04 ± 4.63</td>
<td>71.39 ± 1.66</td>
<td>0.377 ns</td>
</tr>
<tr>
<td>Components of Carcass :</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Breast meat, %</td>
<td>33.16 ± 1.47</td>
<td>33.35 ± 1.50</td>
<td>0.418 ns</td>
</tr>
<tr>
<td>- Wings, %</td>
<td>11.27 ± 0.59</td>
<td>10.55 ± 0.37</td>
<td>0.017*</td>
</tr>
<tr>
<td>- Back, %</td>
<td>19.83 ± 0.43</td>
<td>20.89 ± 1.81</td>
<td>0.115 ns</td>
</tr>
<tr>
<td>- Drumstick + Thigh, %</td>
<td>27.10 ± 2.30</td>
<td>26.92 ± 1.77</td>
<td>0.438 ns</td>
</tr>
<tr>
<td>Adominal fat, %</td>
<td>0.65 ± 0.18</td>
<td>1.20 ± 0.29</td>
<td>0.002**</td>
</tr>
</tbody>
</table>
Results of *t-test value* were shown significant effects (P<0.05) on slaughter weight and wings percentage of the broiler at 5 weeks old and shown high significant effects (P<0.01) on abdominal fat. However in carcass percentage, breast meat, back, drumstick and thigh were resulted in no significant effects. This gives an indication that the production of carcass resulting from the use of local feed ingredients in broiler ration has relatively the same quality with commercial diets. Carcass yield was found in this experiment as 72.04 ± 4.63 (LD) and 71.39 ± 1.66 (CD), this results more higher compared to Sarjuni (2011) that found 68.28-71.42%, 67.30-69.90% (Muiz, 2014), and 70.44-74.13% (Yadav and Sah, 2005).

**Economic Value of the Ration**

The means of economic value of the ration i.e feed efficiency, income over feed and chick cost as shown in Table 4.

**Table 4.** Averages of economic value of the ration i.e feed efficiency, income over feed and chick cost during 5 weeks old

<table>
<thead>
<tr>
<th>Economic Value</th>
<th>Treatments</th>
<th>T-test value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LD</td>
<td>CD</td>
</tr>
<tr>
<td>Feed efficiency</td>
<td>0.411 ± 0.043</td>
<td>0.422 ± 0.024</td>
</tr>
<tr>
<td>Income over feed &amp; chicks cost</td>
<td>0.340 ± 0.08</td>
<td>0.147 ± 0.030</td>
</tr>
</tbody>
</table>

**Note:** ns Non significant different of the two treatments (LD and CD) with Confidence Level 95%

**High significant different (P< 0.01) of the two treatments (LD and CD)**

LD = Local diets; CD = Commercial diets

Economic value of ration based on t-test analysis was found no significant different in feed efficiency, however in income over feed and chicks cost was shown high significant different (P<0.01) of the two treatments (LD and CD). This means that the use of local feed ingredients in broiler ration formulation gives a positive result, can lower the price of ration and produce value income over feed and chick cost greater. Rasyaf (2005) which stated that the efficiency of feed use will reduce the cost of feed elements occupy the highest expenditure of the cost of production. The improvement in income over feed cost could be attributed to the decreased feed intake and feed cost (Yadav and Sah, 2005).

Funk and Frank (2008) states that a decision needs to be taken in addressing the pricing of feed ingredients that are needed by farmers. On the other hand, Joseph (2004) found an effort to improve the success of broiler maintenance in addition to inexpensive materials that can also be through the addition of feed supplements to the ration. When rations are used not provide good efficiency it is advisable to provide additional supplements to the diet can be beneficial in order IOFCC (Rombe, M.B. 2012). Whenever, Luis et al., (2004) can be managed to improve the efficiency of feed and IOFCC through the addition of protease supplements.

**CONCLUSION**

The results of this experiment show that the positive effect of used the local feed in broilers diets and provide the performance results that do not differ significantly in body weight, feed...
intake, feed conversion, and carcass production but significantly different in slaughter weight and wing pieces. Whenever, showed high significant effect to reduced abdominal fat pad. Evaluation of local feed prices lower than 26.63% compared to commercial feed. Future research in this area should focus on the attempt to give confidence of farmer in small scale farm to use of local feed in diets formulation of broiler.

REFERENCES


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Digestibility and Nutritional Value of Gedi (*Abelmoschus manihot* (L.) Medik) Leaves Meal in the Diet of Broilers

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**ABSTRACT:** A study was carried out to determine the nutrient utilization and nutrient value of gedi (*Abelmoschus manihot* (L.) Medik) leaves meal, a native plant that abundant in the Northern-Sulawesi of Indonesia, when substituted at various levels in the diets. Sixteen adult broiler chickens Cobb-CP 707 35 days of age were conducted in metabolic cages and allocated in four groups of four birds each to determine AME and AMEn, crude protein and crude fibre digestibility. Birds were corresponded to four dietary treatments containing respectively 0, 5, 10, and 15% gedi leaves meal. Birds were weighed at the beginning and at the end, collected fresh excreta were weighed daily and the droppings were oven-dried at 55 °C and ground per bird for three days. Experimental diets and collected excreta were subjected to chemical analysis. The results showed that the gedi (*Abelmoschus manihot* (L.) Medik) leaves were relatively rich in crude protein (20.18%), crude fiber (17.53), calcium (3.29%), lysine NDF (20.76%) and positively have steroid and flavonoid. The inclusion of gedi leaves in the diet highly significant (P<0.01) decreased AME and AMEn and significantly (P<0.05) decreased crude protein and crude fiber digestibility. Gedi leaves in diets improved the metabolizable energy utilization in birds fed the 5% level and improved crude protein and crude fiber utilization in birds fed 10% level inclusion diet. Gedi was rich in sticky mucilage, a soluble-polysaccharide, that affected to rate of passage of digesta. It can be concluded that gedi leaves meal can be fed to broiler chickens at up to 10%, and results suggested that adding gedi leaves to broiler diets may benefit after processing the mucilage.

**Keywords:** gedi, broilers, digestibility, nutritional value

**INTRODUCTION**

Poultry rations usually contain antibiotic growth promoters (AGP) to enhance performance of birds. However, the use of antibiotics as a growth promoter in chicken has been reported to cause some unwanted results (Botsoglou and Fletouris, 2001). Poultry nutritionists now are being challenged to develop an alternative for AGP. Considerable attention has been paid to medicinal herbs as replacements for AGP (Ibrahim et al., 2005). As an alternative to AGP, medicinal plants are the most popular options (Durrani et al., 2008; Ocak et al., 2008). That phytogenic feed additives have attracted as alternative feeding strategy to replace AGP (Salary et al., 2014).

Gedi (*Abelmoschus manihot* (L.) Medik) has beneficial effects in medicine. Gedi, a native plant that abundant in the Northern-Sulawesi of Indonesia, has been consumed as a medicinal product in Asian countries, South and Southeast Asia, Pasific Island, tropical Africa, and tropical America (Preston, 1998). It showed anti-inflammatory and antibacterial (Jain dan Bari, 2010 1 and 2), analgesic effect (Jain dan Bari, 2011 1 and 2), anticonsulvant and anti depressant-like (Guo, et al., 2011), anti-inflammatory and anti-diabetes (Sarwar et al., 2011). Gedi contain high viscosity of mucilage (gum) that rich in polysaccharides and protein. Han et al. (2005) reported that polysaccharides of mucilage of the root of gedi consist of rhamnosa, galacturonate acid, glucuronat acid, glucose, arabynose, dan galactose.
There was slightly information about the utilization of gedi leaves as feedstuff in broiler ration, and whether their inclusion as a solid herb material would have growth promoting effects in live birds. So, there is need therefore to investigate the effect of these unconventional feed resources on the performance characteristics of broiler. The objective of this research was to determine the nutrient utilization and digestibility of gedi (*Abelmoschus manihot* (L.) Medik) in broilers diet for exploring the potential of this plant as a herb plant for a candidate of poultry feed.

**MATERIALS AND METHODS**

The harvested gedi leaves were air dried in shade under a shed until they were crispy to touch, while retaining their greenish colouration. The leaves were then milled to obtain a product as gedi leaf meal (GLM). Chemical analysis was also performed to determine the phytochemical and nutritional contents of gedi leaves.

In this experiment, 16 broiler chicks Cobb-CP 707 35 days of age were utilized for determination of apparent metabolizable energy and apparent metabolizable energy corrected for nitrogen (AME and AMEn, respectively), crude protein and crude fibre digestibility, through the standard total excretion collection method. Based diet was commercial complete based diet and dietary treatments were basal diet (R0), 95% basal diet + 5% gedi leaves meal =GLM (R1), 90% basal diet + 10% GLM (R2), and 85% basal diet + 15% GLM (R3). The experimental diets were formulated iso-protein and iso-calory, contained 22% CP and 2900 Kcal ME/kg. The experimental period was of 7 days: three for birds to adapt to cages, diets and management, one for fasting and three for total excreta collection. The experimental design was completely randomized, with four treatments and four replicates of one bird. Chicks were raised in metabolic cages fitted with mechanism for quantitative feeding and faecal collection. The excreta of all experimental units were collected daily on trays covered with plastic. The collected excreta were sprayed by 5% boric acid solution to prevent any loss in ammonia, then dried in an oven at 55°C for 24 hours, then after weighed, finely ground and kept for chemical analysis according to AOAC (1990) methods.

The data were used to calculate apparent metabolizable energy (AME), apparent metabolizable energy corrected for nitrogen (AMEn) values according to the following formula (Zarei, 2006), as follow:

1. \(\text{AME} = \frac{[(Fi \times GEf) - (E \times GEe)]}{Fi}\)
2. \(\text{AMEn} = \frac{[(Fi \times GEf) - (E \times GEe) - (NR \times K)]}{Fi}\)

AME: Apparent Metabolizable Energy (kcal/gm)
AMEn: Apparent Metabolizable Energy corrected for nitrogen (kcal/gm)
Fi: Feed intake (gm)
E: Excreta (gm)
GEf: Gross Energy of feed sample (kcal/gm)
GEe: Gross Energy of excreta (kcal/gm)
NR: Nitrogen Retention at zero level for control group (gm)
NF: Feed Nitrogen (%)
Ne: Faecal Nitrogen (%)
K: Nitrogen Retention corrected coefficient (8.73kcal/gm for each gm N)

The digestibility values for crude protein (CP) and crude fibre (CF) were calculated as nutrient intake minus nutrient excreted divided by nutrient intake multiplied by hundred (McDonald *et al.*, 1995), with equations as follow:

\[
\text{Apparent Nutrient Digestibility} = \frac{\text{Total Intake x % Nutrient Intake} - \text{Total Output x % Nutrient Output} \times 100}{\text{Total Intake x% CP Intake}}
\]
RESULTS AND DISCUSSION

**Nutritional value.** Results showed the nutritional value of gedi leaves, that were high in crude protein (20.18%), crude fiber (17.53%), calcium content (3.29%), amino acid lysine (425 mg/g), and positive bioactives steroid and flavonoid.

**AME and AMEn.** Results showed that the value of AME (Table 1) for R2 and R3 diets were significantly lower than control diet and R1 diet. Nadeem et al. (2005) reported that plant origin in diet contain high NSP (non-starch polysaccharide), such as arabinoxylan, glucan and pectin that are bonded to each other and it would be difficult to be digested by birds. Soluble NSP affect on digestibility and absorption of nutrients in poultry, because soluble NSP is able increase digesta viscosity. Caprita et al. (2010) reported that when digesta viscosity increases due to the NSP, the diffusion will decrease.

Insoluble NSP will form the bulk of the total fiber in the diet. These polysaccharides have the ability to absorb water in greater amounts (Saki et al., 2011). That soluble NSP generally inhibit the digestive process while the insoluble NSP physically impede access endogenous enzymes on its substrate. High fiber in feed ingredients caused bulkiness of feed and lower energy concentration (Zarei, 2006). From this discussion it can be stated that soluble and insoluble NSP of 10% and 15% of GLM were used in the study contribute to lowering the AME value of this research.

**Table 1.** Effects of dietary gedi leaves meal on AME, AMEn, crude protein and crude fiber digestibility of broilers

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Dietary Treatments</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R0</td>
<td>R1</td>
</tr>
<tr>
<td><strong>AME (Kkal/kg)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2844 ± 81.44c</td>
<td>2775 ± 139.60c</td>
<td>2534 ± 27.90b</td>
</tr>
<tr>
<td><strong>AMEn (Kkal/kg)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2788 ± 77.00c</td>
<td>2722 ± 134.20c</td>
<td>2488 ± 28.37b</td>
</tr>
<tr>
<td><strong>N Retention (g)</strong></td>
<td>6.4 ± 0.51</td>
<td>6.1 ± 0.65</td>
</tr>
<tr>
<td><strong>ACP Digestibility (%)</strong></td>
<td>55.2 ± 4.29b</td>
<td>62.7 ± 6.61c</td>
</tr>
<tr>
<td><strong>ACF Digestibility (%)</strong></td>
<td>42.1 ± 5.55b</td>
<td>43.9 ± 9.93b</td>
</tr>
</tbody>
</table>

Notes: ACP = apparent crude protein; ACF = apparent crude fiber

The values of AMEn for R2 and R3 diets were significantly lower than control diet and R1 diet. McDonald et al. (2010) stated that the calculation of ME needs to be corrected for the amount of N that because of the ability of animals to utilize the gross energy of feed protein varies greatly.

**Crude protein.** Crude protein digestibility values significantly increased in administration of 5% gedi leaves (R1), but decreased in the provision of 10% and 15% of gedi leaves. Das et al. (2012) stated that the saponins lower the digestibility of proteins through the formation of saponin-protein complexes that are difficult to digest. The reducing of digestibility of crude protein in the treatment of 10% and 15% may be caused by the influence of saponins in the feed that is able to form complexes with proteins, so it becomes difficult to digest protein. Also probably was because of increasing of the NSP. This agrees with the submission of Delorme and Wojcik (1982) who reported that as dietary fibre increased, adequate protein nutrition becomes critical. The results of the present study are in contrast with the findings of Nabizadeh (2012) who reported that supplementation of herbal plants leaf extracts significantly improved crude protein digestibility of the rations. Also, Awad et al (2011) reported that supplementation of herbal plants extracts to broiler improved the crude protein digestion and absorption.
Crude fiber. Result showed there were no significant different of crude fiber digestibility values between R0, R1, and R2 diets, but between R2 and R3 was significantly decreased. In this research, gedi leaves in diets improved the metabolizable energy utilization in birds fed the 5% level and improved crude protein and crude fiber utilization in birds fed 10% level inclusion diet. Gedi was rich in sticky mucilage, a soluble-polysaccharide, so that affected to rate of passage of digesta. The result of present study are in contrast with the finding of Durrani (2008) who observed higher digestibility of crude fiber and dry matter in the birds fed diet supplemented with neem leaves infusion. Also, Biu et al (2009) reported that supplementation of ginger and kalongi improved the crude fiber digestibility in broiler fed supplemented diets.

CONCLUSION

From the results of this study, it can be concluded that gedi leaves meal can be fed to broiler chickens at up to 10%, and results suggested that adding gedi leaves to broiler diets may benefit after processing the mucilage.

REFERENCES

Jain, P. S., and S. B. Bari. 20102. Evaluation of wound healing effect of petroleum ether and
ABSTRACT: In the prospect of skipjack tuna (*Katsuwonus pelamis L.*) fish that abundant in Sulawesi Ocean, using as a protein source for chicken diets, a study was carried out to determine the effect of skipjack tuna gill meal (STGM) on carcass percentage, abdominal fat percentage and mortality. Five dietary treatments containing 0, 3, 6, 9, and 12% levels (factor A) substituted to fish meal and three methods of processing containing sun dried, steamed, boiled processing (factor B) were fed to 225 broiler chickens according to factorial design constructed from completely randomized design with three replication. Treatments were administrated during 35 days and feed and water were provided *ad libitum*. Result showed that dietary skipjack tuna gill meal up to 12% exert no significant difference (P˃0.05) compared to control on carcass percentage, abdominal fat percentage and mortality, and methods of processing exert no significant effect (P˃0.05) too on carcass percentage, abdominal fat percentage and mortality. There was no significant interaction (P˃0.05) between levels and methods. It can be concluded that skipjack tuna meal can be substituted to fish meal up to 12%.

Keywords: Skipjack Tuna Meal, Fish Meal, Carcass Quality

INTRODUCTION

In recent year, poultry nutritionists have aimed their researchs towards the use of non-traditional feedstuffs in partial or total replacement of the conventional ingredients. Agro-industrial by-products are being evaluated to access their nutritive potential to support poultry productivity. Fish meal is a conventional animal protein source when added to the diet increases poultry production cost (Islam, 1993). Research has confirmed that fishmeal is a useful protein source for poultry (Machin et al., 1990). However, there are a number of unfavorable characteristics, which present limiting factors in fishmeal usage (Mikulec et al., 2004). Moreover, poultry is a competitor of human being in respect of dry fish consumption. Effort of reducing production cost from feed needs to find alternative feed materials of relatively same nutritive value as the fish meal.

There are many non-conventional feeds and by-products could be utilized effectively to improve the supply of local poultry feeds. Fish by-products are the most important by-products available at reasonable prices. These fish by-products have the potential as high protein supplements for poultry. One of them is skipjack tuna gills as animal-derived protein source of poultry feed. The gill of skipjack tuna as protein source will decay if it is not processed due to containing good components for bacterial growth. Skipjack gill is also a living habitat for bacteria beside intestine and skin. For these reasons, the skipjack gill could be utilized as bird feed through processing techniques. Processing to make gill meal can be done through a) sun drying, b) steaming, and c) boiling. The important factor needed to be considered in fish processing is drying temperature. In semi-conventional or conventional processing of the skipjack gill often occurs the protein...
denaturation due to over-heating. The animal protein in the ration should be less or equal to one-third the total protein of the ration. The animal protein about one-fourth the total ration protein could still give good performance of the broiler growth rate. Carcass is part of the body after the cut and discarded chicken feathers, abdominal fat, organs, legs, head, neck and blood, except the lungs and kidneys (Rizal, 2006). According to Lesson (2000), nutrients in diet were the factors that affect the carcass weight. Percentage of carcass weight is calculated by dividing the carcass weight multiplied by 100% live (Rizal, 2006). The objective of this study was to evaluate the effect of different administration levels of the skipjack gill meal as fish meal substitute in the ration on the carcass percentage and abdominal fat percentage.

MATERIALS AND METHODS

Two-hundreds and twenty-five Arbor Acres CP 707-strained broiler chicks were used in this study with initial mean weight of 44.50 g and coefficient of variant 5.23%. These chicks were randomly placed in 45 units of cages, each of which had 5 individuals of broiler chicks. The composition of diets were 15 kinds of rations as treatments, i.e 5 administration levels of skipjack gill meal, 3, 6, 9 and 12%, and 3 processing methods, sun-drying, steaming, and boiling with 3 replications. All rations were made in 22% of protein and metabolizable energy of 3200 Kcal/kg according to NRC (1994). The nutrients of skipjack tuna gill meal and the composition of feedstuffs and nutrients in diet were shown in Table 1 and Table 2.

**Table 1.** Nutrients in skipjack tuna gill meal (STGM)

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>STGM sun-dried</th>
<th>STGM-steamed</th>
<th>STGM-boiled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water (%)</td>
<td>10.80</td>
<td>10.65</td>
<td>10.95</td>
</tr>
<tr>
<td>Crude protein (%)</td>
<td>42.56</td>
<td>41.71</td>
<td>40.67</td>
</tr>
<tr>
<td>Crude fat (%)</td>
<td>7.39</td>
<td>7.10</td>
<td>6.67</td>
</tr>
<tr>
<td>Crude fiber (%)</td>
<td>0.28</td>
<td>0.32</td>
<td>0.12</td>
</tr>
<tr>
<td>NFE</td>
<td>6.08</td>
<td>6.27</td>
<td>7.69</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>32.89</td>
<td>33.95</td>
<td>33.90</td>
</tr>
<tr>
<td>Ca (%)</td>
<td>10.27</td>
<td>10.39</td>
<td>10.88</td>
</tr>
<tr>
<td>P (%)</td>
<td>6.36</td>
<td>6.12</td>
<td>7.52</td>
</tr>
<tr>
<td>Gross energy (Kcal/kg)</td>
<td>4760</td>
<td>4150</td>
<td>4060</td>
</tr>
</tbody>
</table>

Notes: STGM = skipjack tuna gill meal

This study used Factorial Completely Randomized Design (5 x 3). Factor (A) was 5 administration level of skipjack gill meal, and factor (B) was 3 gill processing methods. The chicks were divided into 15 groups of treatments, each of which consisted of 3 cages as replication and each cage kept 5 individuals. Data obtained was analyzed using analysis of variance (Steel and Torrie, 1980).

Parameters measured for carcass quality were carcass percentage and abdominal fat percentage. All data generated were subjected to the analysis of variance technique according to factorial completely randomized design.
The 6th International Seminar on Tropical Animal Production
Integrated Approach in Developing Sustainable Tropical Animal Production
October 20-22, 2015, Yogyakarta, Indonesia

**Tabel 2. Diets and nutrients in diets**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>K0</th>
<th>j1</th>
<th>j2</th>
<th>j3</th>
<th>j4</th>
<th>k1</th>
<th>k2</th>
<th>k3</th>
<th>k4</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
<th>R4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn</td>
<td>55.95</td>
<td>55.95</td>
<td>55.72</td>
<td>54.7</td>
<td>54.14</td>
<td>55.4</td>
<td>54.8</td>
<td>54.4</td>
<td>54.25</td>
<td>55.8</td>
<td>54.78</td>
<td>54.15</td>
<td>53.6</td>
</tr>
<tr>
<td>Rice bran</td>
<td>6</td>
<td>6</td>
<td>5.75</td>
<td>5.05</td>
<td>5.1</td>
<td>5.55</td>
<td>5.05</td>
<td>5</td>
<td>6.05</td>
<td>6.05</td>
<td>6</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Soybean cake</td>
<td>17</td>
<td>17</td>
<td>17</td>
<td>17.8</td>
<td>17.25</td>
<td>17</td>
<td>17</td>
<td>17.5</td>
<td>16.5</td>
<td>17</td>
<td>17</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Coconut cake</td>
<td>3</td>
<td>3</td>
<td>2.5</td>
<td>2.5</td>
<td>3</td>
<td>3</td>
<td>2.5</td>
<td>2</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Fish meal</td>
<td>12</td>
<td>12</td>
<td>9.98</td>
<td>7.97</td>
<td>5.96</td>
<td>10</td>
<td>8.07</td>
<td>6.1</td>
<td>4.15</td>
<td>10.1</td>
<td>6.25</td>
<td>6.25</td>
<td>4.33</td>
</tr>
<tr>
<td>STGM sun-dried</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>STGM-steamed</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>STGM-boiled</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>9</td>
<td>9</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Coconut oil</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Grit</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0.05</td>
<td>1</td>
<td>0.01</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Top Mix</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Nutrients:
- Protein (%): 22.41, 22.26, 22.42, 22.1, 22.04, 22.3, 22.2, 22.17, 22.1, 22.18, 22.13, 22.4
- ME (Kcal/kg): 3200, 3204, 3202, 3201, 3202, 3204, 3204, 3230, 3202, 3201, 3213, 3223
- Ca (%): 1.3, 1.48, 1.66, 1.84, 2.03, 1.49, 1.67, 1.86, 1.76, 1.51, 1.71, 1.62, 1.82
- P (%): 0.47, 0.6, 0.73, 0.86, 1, 0.59, 0.72, 0.84, 0.95, 0.63, 0.8, 0.96, 1.13

Notes: Jo = Control diet, J1=3% STGM sun-dried, J2= 6 % STGM sun-dried, J3= 9% STGM sun-dried, J4= 12 % STGM sun-dried, K1= 3% STGM-steamed, K2= 6 % STGM-steamed, K3= 9% STGM-steamed, K4= 12 % STGM steamed, R1= 3% STGM-boiled, R2= 6 % STGM-boiled, R3= 9% STGM boiled, R4= 12 % STGM-boiled.

**RESULTS AND DISCUSSION**

**Carcass Percentage.** The percentage of carcass based on the administration level and processing method of the skipjack gill meal is presented in Table 3.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Processing Methods</th>
<th>administration level of the skipjack gill meal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R0</td>
<td>R1</td>
</tr>
<tr>
<td>Carcass (%)</td>
<td>Sun-dried</td>
<td>74.56</td>
</tr>
<tr>
<td></td>
<td>Steamed</td>
<td>74.19</td>
</tr>
<tr>
<td></td>
<td>Boiled</td>
<td>74.39</td>
</tr>
<tr>
<td>Abdominal Fat (%)</td>
<td>Sun-dried</td>
<td>2.04</td>
</tr>
<tr>
<td></td>
<td>Steamed</td>
<td>1.85</td>
</tr>
<tr>
<td></td>
<td>Boiled</td>
<td>2.02</td>
</tr>
</tbody>
</table>

Result showed that the skipjack gill meal administration level and processing method interaction did not give significant effect (P > 0.05) on the carcass percentage of the broiler. Aliyani (2002) stated that weight of live of broiler was affected by feed consumption, feed quality, and activity of broiler. Carcass percentage values recorded in ranged 73.18 to 74.38%. This result
agrees with Bell and Weaver (2002) that carcass of 1520 g/body weight is 65.5 %. Shanin and Abdul ElAzeem (2005) suggested that chicken carcasses fed with a high content of fiber, both with high or low protein content have the proportion of carcass weight with higher bone than the chickens fed with a low content of fiber, both with content high or low protein.

Abdominal fat percentage. Abdominal fat percentage of the broilers based on administration level and processing method of skipjack gill during this study is given in Table 3. Result showed that gill meal administration level and processing method interaction, administration level, and processing method did not significantly affected (P>0.05) abdominal fat percentage of broilers. Average of abdominal fat percentage was in common range, 1.87 to 1.97%. North (1984) stated that the abdominal fat content of the broiler should not be higher than 4%. It reflected that the use of the administration level and the processing methods in this study produces the abdominal fat lower than 4%, meaning that the abdominal fat of the broiler is the normal range.

In the fat developing process, the body fat is produced from carbohydrate, protein, food fat, after the carbohydrate is absorbed in glucose form and glycogenic glucose is changed to glucose and then transferred to the liver to be stored as glycogen, while some fat enters the circulatory system through lymphatic system and can directly stored in the tissue. Since each certain cell possesses the highest limit of protein storage, excessive amino acid will be degraded to be energy source and will stored as body fat. Non-significantly different abdominal fat could result from that the energy and protein content in the ration is the same despite similar energy consumption. Abdominal fat could also rise if high energy level is given (North and Bell, 1990). This study used the ration of 22% protein and metabolizable energy of 3200 Kcal/kg. Beside for major living need, the excessive energy is then stored in fat form occurring in the body cavity and attaching to the organs. Resnawati (2004) stated that the percent of abdominal fat at 5 weeks old ranged from 1.5 to 2.11%. The broilers used in the study had the same age and lived in the same environment. The skipjack (Katsuwonus pelamis L) gill waste through steaming processing method and administration of 12% as a replacement of anchovy meal protein in the ration gave good response to the percent of carcass weight and abdominal fat.

CONCLUSION

This study concluded that skipjack tuna gill meal can replace up to 12% of fish meal in broiler diets without affecting carcass quality of broiler meat and it would be economically profitable to include STGM in feed mixtures for broiler production as part of their balanced diet.

REFERENCES


The Dynamics of Indigenous Probiotics Lactic Acid Bacteria on Growth Performance, Total Adherence Bacteria, and Short-Chain Fatty Acids Production in the Ileum of Male Quail

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ABSTRACT: The aim of this study was to evaluate the dynamics of indigenous probiotics lactic acid bacteria in connection with growth performance, total adherence bacteria in the ileum, and their short-chain fatty acids production of male quails raised for 42 days. The probiotics consisted of three indigenous lactic acid bacteria strains, namely *Lactobacillus murinus* (Ar3), *Streptococcus thermophilus* (Kp2) and *Pediococcus acidilactiti* (Kd6). A total of 192 day old male quails were randomly divided into four treatment groups: T0, T1, T2 and T3. The treatment of T0 was unsupplemented probiotics, while T1, T2 and T3 were orally supplemented multi strain probiotics contained $10^7$, $10^8$, $10^9$ CFU/ml/bird/day, respectively. The layer quail diet was formulated to meet the National Research Council recommendation, without antibiotic and coccidiostat. Feed and drinking water were provided ad libitum. The data were analyzed by one way anova of Completely Randomized design (CRD) followed by Duncan New Multiple Range Test (DMRT). The result showed that supplementation of probiotics improved growth performance of male laying quails, increased ileal short-chain fatty acids production consisted of acetic, propionic and butyric acid (P<0.05). The count of ileal lactic acid bacteria increased according to the level of probiotics supplementation. The adherent of lactic acid bacteria count in the ileum was 2 log cycle greater than the control one.

**Keywords:** Quails, Probiotics, Growth performance, Short-chain fatty acid production, Lactic acid bacteria count.
Selection of Human-origin Lactobacillus strains as Probiotics with Capability in Synthesizing Conjugated Linoleic Acid and Alleviating Hyperglycemia in Rats (Rattus norvegicus) in vivo

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ABSTRACT: The objective of this study was to select Lactobacillus strains as potential probiotics with the capability to synthesize bioactive compounds Conjugated Linoleic Acid (CLA) and their ability to alleviate hyperglycemia in rats (Rattus norvegicus) in vivo. Five strains of Lactic Acid Bacteria consists of Lactobacillus casei strain AP and AG, and Pediococcus acidilactici strains AA, BE and BK were previously isolated and identified from faeces of infants who consumed breast milk as the only source of diet. In vitro evaluation those five strains showed their potential as probiotic based on their capability to grow on media with pH 2.0 and 1.5% concentration of bile salts, the ability to attach on gastric mucin in vitro, and their ability to inhibit the growth of pathogen. Evaluation on the ability to use prebiotic inulin as carbon source showed that Lactobacillus casei (strain AP and AG) and Pediococcus acidilactici strain BE had the ability to degrade inulin as a prebiotic. Evaluation of probiotic on their capability to synthesize Conjugated Linoleic Acid (CLA) from free linoleic acid showed that Lactobacillus casei strain AP was able to convert more than 60% of free linoleic acid to CLA in the media. Further in vivo studies using rats (Rattus norvegicus) showed that Lactobacillus casei strain AP had the ability to alleviate hyperglycemia. The ability of Lactobacillus casei strain AP in reducing hyperglycemia was comparable with that of metformin (anti-hyperglycemia drug) provided orally at level 45 mg/kg of body weight.

Keywords: Probiotics, Lactobacillus, Hyperglycemia, Conjugated Linoleic Acid

INTRODUCTION

Probiotics are defined as “living microorganisms which when administered in adequate amounts confer a health benefit on the host” (FAO/WHO, 2001). The International Scientific Association for Probiotics and Prebiotics (ISAPP) in 2013 recommended that probiotics definition was relevant and sufficiently accommodating for current and anticipated applications. Health-associated benefits to the hosts in consuming probiotics have already been reported, included here are the ability to reduce concentration of serum cholesterol (Ooi and Liong, 2010; Anderson et al., 1999), to prevent and reduce risk of certain cancers (Xiao et al., 2006; Wollowski et al., 2001; Ohashi et al., 2000), and to stimulate the immune systems (Pareira et al., 2003; Nagao et al., 2000; Gill, 1998). To be functional as probiotics and to guarantee as safe for human consumption, bacterial strains must be non pathogenic, survive to gastric acid and bile toxicity, able to attach and colonise gastrointestinal tract (GIT), and ideally must be originated from human (Dunne et al., 2001; Dunne et al., 1999). Bacterial member of genus Lactobacilli and Bifidobacteria have commonly been applied as probiotics for human consumption (Grajek et al., 2005; Mercenier et al., 2003; Otieno, 201; Roberfroid, 2000; Gomes and Malcata, 1999).

The human gastrointestinal tract (GIT) is the best source of probiotics (Margolles et al., 2009). Favier et al. (2003) previously reported that consumption of human milk oligossacharide
(HMO) promotes the development of colonic microbiota in the newborn infants. The microbiota of breast-fed infants are dominated by *Bifidobacteria* and *Lactobacilli* as their growth were induced by HMO provided within breast milk (Boehm and Stahl, 2007; Favier *et al*., 2003). Human-origin probiotic strains isolated have been commercially presented. These include *Lactobacillus rhamnosus* GG, *Lactobacillus casei* Shirotta, and *Lactobacillus acidophilus* LA-1 (Dunne *et al*., 2001).

Isolation and identification of *Lactobacillus casei* and *Pediococcus acidilactici* from fecal of Indonesian infants had previously been reported (Widodo *et al*., 2012a; Widodo *et al*., 2012b). Further experiments to evaluate their potential as probiotics had also been conducted (Widodo *et al*., 2012b; Widodo *et al*., 2014). Probiotic assays showed that more than 50% of cells were viable after grown on pH 2.0 for 90 min, and around 80% of cells from the same strains were survived on media supplemented with bile salt 1.5% for 2 h. All of strains had high adhesion capacity as seen by more than 75% of cells attached on pig gastric mucin in vitro. Investigation of selected strains to grow on inulin as the only carbon source showed *Lactobacillus casei* strain AP and AG, and *Pediococcus acidilactici* strain BE were able to consume inulin (Widodo *et al*., 2012b; Widodo *et al*., 2014). These three strains grew normally on inulin-containing media as the only carbon source, suggesting that they were able to utilize inulin as carbon source. This study is a continuation of previous studies with emphasize to select of *Lactobacillus* and *Pediococcus* strains with ability to synthesize *Conjugated Linoleic Acid* (CLA) and to evaluate their capability in alleviating hyperglycemia in rats (*Rattus norvegicus*) in vivo.

**MATERIALS AND METHODS**

**Bacterial strains**

*Lactobacillus casei* strain AP and AG, and *Pediococcus acidilactici* BE were obtained from previous experiments (Widodo *et al*., 2012a; Widodo *et al*., 2012b). Bacterial cells were purified by plating on De Man-Rogosa-Sharpe (MRS, Merck) agar supplemented with L-cysteine 0.5 g/L (Sigma) and incubated at 37°C for 48 h in microaerobic condition.

**Growth media and CLA synthesis**

Bacterial cells were grown on MRS broth and harvested at the logarithmic phase. The bacterial culture (2.5% v/v) were collected and inoculated on MRS broth supplemented with linoleic acid at 0.4 mg/ml (dissolved in 80% Tween solution), incubated at 37°C for 24 h. After 24 hours, samples (8 ml) were harvested by centrifugation at 5000 rpm for 30 minutes at 5°C. The supernatant were collected for CLA analysis using Gas Chromatography-Mass Spectrometry (GC-MS) according to Alonso *et al*., 2003).

**Fat extraction**

Fat extraction was carried out according to Alonso *et al*., (2003) with modification. Sample of supernatant (6 ml) was mixed with 12 ml isopropanol and homogenized. The solution was then mixed with 9 ml hexane and centrifuged at 23000 rpm for 5 minutes at 5°C. The upper layer solution was collected and filtered using natrium sulphate, and washed with 7 ml hexane. The hexane faction was then evaporated at room temperature (30 - 40°C) resulted in condensed fat. The esterification of fat residue was carried out with 300 µl 14% boron trifluoride (BF3) in methanol at 50-60°C for 2 h. After esterification, 800 µl hexane was added and sampled was analyzed using GC-MS.

**GC-MS Analysis**

Methil ester of CLA was analyzed using GC-MS according to Alonso *et al*., (2000) with modification. Sample analysis was carried out in a column AGILENTP%W DB-1 (30 m x 0.25 mm i.d) with helium as the carrier and ionizer El 70 Ev was applied. The coloumn temperature was set at 80°C, injection temperature at 310°C using split injection, pressure at 16.5 kPa, flow rate 40 mL/mins, flow rate in coloumn at 0.50 mL/mins with split rasio 73. Injection volume was 1 µl, and peaks of CLA were identified using retention time after spiking.
Study hyperglycemia in vitro in rats

Selected bacterial strains with capability in synthesizing CLA (Lactobacillus casei strain AP) and Lactobacillus casei strain AG (non synthesizing CLA) were applied as starters in dairy fermentation by inoculating 5% (v/v) of bacterial cultures into the pasteurised fresh milk and incubated at 60°C for 10 h. After fermentation, physico-chemical and microbiological qualities of the product was evaluated and 2 ml of the fermented products bearing total lactic acid bacteria 1x10⁸ cfu/ml was applied for in vivo studies in rats (Rattus norvegicus). Rats were treated with 5 treatments as follows:

T1: rats were fed with standard feed and water provided at libitum.
T2: rats were fed with high content of fat and sucrose.
T3: rats were fed with high content of fat and sucrose, and after 129 days of treatments were fed with 2 ml milk fermented with L. casei strain AP.
T4: rats were fed with high content of fat and sucrose, and after 120 days were fed with 2 ml milk fermented with L. casei strain AG.
T5: rats were fed with high content of fat and sucrose, and after 120 days of treatments were fed with metformin at 45 mg/kg.

Variables measured were weight of rats and level of blood sugar at 0, 30, 60, 60, 90, 120 (before treatments), and 135 days (after treatments). Blood sugar was measured base on glucose oxidase (GOD-PAP) using DiaSys diagnostic systems Gmbh according to the manufacturer’s instruction.

RESULT AND DISCUSSION

Isolation and identification Lactobacillus casei and Pediococcus acidilactici from fecal of Indonesian infants had previously been reported (Widodo et al., 2012a; Widodo et al., 2012b; Widodo et al., 2014). In this study, further experiments were conducted to evaluate their ability to synthesize CLA in vitro and to function as anti-hyperglycemia in rats. Growth media used for CLA synthesis was MRS broth supplemented with 0.4 mg/ml linoleic acid as precursor for CLA synthesis. After fermentation, derivatization of products was carried out using boron trifluoride in methanol (BF3-metanol) followed by analyzed using GC-MS. Derivatisation converts linoleic acid to methylated linoleic that can be analyzed using GC-MS.

Figure 1 showed that samples prepared from products fermented with Lactobacillus casei strain AP had 4 peaks with similar molecular ions and mass-to-charge ratio (m/z) at 294. Mass spectra of peak number 3, 4, 5 and 6 were similar (data not shown), suggesting that those four peaks are isomers. Based on mass spectra, it was difficult to determine what compounds are peak number 3, 4, 5, and 6. To solve that problem, spiking or injecting compounds that has been known was carried out.

Spiking was carried out by injecting linoleic acid. The increasing peaks after spiking suggesting that those peaks were linoleic acids. Peak number 2 with retention time 22.912 was dramatically increased after spiking leading to the conclusion that this peak is linoleic acid (Fig 1a and 1b). On the other hand, peak number 3, 4, and 5 were proposed as isomers of linoleic acids or Conjugated Linoleic Acid (CLA) (Fig 1a and 1b).

a. Before spiking
b. After spiking with linoleic acid

Figure 1. (a) GC-MS chromatogram of sample *L. casei* strain AP before spiking and (b) after spiking with linoleic acid.

GC-MS chromatogram showed that retention time of CLA isomers of peaks 4, 5 and 6 were detected at 23.310; 23.563, dan 23.710 minutes (data not shown) suggesting isomers separation. However, separated isomers could not be identified their geometric position and structure due to unavailability of comparable CLA standard.

<table>
<thead>
<tr>
<th>Peak number</th>
<th>Retention time</th>
<th>Proposed compounds</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21.548</td>
<td>Palmitic acid</td>
<td>12.85</td>
</tr>
<tr>
<td>3</td>
<td>22.936</td>
<td>Palmitic acid</td>
<td>12.71</td>
</tr>
<tr>
<td>4</td>
<td>23.310</td>
<td>CLA</td>
<td>46.77</td>
</tr>
<tr>
<td>5</td>
<td>23.563</td>
<td>CLA</td>
<td>10.36</td>
</tr>
<tr>
<td>6</td>
<td>23.710</td>
<td>CLA</td>
<td>9.43</td>
</tr>
</tbody>
</table>

Tabel 1 showed that *L. casei* strain was able to do isomerization of linoleic acid resulting in production of CLA (66.56% of products). Meanwhile, hydrogenation of the rest linoleic acid was proposed argument why *L. casei* strain AP synthesize palmitic acids (25.56%) (Table 1).

According to Alonso et al. (2003), geometrical isomers of CLA that was converted from linoleic acids by human-isolated *L. casei* dan *L. acidophilus* were cis-9,trans-11; trans-10,cis-12 dan trans-9,trans-11. Alonso et al. (2003) also reported that *L. casei* E10 had the ability to manly synthesize CLA (80.14%) when grown on MRS broth supplemented with free linoleic acids at 0.2 mg/ml and incubated at 37°C for 24 hours. The level of CLA synthesized reported here is lower than that reported by Alonso et al. (2003), was likely due to differences on fermentation conditions.

CLA-synthesizing *Lactobacillus casei* strain AP was then selected as starters for milk fermentation, whilst non-synthesizing CLA *Lactobacillus casei* strain AG was also selected as negative control. The fermented product was fed to rats after being treated with high fat and sucrose for 120 days, and the treatment was prolonged for 15 days. Blood samples of rats before (120 days in high fat and sucrose) and after treated (15 days) was collected, and level of sugar was measured. The data of blood sugar before and after *L. casei* strain AP-containing fermented milk was presented at Figure 2.
Figure 2. Level of blood sugar (mg/dl) before and after being fed with standard feed (T1), high fat and sucrose (T2), milk fermented with *L. casei* strain AP (T3), *L. casei* strain AG (T4) and metformin (T5).

Figure 2 showed that level of blood sugar in rats fed with milk fermented with *Lactobacillus casei* strain AP (T3) and metformin (T5) was reduced after 15 days of treatments, suggesting that *Lactobacillus casei* strain AP and metformin function as anti-hyperglycemia. Level of blood sugar in T3 decreased from 172.45±2.15 mg/dl to 147.20±6.01, while metformin (T5) reduced blood sugar from 173.53±6.55 to 124.18±16.90. Metformin is commercially known as antidiabetic medication to treat people with type 2 diabetes. On the other hand, untreated rats (T2) and rats fed with standard feed (T1) and fed with milk fermented with *Lactobacillus casei* strain AG had no effects on blood sugar reduction (Figure 3).

**CONCLUSION**

In conclusion, *Lactobacillus casei* strain AP had the ability to synthesize CLA on media supplemented with linoleic acid. Rats fed with milk fermented with *Lactobacillus casei* strain AP showed reduction on blood sugar after treatment for 15 days.

**ACKNOWLEDGEMENT**

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168S-7S (Supplementary).

isolated from Indonesian infants demonstrating potential characteristics as probiotics

strains isolated from feces of Indonesian infants with in vitro capability to consume prebiotic

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Bifidobacterium longum BBS36 in relieving clinical symptoms and modulating plasma
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Production Performance and Quality of Eggs of Laying Hens Fed Diets Supplemented with Plants Rich in alpha-Linolenic Acid

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ABSTRACT: The aim of the study was to evaluate the effects of including a plant source of n-3 fat in the form of alpha-linolenic acid (ALA, 18:3n-3) in the diets of layers on production performance and quality of eggs. One hundred twenty five hens were assigned to five dietary treatments. The diets were supplemented with 0, 1.5, 3.0, 4.5 and 6.0% Portulaca orelacea flour, as a source of ALA. Birds were placed at point of lay and fed for 4 weeks. Water and feed were provided ad libitum. Feed consumption was measured weekly and FCR was calculated at the end of the trial. A total of 25 egg yolk samples of day 28 (n = 5 egg yolks for each treatment) were collected to analyse the egg quality. Results showed that the incorporation of plants rich in ALA did not modify feed intake (FI), feed conversion ratio (FCR) and egg production. The average of FI and FCR of hens fed diets containing ALA was 98.73 g/day and 2.11. Enriching ALA levels in the diets had no effect on physical quality of eggs, including egg weight, yolk weight, albumen index, yolk index and Haugh Unit (HU). The average of egg weight and yolk weight were 59.5 and 15.0 g, respectively. Diet containing Portulaca orelacea increased yolk colour of egg. In conclusion, laying hens fed diets supplemented with Portulaca orelacea rich in ALA improved yolk colour and did not change the production performance of the birds or the qualities of the eggs.

Keywords: Portulaca orelacea, alpha-linolenic acid, Performance production, Egg quality
Performance of Japanese Quails Fed Different Protein Levels and Supplemented with Betaine

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ABSTRACT: The objective of the experiment was to investigate the performance of Japanese quails (*Coturnix coturnix japonica*) fed different levels of protein and supplemented with betaine. The experiment used 300 quails with an average initial body weight of 43.21±2.68 g. The design used was completely randomized design of factorial 2 × 2. The first factor was the 2 levels of crude protein (18.0 and 19.5%) and the second factor was the supplementation of betaine (0 and 0.12% betaine). Each treatment used 5 replications containing 15 quails each. During adaptation, quails were fed a grower diet until the age of 41 days and then replaced with a layer diet containing 18% protein. The treatments were given when egg production has reached 50%. The data were analyzed using analysis of variance followed by Duncan’s test. Feeding 19.5% increased feed intake (P<0.5). However, dietary protein did not affect egg production, egg weight, feed conversion and protein efficiency ratio. Feeding 19.5% protein improved eggshell weight but resulted in a lower yolk index compared with 18% protein (P<0.05). Supplementation of 0.12% betaine increased feed intake, egg production, egg weight and protein efficiency ratio and decreased feed conversion (P<0.05). Supplementation of 0.12% betaine did not affect albumen index and eggshell weight. Moreover betaine increased yolk weight but decreased yolk index (P<0.05). It can be concluded that increasing dietary protein levels from 18.0 to 19.5% had minor impacts on quails’ performance and egg quality. Supplementation of betaine improved the performance of quails but showed inconsistent effects on egg quality.

Keywords: Quails, Performance, Egg Quality, Protein, Betaine

INTRODUCTION

According to NRC (1994) protein requirement for laying quail at moderate temperature (21°C) is approximately 20%. However, this requirement may be not appropriate to be applied in Indonesia which has a tropical climate with high ambient temperatures. The high protein content in quail diet may cause heat stress as a result of metabolic processes (Li *et al.*, 2011). The high protein content in the diet can also increase undigested nutrients, thereby leading to inefficiency because many nutrients are excreted from the body and decrease the performance of poultry (Faria-Filho *et al.*, 2007).

Betaine (trimethyl glycine) is a methyl group donor and is involved in protein and energy metabolisms (Metzler-Zebeli *et al.*, 2009; Ratriyanto *et al.*, 2014). Supplementation of betaine may be an alternative to obtain optimal protein content as betaine improves the availability of methionine for protein synthesis (Ratriyanto *et al.*, 2009). In addition, betaine has an osmotic function for both epithelial cells and the microflora of the digestive tract thereby potentially increasing the digestibility of nutrients and animal performance (Metzler-Zebeli *et al.*, 2009).

Previous studies showed an increased egg production and feed efficiency in laying hens.
due to betaine supplementation (Zou and Lu, 2002; Ezzat et al., 2011). Betaine supplementation is expected to increase protein synthesis and improve performance of quail. Therefore, the objective of this study was to determine the effect of protein levels and betaine supplementation on performance of laying quail (*Coturnix coturnix japonica*).

**MATERIALS AND METHODS**

The study used 300 quails aged 21 days with an average initial body weight of 43.21 ± 2.68 g. The experiment was designed to as completely randomized design of factorial 2 × 2. The first factor was the 2 levels of crude protein (18.0 and 19.5%) and the second factor was the supplementation of betaine (0 and 0.12% betaine). Each treatment used 5 replications containing 15 quails each.

The basal diet was formulated to meet the nutrient requirement of laying quail according to the recommendation of the Indonesian National Standard (2006). The nutrient composition of the basal diet can be seen in Table 1.

**Table 1. Nutrient composition of experimental diets**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Protein Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18.0%</td>
</tr>
<tr>
<td>Metabolizable energy (KCal/kg)</td>
<td>2800.00</td>
</tr>
<tr>
<td>Crude protein (%)</td>
<td>18.01</td>
</tr>
<tr>
<td>Calcium (%)</td>
<td>3.41</td>
</tr>
<tr>
<td>Available phosphorus (%)</td>
<td>0.63</td>
</tr>
<tr>
<td>Lysine (%)</td>
<td>1.14</td>
</tr>
<tr>
<td>Methionine (%)</td>
<td>0.41</td>
</tr>
</tbody>
</table>

This experiment used 20 units of colony cages with the size 75 × 50 × 35 cm (p × l × t). During the experiment, diet and water were provided ad libitum. The quails were fed twice a day, at 07:00 and 13:30. During the growing phase, the quails were fed a commercial grower diet. From the age of 42 days until the egg production reached 50% quails were fed a basal diet containing 18% protein. The experimental diets were fed after egg production reached 50%.

The observed data included the feed consumption, egg production, egg weight, feed conversion (FCR) and protein efficiency ratio (PER), albumen and yolk index, and yolk and eggshell weight. The PER value is the ratio between the egg mass and protein consumption (Supriatna et al., 2009).

The data obtained in this study were analyzed using analysis of variance (ANOVA) to determine the effect of treatment and followed with Duncan’s test for significant effect (Steel and Torrie, 1991). Significance level was set at α = 0.05.

**RESULTS AND DISCUSSION**

There was no interaction between protein and supplementation of betaine on performance and egg quality of the quails. Feeding 19.5% protein resulted higher feed intake (Table 2) and eggshell weight (Table 3) than feeding 18.0% protein (P<0.05). In accordance with this result, feeding 18% protein increased feed intake compared with 16% protein (Garcia et al., 2005),
although feeding 17.75 vs 19.95% protein (Li et al., 2011) and feeding 18 vs 20% protein (Garcia et al., 2005) did not affect feed intake of the quails (Coturnix coturnix japonica). Meanwhile, Garcia et al. (2005) showed that feeding 18 and 20% protein did not affect egg production, egg eight and feed conversion of the quails. Garcia et al. (2005) also showed that feeding 18 vs 20% protein resulted similar responses on egg quality of Japanese quails. This result indicated that feeding 18% protein was adequate for laying quails in the tropics. Optimal protein requirement for quail is greatly influenced by the type of quail (Ri et al., 2005) and environmental conditions (Garcia et al., 2005). Compared to carbohydrates and fats, proteins produce more heat, therefore, the low protein diet is expected to minimize heat production, especially in tropical climates (Furlan et al., 2004).

**Table 2.** The effect of protein levels and betaine supplementation on performance of Japanese quails

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Feed Intake (g/day)</th>
<th>Production (%)</th>
<th>Egg Weight (g)</th>
<th>Feed Conversion</th>
<th>PER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction effect between protein and betaine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.0 Control</td>
<td>18.80</td>
<td>61.54</td>
<td>8.34</td>
<td>3.68</td>
<td>1.52</td>
</tr>
<tr>
<td>18.0 Betaine</td>
<td>19.72</td>
<td>70.39</td>
<td>8.72</td>
<td>3.24</td>
<td>1.72</td>
</tr>
<tr>
<td>19.5 Control</td>
<td>18.75</td>
<td>63.44</td>
<td>8.40</td>
<td>3.56</td>
<td>1.46</td>
</tr>
<tr>
<td>19.5 Betaine</td>
<td>20.51</td>
<td>72.75</td>
<td>8.65</td>
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<td>1.58</td>
</tr>
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<td>Significance</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
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<tr>
<td>Main effect of protein</td>
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<tr>
<td>18.0</td>
<td>19.26b</td>
<td>65.97</td>
<td>8.53</td>
<td>3.46</td>
<td>1.62</td>
</tr>
<tr>
<td>19.5</td>
<td>19.63a</td>
<td>68.10</td>
<td>8.53</td>
<td>3.41</td>
<td>1.52</td>
</tr>
<tr>
<td>Significance</td>
<td>&lt;0.05</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Main effect of betaine</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Control</td>
<td>18.78b</td>
<td>62.49b</td>
<td>8.37b</td>
<td>3.62a</td>
<td>1.49b</td>
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<tr>
<td>Betaine</td>
<td>20.11a</td>
<td>71.57a</td>
<td>8.69a</td>
<td>3.25b</td>
<td>1.65a</td>
</tr>
<tr>
<td>Significance</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
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</table>

PER: protein efficiency ratio, NS: not significant.

\( ^a,b \) Means within a treatment and column with different superscripts differ significantly (P<0.05).

Supplementation of betaine improved (P<0.01) performance of the quails (Table 2) and yolk weight but decreased yolk index (Table 3). However, albumen index and eggshell weight were not affected by betaine supplementation (Table 3). Supplementation of betaine increased feed intake by 7.1% (P<0.01), which was in accordance with the increase in egg production, egg weight, protein efficiency ratio and the decrease in feed conversion. This suggests that supplementation of betaine contribute to increased protein synthesis and manifested by increased performance of the quails. Betaine donates its labile methyl groups in the process transmethylation and plays an important role in the metabolism of proteins (Ratriyanto et al., 2009). Haryadi et al. (2015) observed that supplementation of betaine into a low protein diet (16.5% protein) increased feed intake and egg production but did not affect egg weight of quails. Previous studies showed that supplementation of 0.1% betaine in the diet enhanced production performance of laying hens (Ezzat et al., 2011). The same result was reported by Zou and Lu (2002), in which betaine increased egg production in laying hens by 8.7%. In accordance with this result, Park et al. (2006) showed that supplementation of betaine increased egg weight in laying hens.
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Integrated Approach in Developing Sustainable Tropical Animal Production
October 20-22, 2015, Yogyakarta, Indonesia

Table 3. The effect of protein levels and betaine supplementation on egg quality of Japanese quails

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Albumen Index (%)</th>
<th>Yolk Index (%)</th>
<th>Yolk Weight (g)</th>
<th>Eggshell Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction effect between protein and betaine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.0 Control</td>
<td>11.59</td>
<td>48.97</td>
<td>2.43</td>
<td>0.81</td>
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<td>18.0 Betaine</td>
<td>11.62</td>
<td>44.68</td>
<td>3.01</td>
<td>0.85</td>
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<tr>
<td>19.5 Control</td>
<td>10.27</td>
<td>47.22</td>
<td>2.49</td>
<td>0.87</td>
</tr>
<tr>
<td>19.5 Betaine</td>
<td>11.27</td>
<td>46.01</td>
<td>2.74</td>
<td>0.90</td>
</tr>
<tr>
<td>Significance</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Main effect of protein</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.0</td>
<td>11.60</td>
<td>46.82</td>
<td>2.72</td>
<td>0.83&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>19.5</td>
<td>10.95</td>
<td>46.62</td>
<td>2.62</td>
<td>0.89&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Significance</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Main effect of betaine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>11.12</td>
<td>48.10&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.46&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.84</td>
</tr>
<tr>
<td>Betaine</td>
<td>11.44</td>
<td>45.34&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.88&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.87</td>
</tr>
<tr>
<td>Significance</td>
<td>NS</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>NS</td>
</tr>
</tbody>
</table>

NS: not significant.
<sup>a,b</sup> Means within a treatment and column with different superscripts differ significantly (P<0.05).

Betaine supplementation increased protein efficiency ratio by 10.7% and decreased feed conversion by 10.2% compared with control (P<0.01), which was caused by the increase in egg production and egg weight. Protein efficiency ratio describes the egg mass produced for each unit of protein intake. Thus, protein efficiency ratio is influenced by productivity of the animals (Suprijatna et al., 2009; Ratriyanto et al., 2012). In support with this results, supplementation of betaine into a low protein diet increased protein efficiency ratio and decreased feed conversion of quails (Haryadi et al., 2015). Ezzat et al. (2011) observed that supplementation of 0.1% betaine in the diet decreased feed conversion of laying hens by 6%.

CONCLUSIONS

Increasing dietary protein levels from 18.0 to 19.5% had minor impacts on quails’ performance and egg quality. Supplementation of betaine improved the performance of quails indicating contribution of betaine in protein metabolism. However, betaine showed inconsistent effects on egg quality.

REFERENCES


The Influence of Vitamin D3 Levels on Diets with Phytase on Production Performance of Layer Quail (*Coturnix coturnix japonica*)

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ABSTRACT: The aim of this research is to know of influence vitamin D3 levels on performance of layer quails on diets with phytase. Laying quails which was used 560 heads on 40 days old. Phytase and vitamin D3 were used a commercial product. The treatment of this research used corn-soybean diets with levels P0 (Basal diets Pav 0.5%; 500 FTU/kg phytase; 250 ICU/kg vitamin C). P1 (P0 + 500 mg/kg vitamin D), P2 (P0 + 1.000 mg/kg vitamin D), P3 (P0 + 1.500 mg/kg vitamin D) and P4 (P0 + 2.000 mg/kg vitamin D). The variable used feed consumption, feed conversion, egg production and egg weight. Experimental design used one way completely randomized design with five replication and replicated sampels with five head layers quail. Statistic analytical with analysis of varians, if it was significantly on mean treatments was analyzed by Duncan Test. The results showed feed consumption, feed conversion, egg weight and egg production were not significantly (P<0.05). Feed consumption, egg production, egg weight and feed conversion with addition levels of vitamin D3 on performance of layer quails on diets with phytase did not improved than control diets.

Keywords: Vitamin D3, phytase, laying quail, production performance, corn-soybean diets.

INTRODUCTION

Phytic acid binded 80% P on grain. Phytic acid is not digestible in poultry gastrointestinal and decreased nutrient value of feed from agricultural crops (Saryska *et al.*, 2005). Phytic acid of feed that can not be digested will be disposed of the form of excreta in the form of phytat bond with P (Jendza *et al.*, 2006). The source of non-ruminant livestock waste contained phytat-P which is source of pollution (Daniel *et al.*, 1988). Phytase was used to decreased P excretion of feed (Mosenthin dan Broz, 2010). Phytase hidrolized phytic acid, so that phytic acid did not pollute the environment and phytat-P can be utilized by livestock (Mittal *et al.*, 2011). Application of phytase in broiler chicken feed decreased the excretion of N thereby lowering ammonia pollution to the environment (Dozier III *et al.*, 2008). Besides the utilization of phytase can be influenced production performance of quail (*Coturnix coturnic japonica*) (Yasar dan Desen, 2014).

Vitamin D3 can increase digestibility of protein, lipid and mineral with increasing Ca on intestinal digestibility. Addition of vitamin D in poultry diets can increase Ca on intestinal digestibility so that effectiveness of phytase can be increased (McDowell, 2000) but did not influence on effectiveness of performance production of broiler chicken (Delezie *et al.*, 2012). Addition of 600 FTY/kg phytase and 5 ug/kg vitamin D3 can increase mineral digestibility on broiler chicken (Aksakal dan Bilal, 2002). Addition of vitamin D3 on laying quail diets with containing phytase and Pav certain to study in Indonesia with tropical climate. The tropical climate is heat stress for laying quail so that interesting to study.

The aim of this research is to know the effect of vitamin D concentration on poultry diets based corn-soybean diets which contains 500 FTU/kg and 0.5 Pav to performance production of laying quail (*Coturnix coturnic japonica*).
MATERIALS AND METHODS

This research used feed with four levels diets treatment that were P0 = basal diets (500 FTU/kg phytase, 0.5 Pav, 250 ICU/kg vitamin C), P1 = basal diets + 500 mg/kg vitamin D3, P2 = basal diets + 1,000 mg/kg vitamin D3, P3 = basal diets + 1,500 mg/kg vitamin D3 and P4 = basal diets + 2,000 mg/kg vitamin D. Research used 500 heads laying quail. Nutrient composition of feed and diet formulation featured on Table 1 and 2.

Table 1. Nutrient content of feed ingredients of diets

<table>
<thead>
<tr>
<th>Feed Material</th>
<th>ME Kkal/kg</th>
<th>CP %</th>
<th>Ca</th>
<th>Pav</th>
<th>Lysin</th>
<th>Met</th>
<th>Vit. C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow corn</td>
<td>3,350.00</td>
<td>7.33</td>
<td>0.02</td>
<td>0.08</td>
<td>0.26</td>
<td>0.18</td>
<td>-</td>
</tr>
<tr>
<td>Bran</td>
<td>2,980.00</td>
<td>10.77</td>
<td>0.07</td>
<td>0.22</td>
<td>0.59</td>
<td>0.26</td>
<td>-</td>
</tr>
<tr>
<td>Soy bean meal</td>
<td>2,230.00</td>
<td>46.462</td>
<td>0.29</td>
<td>0.27</td>
<td>2.69</td>
<td>0.62</td>
<td>-</td>
</tr>
<tr>
<td>Fish flour</td>
<td>2,820.00</td>
<td>52.21</td>
<td>5.11</td>
<td>2.88</td>
<td>4.17</td>
<td>1.51</td>
<td>-</td>
</tr>
<tr>
<td>Coconut oil</td>
<td>8,600.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DL-Methionin</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>99.00</td>
</tr>
<tr>
<td>Dicalcium phosphate</td>
<td>-</td>
<td>-</td>
<td>29.00</td>
<td>18.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Limestone</td>
<td>-</td>
<td>-</td>
<td>38.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Premix</td>
<td>-</td>
<td>0.00</td>
<td>03.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Vitamin C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>35.30</td>
</tr>
</tbody>
</table>

Source: 1) NRC (1994)  
2) Mineral B12 (Eka Farma Product. Semarang)  
3) Hartadi et al. (1994)  
4) Laboratory analysis of Chem Mix Pratama

Table 2. Diets Composition and Nutrient Content Treatment Diets

<table>
<thead>
<tr>
<th>Bahan Pakan</th>
<th>P0</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow corn</td>
<td>48,000</td>
<td>48,000</td>
<td>48,000</td>
<td>48,000</td>
<td>48,000</td>
</tr>
<tr>
<td>Bran</td>
<td>16,983</td>
<td>16,983</td>
<td>16,983</td>
<td>16,983</td>
<td>16,983</td>
</tr>
<tr>
<td>Soy bean meal</td>
<td>19,700</td>
<td>19,700</td>
<td>19,700</td>
<td>19,700</td>
<td>19,700</td>
</tr>
<tr>
<td>Fish flour</td>
<td>7,000</td>
<td>7,000</td>
<td>7,000</td>
<td>7,000</td>
<td>7,000</td>
</tr>
<tr>
<td>Coconut oil</td>
<td>0.830</td>
<td>0.830</td>
<td>0.830</td>
<td>0.830</td>
<td>0.830</td>
</tr>
<tr>
<td>DL-methionin</td>
<td>0.050</td>
<td>0.050</td>
<td>0.050</td>
<td>0.050</td>
<td>0.050</td>
</tr>
<tr>
<td>Dicalcium phosphate</td>
<td>0.810</td>
<td>0.810</td>
<td>0.810</td>
<td>0.810</td>
<td>0.810</td>
</tr>
<tr>
<td>Limestone</td>
<td>6.050</td>
<td>6.050</td>
<td>6.050</td>
<td>6.050</td>
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<tr>
<td>Premix</td>
<td>0.250</td>
<td>0.250</td>
<td>0.250</td>
<td>0.250</td>
<td>0.250</td>
</tr>
<tr>
<td>NaCl</td>
<td>0.250</td>
<td>0.250</td>
<td>0.250</td>
<td>0.250</td>
<td>0.250</td>
</tr>
<tr>
<td>Phytase</td>
<td>0.010</td>
<td>0.010</td>
<td>0.010</td>
<td>0.010</td>
<td>0.010</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>0.067</td>
<td>0.067</td>
<td>0.067</td>
<td>0.067</td>
<td>0.067</td>
</tr>
</tbody>
</table>
Vitamin D

<table>
<thead>
<tr>
<th>Amount</th>
<th>0</th>
<th>0.0005</th>
<th>0.001</th>
<th>0.0015</th>
<th>0.002</th>
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</thead>
<tbody>
<tr>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
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<td></td>
</tr>
</tbody>
</table>

Nutritional content

<table>
<thead>
<tr>
<th>Metabolizable energy (kcal/kg)</th>
<th>2,800.080</th>
<th>2,800.080</th>
<th>2,800.080</th>
<th>2,800.080</th>
<th>2,800.080</th>
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</thead>
<tbody>
<tr>
<td>Crude protein (%)</td>
<td>18.010</td>
<td>18.010</td>
<td>18.010</td>
<td>18.010</td>
<td>18.010</td>
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<tr>
<td>Ca (%)</td>
<td>3.300</td>
<td>3.300</td>
<td>3.300</td>
<td>3.300</td>
<td>3.300</td>
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<tr>
<td>P available (%)</td>
<td>0.500</td>
<td>0.500</td>
<td>0.500</td>
<td>0.500</td>
<td>0.500</td>
</tr>
<tr>
<td>Lysin (%)</td>
<td>1.040</td>
<td>1.040</td>
<td>1.040</td>
<td>1.040</td>
<td>1.040</td>
</tr>
<tr>
<td>Methionin (%)</td>
<td>0.410</td>
<td>0.410</td>
<td>0.410</td>
<td>0.410</td>
<td>0.410</td>
</tr>
<tr>
<td>Vitamin C (%)</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
</tr>
</tbody>
</table>

Source: Based on the calculation of feed content from Table 2.

Maintenance management of this research included feeding, drinking, vaccination, drug based Medion, and diets nutrient standard based on SNI. Variable observed on this research were feed consumption (FC) on g/heads/day, egg production in the HDA on egg/head, egg weight on g and feed conversion ratio (FCR) (Tillman et al., 1989).

RESULTS AND DISCUSSION

The results of this research in the form of averages of production performance in quail (Coturnix coturnix japonica) is shown in Table 3.

<table>
<thead>
<tr>
<th>Variables</th>
<th>P0</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>Pr. F</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC (g/head/day)</td>
<td>18.89</td>
<td>18.93</td>
<td>18.91</td>
<td>18.97</td>
<td>19.17</td>
<td>0.972</td>
</tr>
<tr>
<td>Egg production (egg/head)</td>
<td>57.81</td>
<td>56.88</td>
<td>58.48</td>
<td>54.95</td>
<td>57.75</td>
<td>0.688</td>
</tr>
<tr>
<td>Egg weight (g/head)</td>
<td>9.02</td>
<td>9.18</td>
<td>8.88</td>
<td>8.90</td>
<td>8.90</td>
<td>0.136</td>
</tr>
<tr>
<td>FCR</td>
<td>3.88</td>
<td>3.82</td>
<td>3.76</td>
<td>4.17</td>
<td>3.89</td>
<td>0.112</td>
</tr>
</tbody>
</table>

Production performance was not significant on the levels treatment of vitamin D3 on research diets of laying quail. Production performance on P0, P1, P2, P3 and P4 had same results that did not different on the effect of treatments to added vitamin D3 with concentration 0, 500, 1,000, 1,500 and 2,000 mg/kg on the diets. Several studies on poultry showed similar results. Diets containing cholecalciferol (vitamin D3) with concentration 0 and 75 mg/kg-1 did not significant difference to FC and FCR on duck (Onyango dan Adeola, 2011). Weight gain. FC and FCR on broiler chicken with deficiency P by phytase and 1a-OHD3 did not significant difference (Driver et al, 2005). Feed consumption, egg production and egg weight on laying hen did not difference with addition phytase and 1.25-(OH)2D3 (Carlos dan Edwards, 1998).

CONCLUSION

Production performance with addition vitamin D on concentration 0, 500, 1,000, 1,500 and 2,000 mg/kg on the diets with 500 FTU/kg phytase and 0.3% Pav and basal diets had similar quality.
REFERENCES


Phytobiotics Habbatus Sauda and Garlic Meal: Are Still Efficacious during the Spread of Marek's Disease Outbreak?

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Telp. +62(0)274-513363, Fac. +62(0)274-521578.
Corresponding email: nanungdd@ugm.ac.id

ABSTRACT: When kept intensively in a closed-house poultry shed, additions of habbatus sauda (Nigella sativa; HSM) or garlic bulb meal (Allium sativum; GBM) in the diets were claimed to be efficacious used as growth promoter for broiler chickens. This study critically evaluated the effectiveness of both phytobiotics during the spread of Marek’s disease outbreak. A hundred male New Lohmann day old broiler chicks were divided into 5 dietary treatments. One-way ANOVA treatment structure in a Complete Randomized Design was used in this experiment. The treatment diets were: basal diets that meet dietary requirements of the breeder, without phytobiotics supplementation (control; P1); basal diets + 1.0% HSM (P2); basal diets + 1.0% GBM (P3); basal diets + 1.0% HSM + 1.0% GBM (P4); and basal diets + 0.5% HSM + 0.5% GBM (P5). Each treatment was replicated 5 times, with 4 birds in each replicate pen. Response parameters that evaluated in this study were growth performance (average daily gain, final weight, feed intake, and feed conversion ratio) and protein-energy efficiency (protein and energy intake, protein and energy efficiency ratio), based on 5 weeks rearing period. Results showed that, when the birds were raised in tropical opened-system poultry shed during the spread of Marek’s disease, dietary addition of 1.0% habbatus sauda and garlic bulb meal did not give any significant positive effects on all response variables that observed on growth performance and protein-energy efficiency parameters. It might be concluded that phytobiotics supplementation is only efficacious for improving productivity of broiler chickens when the birds are reared in closed-house poultry shed that free from disease outbreak.

Keywords: Phytobiotics efficacy, Marek’s disease outbreak, Growth performance, Protein-energy efficiency

INTRODUCTION

Available studies suggest that traditional poultry farmers face serious problems in disease attacks, such as: infectious bursal disease (Berg, 2010), Newcastle disease, infectious bronchitis, avian influenza, and Marek’s (Tabbu, 2000). Studies reported that development of the body self-defence might be depressed by low biosecurity level, poor sanitary condition, and low quality of feed stuffs (Gibbens et al., 2001). Uncontrolled farm condition and non-intensive poultry managements seem to be responsible for this problem. Traditional farmers might use antibiotics to solve this problem. Antibiotics have been administered mostly during the grow-out period to control growth and proliferation of exogenous pathogens, promote growth, maintain health, facilitate better feed efficiency, and improve meat quality. In order to limit the spread and development of antibiotic resistant microflora, the authorization of several antibiotics as feed additives has been withdrawn in European Union since 1997 (Dibner and Richards, 2005). However, the removal of antibiotics authorization resulted in substantial increase in infection in poultry (Knarreborg et al., 2002; Casewell et al., 2003).

Some studies showed that garlic bulb meal (GBM) and habbatus sauda meal (HSM) have been known to be efficacious as sources of phytobiotics for poultry. Numerous studies reported that GBM improved the growth performance of poultry with non-antibiotics diets (Mahmood et
al., 2009). On the other hand, habbatus sauda was also reported to be good as growth promoter for broiler chickens (Abu-Dieyeh and Abu-Darwish, 2008; Al-Beitawi and El-Ghousein, 2008; Shewita and Taha, 2011).

However, these studies were done in intensive poultry management, using good quality feed stuffs and closed-housed poultry system. Therefore, the results did not draw the ‘real’ condition. Since there is no study to report the effects of dietary supplementations of garlic bulb and habbatus sauda on New Lohman broiler chickens during the outbreak of poultry diseases, this study is important to evaluate the factual effects of phytobiotics supplementations on real condition in traditional farmers.

MATERIALS AND METHODS

Birds, Diets, Housing, and Experimental Design

A hundred male day old New Lohman broiler chicks from local commercial breeder were allocated to 5 treatments in a complete randomized fashion. Each treatment had 5 replicate pens with 4 birds per replicate pen. The treatment diets were: basal diets that meet dietary requirements of the breeder, without phytobiotics supplementation (control; P1); basal diets + 1.0% HSM (P2); basal diets + 1.0% GBM (P3); basal diets + 1.0% HSM + 1.0% GBM (P4); and basal diets + 0.5% HSM + 0.5% GBM (P5). These dose rates were based on the recommendation of the previous studies from the available literatures. The basal diets were composed of yellow corn, rice polished, soybean meal, meat bone meal, crude palm oil, Di-Calcium Phosphate, Calcium Carbonate, mineral-vitamin premix, methionine, salt, with garlic bulb meal and habbatus sauda meal added at different doses. All diets for starter and grower stages were prepared with the same batch of ingredients. The feeding program consisted of a single starter diet (from 0 – 14 days of age) and a layer diets (15 to 35 days of age). The diets were formulated to meet the recommendations of the National Research Council (1994) for broiler chickens. The ingredients and chemical compositions of the diets are presented in Table 1. Feed and drinking water were given for ad-libitum consumption. During the experiment, no enzymes or coccidiostat were added to the experimental diets. The chicks were vaccinated at the hatchery, and no additional vaccinations were administered during the study.

Sampling Procedures and Statistical Analyses

Response parameters that evaluated in this study were growth performance (average daily gain, final weight, feed intake, feed conversion ratio) and protein-energy efficiency (protein and energy intake, protein and energy efficiency ratio), based on 5 weeks rearing period. Body weight and feed intake data were taken on d 0 and 35 for calculation of average daily gain and feed conversion ratio. The protein and energy intake was based on the amount of feed intake, multiplied by protein and energy content in the feed. The protein efficiency ratio (PER) and energy efficiency ratio (EER) were calculated for each phase using the following formula:

\[
\text{PER (g/g)} = \frac{\text{Body weight gain (g)}}{\text{Protein intake (g)}}
\]

\[
\text{EER (g/100 kcal)} = \frac{\text{Body weight gain (g) \times 100}}{\text{Gross energy intake (kcal)}}
\]

Growth performance data, as well as nutrient and energy utilization data, were analyzed statistically by Analyses of Variance employing Complete Randomized Design (Steel and Torrie, 1993). Significance was declared for the probability of less than 5%. All statistical analyses were performed using Statistical Procedures for Social Science (SPSS) for Windows versi 16.0 (SPSS Inc., Chicago, IL) software.
The 6th International Seminar on Tropical Animal Production
Integrated Approach in Developing Sustainable Tropical Animal Production
October 20-22, 2015, Yogyakarta, Indonesia

Table 1. Composition of experimental starter and grower diets (%)

<table>
<thead>
<tr>
<th>Items</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>P5</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>P5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow corn</td>
<td>38.29</td>
<td>38.29</td>
<td>38.29</td>
<td>38.29</td>
<td>38.29</td>
<td>42.92</td>
<td>42.92</td>
<td>42.92</td>
<td>42.92</td>
<td>42.92</td>
</tr>
<tr>
<td>Rice polished</td>
<td>7.93</td>
<td>7.93</td>
<td>7.93</td>
<td>7.93</td>
<td>7.93</td>
<td>6.91</td>
<td>6.91</td>
<td>6.91</td>
<td>6.91</td>
<td>6.91</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>41.10</td>
<td>41.10</td>
<td>41.10</td>
<td>41.10</td>
<td>41.10</td>
<td>37.89</td>
<td>37.89</td>
<td>37.89</td>
<td>37.89</td>
<td>37.89</td>
</tr>
<tr>
<td>Meat bone meal</td>
<td>7.25</td>
<td>7.25</td>
<td>7.25</td>
<td>7.25</td>
<td>7.25</td>
<td>5.15</td>
<td>5.15</td>
<td>5.15</td>
<td>5.15</td>
<td>5.15</td>
</tr>
<tr>
<td>Di-calcium phosphate</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
<td>0.10</td>
<td>0.10</td>
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<tr>
<td>Calcium carbonate</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
<td>0.09</td>
<td>0.27</td>
<td>0.27</td>
<td>0.27</td>
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</tr>
<tr>
<td>Mineral-vitamin premix</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.01</td>
<td>0.01</td>
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<tr>
<td>Methionine</td>
<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.04</td>
<td>0.04</td>
<td>0.04</td>
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</tr>
<tr>
<td>Salt</td>
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<td>0.00</td>
<td>1.00</td>
<td>1.00</td>
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<tr>
<td>Garlic bulb meal</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Habbatus sauda meal</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.00</td>
<td>1.00</td>
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</tr>
<tr>
<td>Filler</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.00</td>
<td>1.00</td>
<td>2.00</td>
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<tr>
<td>Total</td>
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<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
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</tr>
</tbody>
</table>

Table 2. Growth performance response and nutrient – energy efficiency ratio of broiler chickens fed diets with phytobiotics supplementation

<table>
<thead>
<tr>
<th>Variables</th>
<th>Treatment diets</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P1</td>
<td>P2</td>
</tr>
<tr>
<td>Growth Performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed intake. g/bird</td>
<td>748.77</td>
<td>752.00</td>
</tr>
<tr>
<td>Average daily gain. g/bird</td>
<td>296.90</td>
<td>334.49</td>
</tr>
<tr>
<td>Final weight. g/bird</td>
<td>333.90</td>
<td>371.49</td>
</tr>
<tr>
<td>Feed conversion</td>
<td>2.50</td>
<td>2.28</td>
</tr>
<tr>
<td>Nutrient and energy utilization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein intake. g/bird</td>
<td>169.45</td>
<td>170.18</td>
</tr>
<tr>
<td>Protein efficiency ratio. g/kg</td>
<td>1.76</td>
<td>1.96</td>
</tr>
<tr>
<td>Energy intake. kcal/g</td>
<td>2175.3</td>
<td>2184.7</td>
</tr>
<tr>
<td>Energy efficiency ratio</td>
<td>13.72</td>
<td>15.28</td>
</tr>
</tbody>
</table>

Note: ¹Means represent 5 pens of 4 bird each per treatment.
²P1= control; basal diets + 1.0% HSM (P2); basal diets + 1.0% GBM (P3); basal diets + 1.0% HSM + 1.0% GBM (P4); and basal diets + 0.5% HSM + 0.5% GBM (P5).
RESULTS AND DISCUSSION

The effects of low dose phytobiotics supplementation on growth performance of broiler chickens are summarized in Table 2. Feed intake, average daily gain, and final weight feed conversion of the male birds fed diets containing garlic bulb meal (GBM) or habbatus sauda meal (HSM) did not differ from those of the birds fed control diets. Dietary supplementation with 1.0% HSM individually or in combination with 1.0% GBM did not stimulate growth performance of male broiler chickens. These results might be attributed to the adverse effects of Marek’s disease on appetite and nutrients absorption. In a critical study with poultry, Tabbu (2000) showed that Marek’s disease was associated with poor appetite, which in turn reduced the amount of micro nutrient available to be absorbed for daily metabolism. On the other hand, reduction of the body immune system due to the occurrence of Marek’s disease, initiated the body to maximally recover their health state. Consequently, available micro-nutrients in the intestine cannot be utilized to stimulate daily growth. Result in current study was in the line with the results of previous studies by Ashayerizadeh et al. (2009), Doley et al. (2009) and Dono (2012) where supplementation of 1.0% HSM did not stimulate growth performance in broiler chickens.

Results in Table 2 also showed that dietary supplementations with GBM or HSM did not stimulate nutrient and energy utilization. At the rate of 1.0% alone or in combination, supplementations of GBM and HSM did not influence nutrient and energy intake, as well as nutrient and energy efficiency ratio. This result might be attributed to the increase of competition for available micro-nutrients between pathogenic microbes and micro-villi in the intestinal wall (Dibner and Richards, 2004). Increase of the population of pathogenic microbes might stimulate production of intestinal mucous barrier and reduce micro-nutrients uptake, which in turn might interfere nutrients and energy utilities for daily metabolism. Result in this study was similar with result of Kirkpinar et al. (2010) that supplemented broiler diets with garlic essential oil.

CONCLUSIONS

It can be concluded from current study that when broiler chicken birds were kept in opened poultry-house research and raised during the spread of Marek’s disease, dietary supplementation of phytobiotics garlic meal and habbatus sauda meal did not have any significant benefits on the growth performance or nutrient-energy utilization of broiler chickens.

REFERENCES


The Effect of Dietary Calcium and Phosphorus Level on Serum Mineral Contents of the Bantul Local Duck within a Day

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ABSTRACT: The study was conducted to determine the effect of various dietary calcium and phosphorus levels on the blood mineral contents of Bantul Local Duck. Two hundred and seventy female ducks, 26 weeks age, were used in the study with a 3x3 factorial pattern, which is a combination of three levels (high, middle, and low) of Ca (3.75; 3.25 and 2.75%) and three levels (high, middle, and low) of P (0.45, 0.35 and 0.25%). Treatment occupied three replication pens, each of which consisted of 10 ducks. At the end of 12 weeks egg production period, one laying duck every pen was observed for serum mineral content. Blood collected for 3 times within a day for each duck, there were: morning (07.00-08.00 a.m.), afternoon (3.00-4.00 p.m.) and evening (10.00-11.00 p.m.) through shank blood arteries. Data recorded were Ca²⁺ and P⁴⁻ contents. The data were analyzed by analysis of variance (ANOVA) using the SPSS computer program. The results showed that there were significant effects (P<0.05) of dietary Ca and P, and time observation on Ca²⁺ and P⁴⁻ contents. The middle dietary Ca content (3.25%) resulted the highest both of Ca²⁺ (6.946±1.201 mmol/l) and P⁴⁻ (8.904±2.331 mg/dl) serum content. The middle dietary P content (0.35%) resulted the highest serum Ca²⁺ content (6.894±0.912 mmol/l), but the lowest dietary P content resulted in the highest serum P⁴⁻ content (8.611±2.294 mg/dl). The serum Ca²⁺ content significantly decline from the morning (7.038±1.024 mmol/l) until evening (6.010±0.964 mmol/l), and the highest serum P⁴⁻ content was in the afternoon (9.970±2.621 mg/dl).

Keywords: calcium and phosphorus levels, local duck, serum mineral.
Supplementation Local Feed Urea Gula Air Multinutrient Block and Different Levels of Sulphur for Increasing Lactation Productivity Doe also Decreasing Kid Mortality Bligon Goat Grazed at Timor Savannah

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¹Faculty of Animal Science, Nusa Cendana University
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ABSTRACT: This research was conducted at the Regional Technical Implementation Unit (UPTD) Breeding Goat Sumlili, Sub-district of West Kupang, Regency of Kupang for 10 weeks from 17th November 2012 to 28th January 2013. Twelve does with initial body weight ranged from 14.2 - 23.8 kg (CV = 14.91) were used in the experiment. The objectives of this study were to evaluate the performance of local (Bligon) does and review their kids that reared under grazing in the savannah at West Timor supplemented with local feed water sugar urea multinutrient blocks (UGMB) and different levels of sulphur (S). Gula air were taken from *Borassus sundaicus* then cooked. Twenty Bligon goat lactating does and their kids were divided into four groups and used as subjects in the experiment. Does were randomly devided into 4 groups of treatment namely, R1 = 0.62% S in the doe kid + solid feed supplement; R2 = 0.62% S in the doe kid without a solid feed supplement; R3 = 0.93% S in the doe kid + solid feed supplement; R4 = 0.62% S in the doe kid without a solid feed supplement. The results of the experiment showed that averaged daily gain (ADG) (g/h/d) of the does were 60.71; 42.86; 52.57 and 45.83 and to the kids were 33.33; 20:24; 21:43; 17.86 for group R1, R2, R3 and R4, respectively (P <0.01). The ADG kids were better on higher milk consumption (P <0.05). All Significantly different treatment found in terms of protein and energy consumption, pH, VFA and NH₃ of rumen fluid but there was no effect of on both protein and energy digestibility. Averaged percentage of kid mortality was 0% R1 and R3, R2 and R4 33.3% 66.7%. It was concluded that local feed supplement with different sulphur increased the percentage of rumen fermentation product and crude protein content of milk and solid feed supplemented kid decrease kid mortality.

Keywords: local feeds, doe performance, sulphur level, savannah, kid mortality

INTRODUCTION

Goats in West Timor is usually kept extensively in the pasture. Pasture forage production during the dry season is very low whereas Bligon goat born more during the end of the dry season, so their lactation more at the end of the dry savannah where forage is less available (Manu et al., 2007). This situation will affect the production of doe’s milk, so it does not meet their needs, while the feed quality of pasture is still too low for kids. Performance does can run normally, if sufficient fodder for livestock pasture in the dry season should be given additional food or supplementation (Smith, 2000). One of the technologies in the field of forage that can be used is urea mollases multinutrients block (UMMB) as suggested by Santosa et al. (2000).

There was unavailable Mollases in Timor so it can look for available substitutes which have almost the same nutrient value named ‘sugar water’. Sugar water is the juice produced from palm trees (*Borassus sundaicus*) and cooked. Extract ingredients without nitrogen (NFE) from molasses about 85.7%, and according Jelantik et al. (2003) on sugar water about 86.03%. Thus, the cooked juice can be replaced by sugar molasses, and it more appropriate supplemented in
the form called UGMB (urea gula air multinutrient blocks). Supplementation strategies can be implemented to provide a supplement to both does or kid. The main source of milk for kid is the does’ milk. Genetically livestock milk production capability is very limited, while kid need a lot of milk. So that strategies can be modified through supplementation is to be given to the kid.

Manu (2010) found that during the dry season goats deficient almost all minerals, one of which is sulphur (S). Timor Island was included in a series of outer arc east of the islands of Indonesia’s low mineral content. Forage left in the savannah in Timor just old high dry forage fiber ballpark during dry season. Sulphur is required in the dry season to increase the crude fiber-digesting microbial populations. It is also important to stimulate the synthesis of amino acids rumen. Non protein nitrogen (NPN) is a source of nitrogen that is easy and inexpensive to use for livestock to pasture. The need of S for Angora goat will be higher if the NPN is used as a partial source of nitrogen (Qi et al., 2002). The purpose of this study was to determine the effect of feed supplementation with local UGMB sulphur different levels in Bligon goat lactating does and their beginners fed solid feed and grazed in the savannah of Timor on the performance of does parent and kid mortality.

**MATERIALS AND METHODS**

This research was conducted at the Regional Technical Implementation Unit (UPTD) Breeding Goat Sumlili, Sub-district of West Kupang, Regency of Kupang for 10 weeks from 17th November 2012 to 28th January 2013. Twelve does with initial body weight ranged from 14.2 - 23.8 kg (CV = 14.91) were used in the experiment. Feed use is forage for grazing is natural grass and a supplement to the does composed of urea, gula air, coconut meal, corn grain, rice bran, sulphur and salt. Solid feed beginners (P3) for kid composed of gula air, pumpkin, fish meal, vitamineral mix and salt, and made in the form of a paste.

Supplements for does and kid were given as much as 1% of body weight on a dry matter basis, and the sum is for daily use. Constituents of feed and feed supplements for additional does to kid used and their nutritional content are presented in Table 1 and 2.

**Table 1. Ingredients Supplements for Does and Kids Based on Dry Matter**

<table>
<thead>
<tr>
<th>Materials Supplement</th>
<th>Doe Supplement (%)</th>
<th>Kid supplement (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urea</td>
<td>2.5</td>
<td>-</td>
</tr>
<tr>
<td>Gula air</td>
<td>35</td>
<td>30</td>
</tr>
<tr>
<td>Coconut meal</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>Rice bran</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>Corn grain</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>Salt</td>
<td>2.5</td>
<td>-</td>
</tr>
<tr>
<td>Fish meal</td>
<td>-</td>
<td>25</td>
</tr>
<tr>
<td>Pumpkin</td>
<td>-</td>
<td>35</td>
</tr>
<tr>
<td>Vitamineral mix</td>
<td>-</td>
<td>10</td>
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</tbody>
</table>
Table 2. Nutrient Supplements and forage pastures.

<table>
<thead>
<tr>
<th>Samples</th>
<th>Dry Matter (%)</th>
<th>Organic Matter (%)</th>
<th>Crude Protein (%)</th>
<th>Crude Lipid (%)</th>
<th>Crude Fiber (%)</th>
<th>Total CHO (%)</th>
<th>BETN (%)</th>
<th>Gross Energy (MJ/kg)</th>
<th>Gross Energy (KKal/Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forage</td>
<td>21.27</td>
<td>87.71</td>
<td>20.89</td>
<td>3.28</td>
<td>18.82</td>
<td>63.54</td>
<td>44.71</td>
<td>17.18</td>
<td>4,089.33</td>
</tr>
<tr>
<td>Doe Supplement</td>
<td>72.27</td>
<td>93.60</td>
<td>17.01</td>
<td>7.59</td>
<td>11.31</td>
<td>69.00</td>
<td>57.69</td>
<td>18.65</td>
<td>4,440.50</td>
</tr>
<tr>
<td>Kid Supplement</td>
<td>47.17</td>
<td>73.23</td>
<td>13.82</td>
<td>2.33</td>
<td>0.86</td>
<td>57.07</td>
<td>56.21</td>
<td>14.02</td>
<td>3,337.81</td>
</tr>
</tbody>
</table>

Each doe is placed in individual pen and were given supplements in the morning before grazing, at noon and in the evening grazing goat housed. During given supplements separated to does and kid. A Randomized Trial Design (RBD) was used in the experiment with four treatments and 3 replicates. The four treatments were:

R1: does supplemented with additional S as much as 0.62% + kid were fed solid starters
R2: does supplemented with additional S as much as 0.62% + kid were not fed solid starters
R3: does supplemented with additional S as much as 0.93% + kid were fed solid starters
R4: does supplemented with additional S as much as 0.93% + kid were not fed solid starters.

Parameters measured were: daily weight gain of does and child (g/head/day), daily does milk production (g/head/day), feed intake (dry matter, protein and energy) and digestibility (dry matter, protein and energy) during grazing, fermentation products rumen (pH, VFA and NH3 rumen fluid) and the percentage of kid mortality. The estimation of dry matter intake in the savannah was used fecal techniques (Minson, 1990). The data collected in this study were subjected to the standard analysis of variance technique (Steel and Torrie, 1995), and Duncan’s Multiple Range test was used to detect differences among the means.

RESULTS AND DISCUSSION

1. Daily weight gain of does and kid and the does’ milk production

Average daily gain (ADG) of does fed with S 0.62% (average of R1 and R2) is not much different from that received S 0.93% (average of R3 and R4). Does with kid receive additional feed showed the average DWG higher than that did not receive additional food. Nevertheless, all does groups showed that their milk production was no different, it is because the main priority of does is to produce milk, so that kid fed additional food has a higher DWG. Feed intake and digestibility does fed S 0.62% (R1 and R2) was lower than their counterparts received 0.93% S (R3 and R4), but ADG more influenced by the treatment of supplementary feeding to kid. This results can be understood as a kid on R1 and R3 will reduce the consumption from does’ milk, so that the feed obtained by the does will be more used to the weight of the does.

Data in Table 3 showed that the averaged ADG kid affected significantly (P <0.01) by treatment. The highest daily weight gain in the group receiving supplemental feed (R1 and R3) and highly significant with R2 and R4 groups. In lactation goats until the age of 6 weeks, the does’ milk is a major nutrient for growth before the kid started to try to consume feed. Growth kid after the age of 6 weeks in addition determined by the hard feed remains largely determined by the does’ milk, so that the level of pre-weaning growth of kid is strongly influenced by the does milk production and feed supplement obtained.
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Integrated Approach in Developing Sustainable Tropical Animal Production
October 20-22, 2015, Yogyakarta, Indonesia

Table 3. Average birth weight kids, milk production does, ADG kid and the does with and without supplements UGMB

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Treatments</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
<th>R4</th>
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</thead>
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<tr>
<td></td>
<td></td>
<td>53.57&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>42.86&lt;sup&gt;c&lt;/sup&gt;</td>
<td>60.71&lt;sup&gt;a&lt;/sup&gt;</td>
<td>45.83&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td>ADG does (g / head / day)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADG kids (g / head / day)</td>
<td></td>
<td>33.33&lt;sup&gt;a&lt;/sup&gt;</td>
<td>20.24&lt;sup&gt;b&lt;/sup&gt;</td>
<td>31.43&lt;sup&gt;a&lt;/sup&gt;</td>
<td>17.86&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Feed intake</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry matter (g / head / day)</td>
<td></td>
<td>360.5</td>
<td>361.876</td>
<td>443.59</td>
<td>368.96</td>
</tr>
<tr>
<td>Energy (MJ / head / day)</td>
<td></td>
<td>5.43</td>
<td>6.48</td>
<td>5.31</td>
<td>6.89</td>
</tr>
<tr>
<td>Protein (g / head / day)</td>
<td></td>
<td>55.72</td>
<td>68.54</td>
<td>55.61</td>
<td>70.12</td>
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<tr>
<td>Digestibility of feed</td>
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<td></td>
</tr>
<tr>
<td>Dry matter (%)</td>
<td></td>
<td>72.158</td>
<td>72.876</td>
<td>75.34</td>
<td>75.534</td>
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<tr>
<td>Energy (%)</td>
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<td>88.07</td>
<td>87.45</td>
<td>90.12</td>
<td>90.28</td>
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<tr>
<td>Protein (%)</td>
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<td>91.12</td>
<td>92.91</td>
<td>93.35</td>
<td>94.25</td>
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<td>Rumen fermentation</td>
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<td></td>
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<tr>
<td>VFA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Acetate (mM/ml)</td>
<td></td>
<td>54.31&lt;sup&gt;a&lt;/sup&gt;</td>
<td>52.38&lt;sup&gt;a&lt;/sup&gt;</td>
<td>58.82&lt;sup&gt;b&lt;/sup&gt;</td>
<td>57.34&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Propionate (mM/ml)</td>
<td></td>
<td>14.53&lt;sup&gt;a&lt;/sup&gt;</td>
<td>13.23&lt;sup&gt;a&lt;/sup&gt;</td>
<td>17.21&lt;sup&gt;b&lt;/sup&gt;</td>
<td>18.79&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Butyrate (mM/ml)</td>
<td></td>
<td>7.31&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.36&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.82&lt;sup&gt;b&lt;/sup&gt;</td>
<td>9.43&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>NH&lt;sub&gt;3&lt;/sub&gt; (mg/dl)</td>
<td></td>
<td>32.85&lt;sup&gt;a&lt;/sup&gt;</td>
<td>33.86&lt;sup&gt;a&lt;/sup&gt;</td>
<td>39.62&lt;sup&gt;b&lt;/sup&gt;</td>
<td>38.32&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>pH</td>
<td></td>
<td>6.82&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.87&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.67&lt;sup&gt;b&lt;/sup&gt;</td>
<td>565&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Does milk production (g/head/day)</td>
<td></td>
<td>616.67&lt;sup&gt;a&lt;/sup&gt;</td>
<td>616.67&lt;sup&gt;a&lt;/sup&gt;</td>
<td>620.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>616.67&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Milk components</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fat (%)</td>
<td></td>
<td>3.51&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.45&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.73&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.78&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Protein (%)</td>
<td></td>
<td>2.93&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.95&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.05&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.07&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>The percentage of child mortality (%)</td>
<td></td>
<td>0</td>
<td>33.3</td>
<td>0</td>
<td>66.7</td>
</tr>
</tbody>
</table>

Different superscripts in the same row indicate significant differences (P < 0.01)

2. The average results of rumen fermentative

The rumen fermentative data indicate that the percentage of sulphur significant effect on VFA and NH<sub>3</sub> rumen fluid. The addition of S would lead to an increase in consumption and digestibility in the rumen consequently more lactic acid is formed so atmosphere tends to sour. NH<sub>3</sub> and VFA concentration of rumen fluid also increases with increasing number of S. This Possibly because the amount of S increases, the number of fiber-digesting microbes grow because these microbes are generally composed of amino acids containing S.

3. The percentage of kid mortality

Death at pre-weaning goat kids can be caused due to lack of feed during lactation. This condition can be improved by the does or the application of additional feed milk substitute or creep feeding for kids (Alexandre et al., 2002). Does’ milk production was not affected by treatment, so that the contribution of all the nutrients of milk on the same treatment. The condition of the kid’s body depends on the intake of nutrients, so that kids have higher intakes will have more endurance.
R1 and R3 treatment kids receive additional food so much more than their nutrient intake of the R2 and R4. Pre-weaning kid is still very vulnerable to infection from the environment due to the body’s defense system that has not been very good so that sufficient nutrients to help kid maintain body condition (Kristianto, 2002). Thus the treatment of feed supplementation in kid reduce the number of kid mortality due to their nutrient needs met.

**CONCLUSION**

Based on the results and discussion, it can be concluded that:
1. The increase in the percentage of S can improve the results of fermentation in the rumen and digestibility of the does.
2. Supplementation in kid improve the performance of the does and kid and pressing pre weaning mortality kid.

**REFERENCES**


Methane Production and Rumen Fermentation Characteristics of Buffalo Ration Containing Sorghum Silage with Rumen Simulation Technique (RUSITEC) Methods

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ABSTRACT: This study was conducted to evaluate buffalo ration containing samurai 2 sorghum straw silage compared with buffalo ration containing pahat sorghum straw silage using rumen simulation technique (RUSITEC) method. RUSITEC Analysis was conducted for eleven days, consisted of five days for adaptation period and six days another for observation period. Statistics design with 2 treatments and 3 replications was applied in this experiment. The fermentation of responses by time were presented descriptively. Averages of responses were analyzed using student t-test. Two treatments ration were: P1 (50% pahat sorghum straw silage + 50% concentrate) and P2 (50% samurai 2 sorghum straw silage + 50% concentrate). Variables measured were total gas, methane (CH₄) production and ruminal fermentation products. Results showed that buffalo ration containing silage of Samurai 2 straw (P2) produced 27.76% lower methane production than buffalo ration containing silage of Pahat straw (P1) (P<0.01). The P2 treatment also produced the highest VFA 24.35% compared to P1, IVDMD (6.22%) and IVOMD (10.56%) (P<0.05). The pH value and total gas production were not significant different. The conclusion showed that buffalo ration containing silage of Samurai 2 straw produced the lowest methane concentration, the highest total VFA, IVDMD and IVOMD.

Keywords: buffalo, CH₄, rumen fermentation, RUSITEC, sorghum silage

INTRODUCTION

Buffalo was a ruminant germplasm in Indonesia which production and conservation needs to be maintained. Although buffalo was also part of the methane (CH₄) emissions contributor from the agricultural and livestock sector. Buffalo population was the second most contributor of enteric methane emission (11.3%) of total enteric methane from livestock meanwhile the largest enteric methane contributor was from cattle (around 74%) (Patra, 2014). In many cases, buffalo productivity should be balanced with good ration to reduce the methane emissions. Methane emissions reflects the loss of some energy that could not be utilized for the production process (Jayanegara et al., 2009).

Sorghum is an alternative roughage for buffalo to increase the productivity. Pahat and Samurai 2 were sorgum varieties derived from mutation radiation breeding in Indonesia National Nuclear Energy Agency (BATAN). Samurai 2 variety was mutation product from Pahat sorghum (Human, 2013). These two varieties potential to be used as a roughage for dairy buffalo in Indonesia. Combination of concentrate and chopped sorghum bagasse as roughage (50:50 at dry matter/DM) were able to increase Murrah buffalo milk fat content (7.61%) and maintaining milk production above 5 kg/day (Seshiaiah et al., 2013). Roughage as fibre source could be made as silage form. Silage treatment on sorghum was to preserve and increase the soluble fiber content as roughage source (Colombo et al., 2007).
Early study to evaluate efficiency of buffalo fed containing sorghum on ruminal fermentation must be done. Rumen simulation technique (RUSITEC) was continous cultures that can be use as tools to evaluate the effects of diets on ruminal fermentation including methane production. The use of this fermenters type may provide useful information before designing and conducting time-consuming in vivo studies (Garcia-Gonzalez et al., 2010). The objectives of this study were to evaluate effect of buffalo fed containing sorghum straw silage on methane production and ruminal fermentation product in RUSITEC fermenters.

**MATERIAL AND METHODS**

**Material and treatments.** Paha and Samurai 2 sorghum were harvested at 80 days. Sorghum straw used include leaves and stems in this study. Silage sorghum straw was made by incubation for 21 days. The research material was dried in the oven at 60 °C and milled and screened at a size of 2 mm. Concentrates composition made by grinding various of feed ingredients (% DM) such as soybean meal (9%), pollard (10%), cassava waste (29%), rice bran (28.5%), soy pulp (15%), lacto-mineral (2%), urea (1.5%), salt (1%), lime (1%), molasses (3%) and then mixed into horizontally-mixer. Formula diets were based on nutritional needs for lactating buffaloes (8% CP and 55-56% TDN) (Parakkasi 1999). Feed ingredients were: P1 (50%:50% Pahat sorghum straw silage:concentrate) and P2 (50%:50% Samurai 2 sorghum straw silage:concentrate). Nutrient composition were presented in Table 1.

<table>
<thead>
<tr>
<th>Nutrient composition (% DM)</th>
<th>Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P1</td>
</tr>
<tr>
<td>Dry Matter (DM)</td>
<td>89.51</td>
</tr>
<tr>
<td>Organic Matter (OM)</td>
<td>85.34</td>
</tr>
<tr>
<td>Crude Protein (CP)</td>
<td>12.15</td>
</tr>
<tr>
<td>Crude Fiber (CF)</td>
<td>22.67</td>
</tr>
<tr>
<td>Ether Extract (EE)</td>
<td>1.14</td>
</tr>
<tr>
<td>Nitrogen Free Extract (NFE)</td>
<td>49.38</td>
</tr>
</tbody>
</table>

P1 (50%:50% Pahat sorghum straw silage:concentrate); P2 (50%:50% Samurai 2 sorghum straw silage:concentrate); Proximate analyses by animal feed science and technology laboratory (2014).

**Semi-continous in vitro system.** Cultures of mixed ruminal microorganisms were maintained in Rumen Simulation Technique (RUSITEC). The fermentation equipment included six 800 ml fermentation vessels was used in this study. The general incubation procedure by Czerkawski and Breckenridge (1977) and described in detail by Kajikawa et al., (2003). Ruminal inocula was collected from a cannulated buffalo bull (300 kg body weight) fed 50%:50% field grass:concentrate diet two equal meals per day. The fermentation inocula (solid and fluid) were collected through the rumen cannula before morning feeding. Fluid was collected from strained through four layer cheesecloth. The supernatant, diluted 1:1 with buffer (McDougall, 1948), was used as fluid inoculum for the fermentation vessels. Solid digesta were collected from strained digesta.

Around 800 ml of fluid inoculum and 75 g solid inoculum (contained in nylon bag, 50 μm pore size), as well as 15 g feed (Table 1) in separate nylon bag were placed in each vessel. Continual infusion of artificial saliva (McDougall, 1948) was maintained at the rate ± 400 ml
through each vessel during study. The experiment in RUSITEC lasted 11 days. To ensure a steady state with in the vessels, an adjustment periods for the first 5 days was allowed. Measurements were on days 6 to 11.

Measurements and chemical analyses. Produced gas was collected into gas bag (5 l A SANSHIN®). Gas volumes were measured with a gas meter and methane concentration were analysed in a MRU VarioPlus gas analyzer. A liquid effluent was collected and samples were taken for pH, ammonia (NH₃-N) (Conway, 1962), total VFA (AOAC, 1991), individual VFA (acetate, propionate and butyrate) (Cottyn and Boucque, 1968), In Vitro Dry Matter Degradability (IVDMD) and In Vitro Organic Matter Degradability (IVOMD) (AOAC, 1991).

Statistical analyses. The fermentation of responses by time (6 days) were presented descriptively. The average fermentation parameters would be statistically analyzed using t-test with 18 replications (6th day observation x 3 vessel replications). Analyses of Variance (ANOVA) was performed with SPSS 16.0. (Matjik and Sumertajaya, 2006)

RESULTS AND DISCUSSION

Daily changes in the fermentation parameters of the RUSITEC from the sixth day of the incubation to the eleventh day were showed in Fig 1. The total gas production, pH, IVDMD and IVOMD became steady during incubation while methane production, NH₃-N and total VFA were fluctuate. Methane production on P2 was always lower than P1 during incubation (Figure 1A). Enteric methane production depend on several factor: 1) roughage age and type (Arthington and Brown, 2005) and 2) acetate and propionate ratio on fermentation product (McAllister et al., 1996). The first factor was not cause the different of methane production due to the roughage sources were harvested at the same age. It could be caused by buffalo fed containing silage of Samurai 2 straw could optimize cellulolitic rumen microbes activity such as propionic bacteria (genus Prevotella) to compete methanogenic bacteria. The P2 average propionic product was higher than P1 (Table 2). In Table 2 also seen the production in P1 acetic was higher than P2. In the cycle of acetate and butyrate formation, hydrogen as a raw methane material would be produced, while in the propionic formation required a hydrogen ion. That was the basic lines of hydrogen utilization competition between propionic production and methanogenesis (Li et al., 2014).

Table 2. Statistical analyses results of an average ruminal fermentation on RUSITEC

<table>
<thead>
<tr>
<th>Peubah</th>
<th>Treatment</th>
<th>SEM</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P1 (P2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total gas production (ml/d)</td>
<td>1038.33 (938.89)</td>
<td>30.704</td>
<td>ns</td>
</tr>
<tr>
<td>Methane production (ml/d)</td>
<td>67.87a (49.03b)</td>
<td>0.187</td>
<td>**</td>
</tr>
<tr>
<td>pH</td>
<td>6.99 (6.97)</td>
<td>0.018</td>
<td>ns</td>
</tr>
<tr>
<td>NH₃-N (mg/100 ml)</td>
<td>21.53b (25.73a)</td>
<td>0.950</td>
<td>*</td>
</tr>
<tr>
<td>Total VFA (mM)</td>
<td>58.44b (72.67a)</td>
<td>2.102</td>
<td>**</td>
</tr>
<tr>
<td>Individual VFA (molar %)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acetate</td>
<td>46.86a (40.58b)</td>
<td>0.745</td>
<td>*</td>
</tr>
<tr>
<td>Propionate</td>
<td>34.84b (37.69a)</td>
<td>0.522</td>
<td>*</td>
</tr>
<tr>
<td>Butyrate</td>
<td>18.30b (21.73a)</td>
<td>0.608</td>
<td>*</td>
</tr>
<tr>
<td>IVDMD (%)</td>
<td>38.76b (41.17a)</td>
<td>0.503</td>
<td>*</td>
</tr>
<tr>
<td>IVOMD (%)</td>
<td>39.57b (43.75a)</td>
<td>0.566</td>
<td>*</td>
</tr>
</tbody>
</table>

P1 (50%:50% Pahat sorghum straw silage:concentrate); P2 (50%:50% Samurai 2 sorghum straw
The 6th International Seminar on Tropical Animal Production
Integrated Approach in Developing Sustainable Tropical Animal Production
October 20-22, 2015, Yogyakarta, Indonesia

Silage:concentrate); * significant (P<0.05); ** highly significant (P<0.01); ns (non significant).

pH values were not significantly different both rations and in neutral range. Kajikawa et al., (2003) reported that RUSITEC pH effluent range was usually 6.80 to 7.00. Falling of pH rumen would affect cellulolytic bacteria activity and population, which help the fermentation process (Martinez et al., 2010). P2 was produce an average NH$_3$-N higher than P1, whereas lower CP content (Table 1). It was thought to be caused by protein solubility of P2 better than P1. Öztürk (2009) reported that in RUSITEC methods, NH$_3$–N concentration depends on balance between deamination of amino acids and NH$_3$-N used by rumen microbes. Total VFA production of P2 was much higher than P1 (Table 2). It was prove that soluble fiber content in Samurai 2 variety was higher than Pahat. The mean of P2 IVDMD and IVOMD were higher than P2. That probably caused by fiber structure changes in Samurai 2 sorghum varieties which was result from radiation mutation breeding from Pahat sorghum, but it needs to be studied more deeply. Chatterjee et al. (2006) suggested that degradation rate of high feed describes the availability of energy and protein to improve fermentation and microbial population growth.

**CONCLUSION**

The conclusion showed that buffalo diets containing silage of Samurai 2 straw produced the lowest methane concentration, the highest total VFA, NH$_3$-N, IVDMD and IVOMD on. It means this ration was the best roughage source for buffalo fed better than buffalo ration containing Pahat straw silage.
REFERENCES

Body Weight Gain Response of Sumba Ongole Cattle to the Improvement of Feed Quality in East Sumba District, East Nusa Tenggara, Indonesia

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ABSTRACT: The main hindrance of cattle feeding in East Nusa Tenggara is the low quality of feed during the long dry season (8-9 months/year) which brought about a low yearly average DWG to the animals. An initial experiment to compare cattle on native grasses and cattle on mainly Leucaena leucocephala leaf was conducted in East Sumba District to demonstrate the importance of improving the quality of feed to the farmers, who for long time have been much relied on native grasses as feed sources. Sumba Ongole Cattle (5-9 heads) with average body weight of 200 kg at two villages i.e. Padadita and Wanga. Five to nine cattle were fed on regular feed of mainly native grasses at Padadita and mainly L. Leucocephala leaf at Wanga. The experiment was conducted during the dry period in 2014 (June to October). Feed was given ad-libitum during the experiment. The results showed significantly higher body weight gain in cattle received leucaena leaf compared with cattle that received native grasses, which lost weight during the experiment. The experiment therefore concluded that it is important to improve the quality of feed in cattle feeding in East Sumba, which could be done through the development and use of L. leucocephala to establish high quality feed resources in the island, where now it can be considered rare.

Key words: East Nusa Tenggara, East Sumba, Sumba Ongole, Leucaena leucocephala, dry season feeding.

INTRODUCTION

The main important hindrance to cattle productivity improvement in Nusa Tenggara Timur is the provision of sufficient feed in quantity and quality, especially during the dry period (Nulik dan Bamualim, 1989), at what time cattle (the free grazing animals) experiencing body weight lost, high calf mortality, as well as long calving interval brought about by the lack of feed availability in the native grasslands.

With its long dry season characters (8-9 months), every year the classic problem of feed shortage during the dry season would always occur again and again with no proper solution with various reasons. The problem of feed shortage in Sumba is obvious from the performances of cattle during the dry season when most of the native grasses have decreased in quality and forage production. During the dry season cattle performances are poor with apparent very low body condition score (Picture 1). The main reasons are: (i) farmer are not used to establishing high quality fodder plant able to produce in all the year (especially to the peak of dry season), (ii) high reliability to the availability of native grazing lands which thus hindered the efforts to develop forage plantings (Kana Hau, et al., 2014), (iii) in general farmers in Sumba believe that SO cattle does not eat leucaena, (iv) general observation in the field too indicated that SO cattle refuse to eat leucaena.

In the beginning, before the experiment, the fact that SO cattle refuse to eat leucaena was suspected relating to the mimosine content in the leucaena forage which may have caused bad experience to the SO cattle. The cause may have caused the animal to experience toxicity (indicating by over salivation, dizziness, lost of hairs especially in the tail and body parts, followed
by bad growth of the animal and animal lost weight) and therefore animal refused to eat the forage even though it is available abundantly during the dry season. This can be observed in the field during the dry season when the group of cattle herd passed by the reachable leucaena swards and prefer to eat the low quality standing hay to the fresh and abundant leucaena. In contrast to the suspicion, the initial investigation in East Sumba to explore the existence of Sinergistes jonesii it was found that the bacteria is consistently present in sufficient amount in several types of animals (cattle, buffaloes, and goats) in Waingapu, Wanga, Melolo, and Kakaha sites detected in urine and rumen fluid (Halliday et al., 2014). Therefore it was concluded that there should be no reason for SO cattle not to eat leucaena.

Depart from the findings and problems an experiment on leucaena feeding has been conducted in East Sumba during the dry season in the year of 2014, under farm condition and feeding practices.

MATERIAL AND METHODS

Two locations have been selected purposely for the experiment, these consisted of: (i) Padadita village in Pandawai Sub-District where the main feed for the cattle consisted of native grasses and other agriculture byproduct such as maize stover, and (ii) Wanga village where the main ration consisted of leucaena (Leucaena leucocephala).

In each village 5 – 9 heads of SO Bull with average weight of 200 kg were used. During the experiment, all bulls were weighed regularly every month, for 6 months during dry season (June to October 2014). Data were then calculated for daily weight gain (DWG) and the cumulative body weight.

Feed was provided and given by the farmers according to the needs of the animals at the initial weighing (about 3% DM of body weight) and were adjusted each month according to the weight of the animals. In general, farmers provide ad-libitum feed for the animals, as it was also difficult in the farmer level to exercise a controlled experiment. Thus farmers were allowed to feed the animals according to their daily practices. As this is an on farm experiment, only body weight gain data that were collected plus visual observations on the acceptance of the animals on the leucaena fodder as well as their adjustment to the diet. And thus only simple statistic was performed, i.e. total and average values, followed by plotting the monthly weight data into graph to understand the trend of the body weight changes during the dry season (June to November) on cattle have improved feed (mainly leucaena) and cattle under normal practices (eat mainly native grasses). An independent T-test was performed on the data of daily weight change (kg/head/day) accordingly.

RESULTS AND DISCUSSION

The initial average body weight of the animals at Padadita was 222 kg (8 SO Bulls), while average initial body weight of the animals at Wanga was 208 kg (5 SO Bulls). From the regular monthly body weight measurement it was discovered that Bulls at Padadita every month continued on losing weight to the end of dry season (November). In contrast, SO Cattle at Wanga (where cattle was just trained to eat leucaena prior to the experiment), though still low, consistently experienced body weight gain in each month of weighing (Graph 1), as the data indicated significant differences by independent T-tests in the period of July-August, August-September, and September October (Graph 2).

From the graph it can be seen that at Padadita village where SO Cattle have dry native grass as their main ration constantly experienced body weight loss to the end of the dry season (October), similar to the general condition of free grazing animals in the native grasslands. It can also be seen
that weight gain on the first month when SO cattle were being trained to eat leucaena was small, this is in relation to the period for the animals to adapt to the new forage, thus no significant difference was obtained (P=0.6). At this stage animals appeared in not proper condition with obvious notable over-salivation, and a little bit loosing hairs, mostly on the tail. This condition only appeared in the first and half period of the second month and then the animals started to regain, and so have better weight gain. This is in accordance with the findings from other authors, that in this period usually the mimosine degradable bacteria Sinergistes jonesii still increasing in their population in the rumen according to the increase consumption or intake of leucaena fodder, as the bacteria needs mimosine as their food requirement (McSweeney, 2014; Halliday et al., 2014).

The simple experiment has demonstrated that there is a great potential for expanding the practice of leucaena feeding, by establishing more leucaena fodder trees in Sumba Island, especially in East Sumba, where most of SO cattle population is concentrated in the island (60%) (Nulik et al., 2013). As currently a new variety of L. leucocephala cv. Tarramba, tolerant to psyllid attack, is being promoted in Eastern Indonesia (Nulik et al., 2013).

CONCLUSION

Leucaena leucocephala forage has the potential to be constantly developed and increased in their usage as high quality feed for SO cattle fattening in Sumba, which are in general always experiencing body weight loss during the dry season, when most of the native grasses have hayed off in the native grasslands. The recommendation to enhance the development of Leucaena leucocephala cultivation in the island of Sumba is encouraged by the findings that the bacteria Sinergistes jonenesii as the main bacteria to degrade mimosine and its derivatives (3,4 DHP and 2,3 DHP) is consistently detected in the rumen of all ruminants (cattle, buffalo and goats) with ration contained 30-40% leucaena, a condition hardly found consistently in Timor Bali cattle (domesticated of wild Banteng) (Hallyday et al., 2014).

Graph 1. Response of cumulative body weight changes in SO cattle in East Sumba fed on Leucaena leucocephala as the main ration compared with that of native grasses only.
Graph 2. Response of daily body weight changes in SO cattle fed on *Leucaena leucocephala* as the main ration at Wanga Village compared with that of native grasses only at Padadita Village in East Sumba.

REFERENCES


Daily Body Weight Gain of Bali Cattle Fed with *Leucaena Leucocephala* as the Main Ration in West Timor, East Nusa Tenggara, Indonesia

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**ABSTRACT:** *Leucaena leucocephala* has long been used in Amarasi sub-district of Kupang in East Nusa Tenggara as the main high quality fodder for intensive cattle feeding in pens. However, the spread of the technology to the adjacent areas in the island is slow. Two villages were selected for the study of leucaena based feeding in the existing and non-existing (Ponain and Oebola Dalam) to observe on the daily weight gain of Timor Bali cattle and the uptake of the technology by new farmers. Oebola-Dalam has just started planting psyllid tolerance leucaena in 2012 and initiated an intensive cattle feeding in 2014. The experiment consisted of comparing the daily weight gain of cattle on leucaena based feeding at the sites. About 18 feeder cattle in Ponain and 30 feeder cattle in Oebola Dalam with average initial body weight of 200 kg were included in the study during the months of January to November 2014. In general cattle were fed ad-lib mainly with the leaf of leucaena. Monthly cattle weighing was conducted accordingly. The results indicated that average daily cattle weight gain in Ponain (0.5 kg/hd/day) was higher than at Oebola Dalam village (< 0.5 kg/hd/day). The best daily weight gain in both sites may reach up to 1 kg/hd/day, while the worst animals lost weight during the study. The study has demonstrated that the provision of sufficient leucaena plants as sources of high quality feed and good knowledge of farmers in cattle feeding resulted in better cattle weight gain and thus encourage the uptake of the technology.

**Key words:** *Leucaena leucocephala*, pen feeding, East Nusa Tenggara, Ponain, Oebola Dalam, Timor Bali Cattle.

**INTRODUCTION**

*Leucaena leucocephala* is a high quality fodder which has long been valued in East Nusa Tenggara Province, Indonesia, following its excellent ability to produce year round fodder at the proper managements such as regular pruning (with interval of 3 to 4 months for each harvest).

The Amarasi sub-district in the regency of Kupang has long been known for the intensive use of *leucaena leaf* as the main ration for fattening of Bali Cattle (domesticated of wild Banteng, *Bos javanicus javanicus*), though the uptake of the technology even to the next door sub-districts (such as in West Kupang and Fattuleu sub-districts in the regency of Kupang) was slow and minimal. To study how the change occurs from free grazing practices into intensive cut and carry pen feeding practices by the farmers in East Nusa Tenggara, an experiment was established to study on the changing process from free grazing on native pastures to intensive feeding based on *L. leucocephala* focusing on the daily weight gain in one year data collection (January to November 2014).

**MATERIALS AND METHODS**

Two locations, one in Amarasi sub-district and one in Fattuleu sub-district in Kupang district have been selected to conduct the studies. Ponain village in Amarasi sub-district in this case as an existing area, at which *L. leucophalah* has been intensively fed to cattle and Oebola Dalam in
Fatuleu sub-district as a non-existing area, where *L. leucocephala* had not been intensively used, with mostly free grazing animals. The two locations have been described before (Kana Hau, 2013). As an existing area where *L. leucocephala* has long been used, farmers in Ponain has cultivated a vast area and thus leucaena is easily obtained abundantly at any time of the year round, though a bit suffer from Heteropsylla cubana insect damage especially during the wet season. Oebola-Dalam as a non-existing area, has just started to grow the legume, thus availability is a bit of a problem, especially during the dry period.

In Ponain Village 16-18 heads of Bali bulls with an initial weight of 200 kg and 5 to 35 of Bali bulls at Oebola Dalam with similar initial body weight were recorded on their live weight by doing a regular monthly weighing at the sites. In Oebola Dalam as a new area, observations were also conducted on yearlings intensively fed *L. leucocephala* by farmers having different levels of the forage availability (low, medium and high). Low level = contained + 1,000 to 1,5000 leucaena plants; Medium = 2,000 to 3,500 leucaena plants, and High level = contained 4,000 to > 5,000 leucaena plants, available for harvest.

As the study was conducted on farm (difficult to have a controlled experiment) only simple measurements, observations, and thus simple analysis were conducted on the collected data (such as total, and average values were calculated) then graphs were draw to see the trend of different between sites and farmers on the cattle body weight change performances.

**RESULTS AND DISCUSSION**

In general it was noticed that intensive feeding of leucaena leaf gave higher body weight gain compared with that of free grazing animal even during the wet season where main forage available was from the native grassland (Nulik et al., 2013). The grazing animals, especially during the dry season experienced body weight lost, while gain in the wet season was only between 1-5 kg monthly, indicating an urgent need to improve forage availability by establishing more drought resistant fodder plants such as Leucaena leucocephala, particularly from the psyllid tolerance cultivar i.e. Tarramba.

The results of the studies indicated that the average daily weight gain of Bali Cattle Bulls was of 0.5 kg/head/day in the existing Ponain Village site, while at Oebola Dalam as the non-existing site the average daily weight gain obtained for most of the cattle in the group was still < 0.5 kg/head/day, identified as the impact of less availability of *Leucaena leucocephala* fodder, especially during the dry season when soil moisture was limiting (following its new development in the village, stared in 2012). The Ponain Village as the existing site has quite abundant sources of leucaena fodder as its introduction has been pronounced since 1974 and thus provided sufficient fodder throughout the year, even in the dry season. Data also indicated that some farmers with sufficient supply of leucaena fodder in both sites were able to obtain cattle daily weight gain of more than 0.5 kg/head/day even reach up to 1 kg/head/day when cattle were given sufficient feed according to the requirements. While in contrast some farmers even obtained less than 0.5 kg/head/day cattle daily weight gain as cattle were given insufficient feed according to the requirements, even in some cases cattle lost weight.

A feeding experiment for 4 months at the modern slaughter house conducted on 8 heads of Bali Cattle bulls with initial weight of 250 kg before entering slaughtering process indicated similar results, that when Timor Bali cattle were properly fed with ad-lib leucaena fodder (no empty feed through) an average daily weight gain of > 0.5 kg was achieved (Syafiril Bustaman, Pers.Com).

The average weight daily gain may be improved if energy feed, such as grounded maize or cassava tuber, be supplemented (Nulik, 2014).
A series of data from farmers at Oebola Dalam Village has demonstrated that yearlings (started at initial body weights of about 100 kg) fed intensively *L. leucocephala* had the highest body weight gains at the farmer with high forage availability, while moderate forage availability farmer obtained moderate cattle weight gain, and the lowest forage availability farmer obtained the lowest cattle weight gain (Graph 2). This has also explained that the availability of forage in sufficient amount is crucial for farmers in West Timor who wanted to raise cattle in pens and fed intensively with *L. leucocephala*.

**Graph 1.** DWG Respons of Bali Cattle to *Leucaena leucocephala* Fodder Based Feeding Practices in West Timor.

**Graph 2.** Differences of body weight gain at different *Leucaena leucocephala* forage availability and offering in West Timor.
CONCLUSION

The current study has demonstrated that *Leucaena leucocephala* has a great potency to be further widely developed in East Nusa Tenggara to boost cattle production in the region dominated by dry land and climate which might be impossible to achieve from other means of developing other cattle forages for cattle feeding.

The more the availability of leucaena forage and thus the higher offering forage the higher the daily cattle weight gain will be achieved as farmers may possible to offer more forage to meet the daily requirements of the animals in the intensive feeding practices. A daily weight gain of > 0.5 kg for Timor Bali cattle will easily be achieved when feeding with sufficient *L.leucocephala* fodder.

REFERENCES


Tannin Anthelmintic Doses, Metabolizable Energy and Undegraded Protein Contents of Rubber Leaves (*Hevea brasiliensis*) as Herbal Nutrition for Goats

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ABSTRACT: Analysis of feed chemical composition, total tannins and condensed tannin contents of rubber leaves carried out in previous research showed that rubber leaves have a potency as herbal nutrition for goats. In this current research, rubber leaves were analyzed further to determine the metabolizable energy (ME) and undegraded protein (UDP) contents, and also to determine the tannin anthelmintic doses of rubber leaves. The materials used were fresh and 1d-withered rubber leaves and branches (edible portion) taken from 4 types of rubber tree clones. The contents of ME and UDP were in sacco analysed according to Ørskov and Mc. Donald (1979). The determination of tannin anthelmintic doses was carried out by analysing the effects of tannins extract against Hemonchus contortus nematodes in vitro. The results showed that the average values of UDP and ME contents in fresh rubber leaves and branches were 40.88% and 8.07 MJ ME/Kg DM, and in 1d-withered form were 37.15% and 8.09 MJ ME/Kg DM. The use of tannin doses in vitro which was equivalent to 2 g (contained in ± 213.6 g fresh rubber leaves), 4 g, 6 g and 8 g tannins doses in vivo, showed that 100 % worms in all doses tested were dead after 4 hours immersing in tannin extracts, and the worms death were preceded by paralysis process. The Speed of the worm paralysis and death increased with the increasing doses tested. It can be concluded that rubber leaves have a low content of ME but a high content of UDP, and hence, it can be used primarily as a high UDP forage source for ruminants, and the tannins compound contained in the rubber leaves with the dose of ≥ 2 g tannins per a head of goat has a strong anthelmintic effect against adult female *Haemonchus contortus* worms.

Keywords: *Hevea brasiliensis*, Metabolizable Energy, Undegraded Protein, Tannins, Anthelmintic

INTRODUCTION

Analysis of rubber leaf (*Hevea brasiliensis*) potency as herbal nutrition (Nutritive Herbs) for ruminants has been carried out previously by quantitatively analyzing the feed chemical composition, the content of total tannins and condensed tannin of the leaves and branches (edible portion) of rubber tree (Wigati, *et al.*, 2014a). The average of feed chemical composition of the fresh rubber leaves were 40.4% DM, 87.9% OM; 19.5% CP; 6.2% EE and 27.0% CF. The branches part of fresh rubber had a lower quality than the leaves part. Withering rubber leaves and branches increase the quality of the feed. The average of total tannin and condensed tannins contents (DM base) of rubber leaves and branches in the fresh form were 2.71%, and 2.37 %. - and in the 1-d withered form were 2.05%, and 2.52% (Wigati, *et al.*, 2014a). The results of the previous research showed that rubber leaves and branches have a good quality as a feed source for goats. The contents of total tannins and condensed tannins in rubber leaves and branches indicated a nutritive level of tannins content, and also indicated a potency as herbal medicine for goats. According to Makkar (2003), tannins within certain limits (2-4% DM basis) can improve the efficiency of microbial protein synthesis and degradation and can protect the protein in the rumen, thereby increasing the
flow of essential amino acids to the small intestine and increase the absorption of amino acid into the blood which in turn will be able to increase the productivity of livestock. In ruminants, tannin, particularly condensed tannin has been reported to have an effect as a medicinal herb, which is as anti-parasitic gastro-intestinal (natural anthelmintic) as reported by Paolini et al. (2003). The objective of the current research was to further explore the potency of rubber leaves and branches (edible portion) as herbal nutrition for ruminant, especially for goats, by in sacco analysis to determine the contents of undegraded protein (UDP) and metabolizable energy (ME), and by in vitro analysis to analyse the effects of tannins extract against adult female Haemonchus contortus nematodes to determine the tannin anthelmintic doses.

MATERIALS AND METHODS

Research Materials

The feed samples used in the study were fresh and 1-d withered rubber leaves with its branches (edible portion) taken from four types of rubber clones growing in several locations of the rural community rubber plantation in Jambi province, Indonesia. The experiment used nylon bags with ± 12 μm porosities, and a fistulated non pregnant female Bali cattle which was fed King grass (Panicum purpureum), rice bran and soya bean cake (rumen pH were 6.7 to 6.9). For the determination of tannin anthelmintic doses were used tannins extract from fresh rubber leaves and its branches, and adult female Haemonchus contortus nematodes obtained from abomasums of local goats.

Research Methods

In sacco analysis. Feed samples in nylon bags were incubated in rumen with incubation time of 2, 4, 8, 16, 24, 48 and 72 hours to measure in sacco feed degradation. The quantity of DM, OM and CP lost from the previous samples were degraded in the rumen, and were then used to measure the values of a, b and c by using the exponential equation according to Orskov and Mc Donald (1979) as followed : P = a + b (1- e-ct), where P is the fraction degraded at time t, a is the intercept (soluble fraction), b is the potentially degraded fraction (the insoluble but fermentable fraction), e is natural log, c is the rate constant of b, and t is incubation time. Subsequently, the obtained values of a, b and c were used to calculate effective degradability (ED) of DM, OM and CP by using the following equation: ED = a + (bc/ c + k), where ED is the amount degraded during the time its spends in the rumen (effective degradability), and a, b, and c are as above and k is the outflow rate.

The Metabolizable Energy (ME) contents of the feed samples were measured by using the value of Degradability of Organic Matter (DOM) at 48 hour incubation (Actual Degradation of Organic Matter) by calculation and its conversion from several equations according to NRC (1981), i.e. 1 Kg DOM = 4.620 Mcal DE = 3.787 Mcal ME; = 16184 KJ ME = 16.20 MJ ME, and 1 MJ ME = 0.234 Mcal ME.

In vitro analysis. The tannin anthelmintic doses of fresh rubber leaves with its branches were determined in vitro by using tannin extracts of the feed samples. The extraction of tannins used ether/aquades solvents. The doses of tannins extract used were 3.5%, 7.0%, 10.5% and 14.0% (dry weight rubber leaves and branches), those doses were equivalent to 2g, 4 g, 6 g and 8 g in vivo for a head of goat. The calculation of anthelmintic tannin doses used data obtained from the previous reseaches, i.e. total volume of rumen fluid of goat were ± 13% of body weight, dry matter, dry weight and total tannin contents of the fresh rubber leaves and its branches were 31.77%, 34.04% and 2.95% respectively (Wigati, et al., 2014a). In this experiment, each of twelve adult female H. contortus worms were directly taken from fresh goat abomasum (<3 hours after
slaughtering) and were inserted into tannin extract in petri dish at a dose that was tested. The signs of activity, paralyse and death of the worms in tannin extract were observed using observation times of 30 min, 60 min, 90 min, 120 min, 150 min, 180 min and 240 min.

**Research Parameters and Data Analysis**

Parameters taken were the contents of Undegraded Protein (UDP) and Metabolizable Energy (ME) of fresh and 1-d withered rubber leaves and its branches, and the anthelmintic doses of tannin extracts from the fresh rubber leaves and its branches. All data obtained in the study were analyzed descriptively.

**RESULTS AND DISCUSSION**

**Feed chemical composition of rubber leaves and its branches**

Feed chemical composition of rubber leaves and its branches was presented in Table 1. The results showed that rubber leaves and its branches have high contents of dry matter (DM), organic matter (OM) and crude Protein (CP) (> 20%), and also high contents of ADF and NDF (> 35%).

<table>
<thead>
<tr>
<th>Sample Type</th>
<th>DM (%)</th>
<th>OM (%)</th>
<th>CP (%)</th>
<th>ADF (%)</th>
<th>NDF (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh</td>
<td>31.77</td>
<td>95.26</td>
<td>20.21</td>
<td>38.76</td>
<td>55.76</td>
</tr>
<tr>
<td>1-d Withered</td>
<td>36.89</td>
<td>95.20</td>
<td>23.07</td>
<td>38.62</td>
<td>57.68</td>
</tr>
</tbody>
</table>

NDF = *neutral detergent fibre*  ADF = *acid detergent fibre*

The contents of undegraded protein (UDP) of the rubber leaves and its branches

The contents of UDP in rubber leaves and its branches in the fresh and 1-d withered forms were presented in Table 2. The UDP content was higher in the fresh form than that in the 1-d withered form. Previous research showed that fresh rubber leaves and its branches had total tannins contents higher than those of 1-d withered rubber leaves and its branches (Wigati, *et al.*, 2014a).

<table>
<thead>
<tr>
<th>Sample Type</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>ED of CP (%)</th>
<th>UDP (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh</td>
<td>41.61</td>
<td>31.20</td>
<td>0.08</td>
<td>59.12</td>
<td>40.88</td>
</tr>
<tr>
<td>1-d Withered</td>
<td>45.18</td>
<td>29.35</td>
<td>0.09</td>
<td>62.85</td>
<td>37.15</td>
</tr>
</tbody>
</table>

It is suggested that there is a close relationship between total tannin content with the value of UDP in a feedstuff. Tannins has been reported to have effect in protecting the feed ingredients from degradation in the rumen (Makkar, 2003). The value of UDP content of fresh rubber leaves and its branches was higher than that of groundnut haulm, King grass, rice bran, dried cassava tubers and soya bean meal, but was lower than that of cassava leaves hay (Wigati, *et al.*, 2014b). Based on the values of DM, OM, CP and UDP of the fresh rubber leaves and its branches (edible portion), it can be concluded that the forage can be used as a high protein feed source. Withering the forage has been reported to improve the quality of the forage (Wigati, *et al.*, 2014a), but slightly lowered its UDP content.
The content of Metabolizable Energy (ME) of the rubber leaves and its branches

Metabolizable Energy calculation was based on the values of the effective degradability of OM, the content of OM and the actual degradation of OM in the feed. Metabolized energy content (Metabolizable Energy/ME) in the rubber leaves and its branches was presented in Table 3. The result showed that the ME content of the fresh rubber leaves and its branches was almost similar to that of the 1-d withered form.

Table 3. The content of Metabolizable Energy (ME) of the rubber leaves and its branches.

<table>
<thead>
<tr>
<th>Sample Type</th>
<th>EDOM (%)</th>
<th>OM (%)</th>
<th>OM (g/kg DM)</th>
<th>DOM (%) at 48 h</th>
<th>DOM (g) at 48 h</th>
<th>ME (MJ/kg DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh</td>
<td>41.43</td>
<td>95.26</td>
<td>952.63</td>
<td>52.56</td>
<td>500.73</td>
<td>8.11</td>
</tr>
<tr>
<td>1-d Withered</td>
<td>40.35</td>
<td>95.20</td>
<td>952.02</td>
<td>52.01</td>
<td>495.17</td>
<td>8.02</td>
</tr>
</tbody>
</table>

The ME contents in both fresh and 1-d withered rubber leaves and its branches were relatively lower than ME contents of other feedstuffs resulting in the previous study (Wigati, et al., 2014b) such as King grass (10.45 MJ ME), cassava leaves hay (11.45 MJ ME), rice bran (10.15 MJ ME) and soybean meal (14.73 MJ ME). Lower content of ME in both fresh and 1-d withered rubber leaves and its branches was suggested to be caused by high crude fiber contained in the feed material as indicated by the value of its ADF and NDF (Table 1). High crude fiber content in the feeds would cause the rate of degradation of organic material was slower and produced less substrate that was degraded to produce energy needed by the animal. Since, rubber leaves and its branches contained a low ME content, hence, the use of rubber leaves and its branches for feeding ruminants should be added with other high energy feed sources.

In vitro analysis of tanin anthelmintic effects of rubber leaves and its branches

The observation results of anthelmintic effect of tannins contained in fresh rubber leaves and its branches were presented in Table 4.

Table 4. Tannin anthelmintic Effects against adult female Haemonchus contortus

<table>
<thead>
<tr>
<th>Observation Time</th>
<th>2 g Tannin dose</th>
<th>4 g Tannin dose</th>
<th>6 g Tannin dose</th>
<th>8 g Tannin dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:00</td>
<td>100 active</td>
<td>100 active</td>
<td>100 active</td>
<td>100 active</td>
</tr>
<tr>
<td>10:00</td>
<td>100 active</td>
<td>100 active</td>
<td>100 active</td>
<td>100 active</td>
</tr>
<tr>
<td>11:00</td>
<td>83.33 active</td>
<td>75 active</td>
<td>16.67 active</td>
<td>16.67 active</td>
</tr>
<tr>
<td>11:30</td>
<td>16.67 paralysis</td>
<td>25 paralysis</td>
<td>83.33 paralysis</td>
<td>83.33 paralysis</td>
</tr>
<tr>
<td>12:00</td>
<td>41.67 active</td>
<td>33.33 active</td>
<td>16.67 active</td>
<td>8.33 active</td>
</tr>
<tr>
<td>12:30</td>
<td>58.33 paralysis</td>
<td>66.67 paralysis</td>
<td>83.33 paralysis</td>
<td>91.77 paralysis</td>
</tr>
<tr>
<td>13:00</td>
<td>100 paralysis</td>
<td>100 paralysis</td>
<td>100 paralysis</td>
<td>91.67 paralysis</td>
</tr>
<tr>
<td></td>
<td>8.33 dead</td>
<td>8.33 dead</td>
<td>8.33 dead</td>
<td>16.67 dead</td>
</tr>
</tbody>
</table>

154
The results showed that the use of tannin doses in vitro which was equivalent to 2 g (contained in ± 213.6 g fresh rubber leaves), 4 g, 6 g and 8 g tannins doses in vivo, showed that 100 % worms in all doses tested were dead after 4 hours immersing in tannin extracts, and the worms death were preceded by paralysis process. The Speed of the worm paralysis and death increased with the increasing doses tested. It can be concluded that the tannins compound contained in the rubber leaves and its branches with the dose of ≥ 2 g tannins per a head of goat has a strong anthelmintic effect against adult female Haemonchus contortus worms.

CONCLUSIONS

Based on these results it can be concluded that both fresh and 1-d withered rubber leaves and its branches have high protein and undegraded protein contents but have a relatively low metabolizable energy content, and that the tannins contained in the rubber leaves and its branches have a strong anthelmintic effect in all doses tested. The results of the study are expected to be the basis of widely use of rubber leaves and its branches as a source of forage and herbal medicine for ruminant, particularly in the development of goats or beef cattle reared in an integrated farming system with rural community rubber plantation.

REFERENCES


Consumption and Digestibility of Nutrients in Bali Cattle at the Last Period of Pregnancy Kept under Semi Intensive System Supplemented with Nutritive Rich Feed Contained Lemuru Oil and Zinc

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ABSTRACT: An experiment was conducted for three months to examine the addition of nutritive rich feed (NRF) containing “lemuru” oil and zinc on consumption and digestion of dry matter, organic matter, crude fiber and crude protein of cows of Bali cattle during late gestation period and kept under semi intensive system. Formulation of NRF consisted of palm (borsus) oil, leucaena leaves and gliricidia leaves meal, fermented rice bran, fish meal, “lemuru” oil, ZnSO₄, urea, and salt. The crude protein content of NRF was 23 %, while total digestible nutrient was 70 %. A total of 12 heads of last pregnancy period of Bali cattle with initial body weight of 241.90 ± 23.25 kg (coefficient variance = 9.61) were employed in this experiment. Experimental design used was completely randomized design consisted of three treatments and four replications. The treatments were: T₀ = cows consumed hay and standing hay as basal diet in pasture; T₁ = T₀ + bidara (Zizipus) leaves as feed addition; and T₂ = T₁ + NRF formulae contained lemuru oil 1.5% + 150 mg ZnSO₄/kg (Table 1). NRF was given in the morning while bidara leaves in the noon. NRF was given 30% of dry matter requirement and dry matter requirement was 3% of body weight. All parameters measured in this experiment were both nutrients consumption and digestibility based on method described by Ranjhan (1988). Data were analyzed by analysis of variance and testing by Duncan’s new multiple range tests. The results of this research indicated that there were highly significant change in dry matter, organic matter, crude fiber, and protein intake (P<0.01). Dry matter, organic matter, and crude protein digestibility were also highly significant differences (p<0.01), but crude fiber digestibility was significant (P<0.05) on supplementation of NRF containing 1.5 % “lemuru” oil and zinc level of 150 mg/kg of dry matter of NRF. It was concluded that supplementation of NRF with 1.5% of lemuru oil and 150 mg of ZnSO₄/kg dry matter of NRF could increased intake and digestibility of dry matter, organic matter, crude fiber and crude protein of the last pregnancy period of Bali cows kept under semi intensive system during the dry season.

Keywords: consumption, digestibility, pregnancy, lemuru oil, ZnSO₄

INTRODUCTION

East Nusa Tenggara Province is one of primary cattle production area in Indonesia. This area is always have feed and feeding problems especially in dry season (which is around 8-9 month per year), where feed production is low and directly affected cattle productivity both population and gain. Heat stress during long dry season can affect both physiological of cattle and vegetation as source of feed for animal. In dry season, standing hay is still available to feed to cattle but their quality is poor due to their nutrient content of neutral detergent fiber (NDF), protein and crude fiber of 88.98%, 2.56% and 38.75% respectively. These nutritional condition caused low palatability and low in vitro with dry matter digestibility and organic matter digestibility of 45.86% and of 48.69% respectively (Hartati and Katipana, 2006).
In general, Bali cattle performance in West Timor is very much reliant on the herbage available on native pasture. Grass availability and particularly its quality fluctuate with season. Reasonable quality grass in this region is only available for a short period during the early rainy season. Even in this period, due to the shooting pattern of growth and more efficient photosynthesis, tropical forage matures rapidly and their crude protein content falls below 4%. For this reason, it is necessary to provide supplement for better utilization of the low quality tropical grasses in attempting to improve productivity of cattle (Belli and Sinlae, 2006). It has also been a general knowledge that ruminants have some advantages compared to monogastric animals, such as the ability to digest high fiber content feedstuffs for their benefits with the help of microorganisms in the rumen. The action of microbes in the rumen enables us to use fibrous roughages as ruminants feed. Urea is commonly used to enhance digestibility of fibrous by product through ammoniation process. Ammoniation of crop residues and agro-industrial by product with urea can supply nitrogen to rumen microbe.

Study with Holstein cattle, Hartati (1998) found that there is a need to give enough nutrients for rumen fermentation to optimalize the growth and activities of microorganisms in the rumen. Nutritive rich feed (NRF) contained lemuuru oil and Zinc is the solution to maximize nutrient supply as the important pre-cursor for both microorganisms in the rumen and cattle. Hartati et al. (2008) produced a package of NRF formulae contained 1.5% lemuuru oil and 150 mg of ZnSO$_4$/kg of NRF. This package gave optimal response to growth of last pregnancy period of Bali cattle kept under intensive system as well as birth weight and immunity level of their fetus due to better protein digestibility, but it was not given significant effect to feed their consumption and dry matter digestibility. This experiment was conducted to use the same package of NRF formulae and fed to Bali cattle kept under semi intensive system.

**MATERIALS AND METHODS**

A total of 12 heads of last pregnancy period of Bali cattle with initial body weight of 241.90 ± 23.25 kg (coefficient variance = 9.61) were employed in this experiment for three months. Experimental design used was completely randomized design consisted of three treatments and four replications. The treatments were: $T_0$ = cows consumed hay and standing hay as basal diet in pasture; $T_1 = T_0 +$ bidara (Ziziphus) leaves as feed addition; and $T_2 = T_1 +$ NRF formulae contained lemuuru oil 1.5% + 150 mg ZnSO$_4$/kg (Table 1). NRF was given in the morning while bidara leaves in the noon. NRF was given 30% of dry matter requirement and dry matter requirement was 3% of body weight.

**Table 1. Ingredients and chemical composition of NRF Formulae**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>NRF (%)</th>
<th>Protein (%)*</th>
<th>TDN (%)*</th>
<th>Protein (%)**</th>
<th>TDN (%)**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palm sugar</td>
<td>30</td>
<td>2.69</td>
<td>72.70</td>
<td>0.81</td>
<td>21.81</td>
</tr>
<tr>
<td>Leucaena leaves</td>
<td>24</td>
<td>25.00</td>
<td>77.00</td>
<td>6.24</td>
<td>18.48</td>
</tr>
<tr>
<td>Gliricidia leaves</td>
<td>17</td>
<td>27.50</td>
<td>76</td>
<td>4.68</td>
<td>12.92</td>
</tr>
<tr>
<td>Bran fermentation</td>
<td>15</td>
<td>19.79</td>
<td>67</td>
<td>2.97</td>
<td>10.19</td>
</tr>
<tr>
<td>Fish meal</td>
<td>10</td>
<td>61.2</td>
<td>69.00</td>
<td>6.12</td>
<td>6.90</td>
</tr>
<tr>
<td>Urea</td>
<td>1.0</td>
<td>281.25</td>
<td>-</td>
<td>2.81</td>
<td>-</td>
</tr>
<tr>
<td>Lemuuru oil</td>
<td>1.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Salt</td>
<td>1.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>23.63</td>
<td>70.30</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Parameters measured in this experiment were both nutrients consumption and digestibility based on method described by Ranjhan (1988). Indicator consumption and digestibility of dry matter is used chromic oxide (Cr₂O₃) technique. After 24 hours of Cr₂O₃ distributed to cows, samples of feces of cows were collected and separated within 24 hours. Total feces samples were also used to analyze nutrient contents in the feces. The formulas used as followed:

\[
\text{Dry matter of feces (g/day)} = \frac{\sum \text{Cr}_2\text{O}_3 \text{ intake daily}}{\text{g Cr}_2\text{O}_3 \text{ per g of feces}}
\]

\[
\text{Dry matter feed digestibility (\%)} = 100 - \left(100 \times \frac{\% \text{ indicator in feed}}{\% \text{ indicator in feces}} \times \frac{\% \text{ dry matter in feces}}{\% \text{ dry matter in feed}} \right)
\]

\[
\text{Dry matter intake (kg/hour)} = \frac{\text{fecal output of dry matter}}{\text{indigestibility}} \times 100
\]

Data were analyzed by analysis of variance and testing by Duncan’s new multiple range tests (Steel and Terrie, 1981).

**RESULTS AND DISCUSSION**

Body weight gain of animal is manifestation of accumulation of feed consumption, digestibility, metabolism and absorbing of nutrient in the body of animal. Mean of dry matter consumption and nutrients as affected by the treatments were presented in Table 2.

Table 2. Mean both nutrients Consumption and Digestibility of all treatments.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T₀</td>
</tr>
<tr>
<td>Consumption:</td>
<td></td>
</tr>
<tr>
<td>- Dry matter (kg)</td>
<td>4.85 ± 0.17 a</td>
</tr>
<tr>
<td>- Organic matter (kg)</td>
<td>4.17 ± 0.15 a</td>
</tr>
<tr>
<td>- Crude protein (g)</td>
<td>157.34 ± 5.24 a</td>
</tr>
<tr>
<td>- Crude fiber (kg)</td>
<td>1.43 ± 0.05 a</td>
</tr>
<tr>
<td>- Non Protein Nitrogen (kg)</td>
<td>2.50 ± 0.09 a</td>
</tr>
<tr>
<td>- Zn (mg)</td>
<td>21.15 ± 0.74 a</td>
</tr>
<tr>
<td>Digestibility:</td>
<td></td>
</tr>
<tr>
<td>- Dry matter (%)</td>
<td>54.98 ± 1.21 a</td>
</tr>
<tr>
<td>- Organic matter (%)</td>
<td>53.78 ± 2.16 a</td>
</tr>
<tr>
<td>- Crude protein (%)</td>
<td>52.54 ± 1.03 a</td>
</tr>
<tr>
<td>- Crude fiber (%)</td>
<td>49.62 ± 2.29 a</td>
</tr>
<tr>
<td>- Non Protein Nitrogen (%)</td>
<td>60.97 ± 5.55 a</td>
</tr>
</tbody>
</table>

Notes: a,b,c Different superscript within rows shows a highly significant differences between treatments (p<0.01).
Statistical results presented at Table 2 confirmed that $T_2$ supplemented with 1.5% of lemuru oil and 150 mg ZnSO$_4$/kg of dry matter NRF gave highly significant differences ($P<0.01$) to increase dry matter consumption, organic matter, crude protein and non protein nitrogen. The increase in the dry matter intake will linearly affect intake of other nutrients. It means that treating of zinc did not affect palatability of feed. Sentana (2005) reported that level of dry matter intake was highly significant affected by energy requirement, rumen capacity and level nutrients of feed intake. Animals will always consuming dry matter until their energy requirement were necessary need and then they will be stopping to consume their feeds. On the other hand, if rumen is full then animals will stop consume feeds even though their energy requirement are not nutritionally met. The increase of protein intake at $T_2$ was probably affected by intensifying of activities of microorganisms synthesis in the rumen. Hartati (2000) reported that addition of zinc until 75mg/kg of dry matter ration will be increased ($P<0.14$) bacteria population in the rumen. Also, the treatment can probably be rose zinc absorption and alkaline phosphatase activity.

Statistical results at Table 2 showed that carboxy peptidase activity was probably raised so that it will increased protein digestibility. Protein intake of cow which consumed NRF with zinc (T2) was 392.55g/head/day and this value higher than the recommendation of 342 g and 350g for basal metabolism of pregnancy cows recommended by NRC (1970). This condition was good because cows can deposit their protein as meat. Fat intake of cows at $T_2$ can increased dry matter digestibility, crude protein, crude fiber and non protein nitrogen. Fat content of $T_2$ was 4.48%/kg dry matter over than optimal fat content (3-4%) required by cows but it was not changed to palatability of $T_2$ which showed at crude fiber digestibility higher the other two treatments (Table 2). These results confirmed the results of Jenkins and Palmquist (1984) that fat content around 6.8% of dry matter ration did not affected to NDF digestibility. Nevertheless, fat content over 10% can be affected rumen fermentation, decreased fiber digestibility and last but not least decreased fiber intake.

Statistical results in Table 2 also showed that fiber intake was increased. It means that fiber digestibility did not disturbing, so that rumen was relatively faster empty (hungry), and animals would be consumed more feeds. This result agrees with earlier works reported by Hungate (1966) and Arora (1989) that zinc requirement for growth and development of rumen microorganisms was relatively high because level of zinc was found around 130-220 mg/kg of dry matter of microorganisms. Therefore, cows which were kept under semi intensive system at dry season where their poor quality feeds from pastures are needed to supply with supplemented feed of high protein value and also zinc and fat as much as necessary. These results confirmed that NRF with 1.5% lemuru oil and 150 mg ZnSO$_4$/kg of dry matter NRF could probably be increased growth of microorganisms in the rumen. Zinc supply would be growing up microorganisms synthesis in the rumen especially bacteria synthesis and then it would be increased optimally fiber digestibility. Zinc was probably also increased the activity of enzyme carboxy peptidase which was supported the increase of protein digestibility at part after the rumen. $T_3$ was also effected to non protein nitrogen intake and it would be working together with nitrogen protein to support fermentation process in the rumen. It was found that pregnancy cows which were raised in pasture especially in the dry season need NRF with 1.5% lemuru oil and zinc of 150 mg ZnSO$_4$/dry matter NRF supply.

**CONCLUSIONS**

Based on result and discussion, it could concluded that supplementation of NRF with 1.5% of lemuru oil and 150 mg of ZnSO$_4$/kg dry matter of NRF could increased intake and digestibility of dry matter, organic matter, crude fiber and crude protein of the last pregnancy period of Bali cows.
cows kept under semi intensive system during the dry season.

ACKNOWLEDGEMENT

The authors wish to thanks Directorate of Research and Community Service, Diretorate General of Higher Education, the Ministry of Education and Culture for financial support of Hibah Bersaing through Competitive Research Fund. They also thanks Head of Research Institute of University of Nusa Cendana, Dean of Faculty of Animal Husbandry, Head of Feed Chemistry Laboratory and Head of Field Laboratory of Faculty of Animal Husbandry, University of Nusa Cendana and all who had supported and facilitated this research.

REFERENCES


Preliminary Screening for Anthelmintic Potential of *Sesbania grandiflora* Leaves for Parasitic Infected Goats in Short-Term Trial

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**ABSTRACT**: In this study, local legume plant; *Sesbania grandiflora* was chose as experimental plant. Eighteen goats with natural infection of gastrointestinal parasites were equally divided into three groups, where two groups were orally treated with fresh and dried leaves of *S. grandiflora* respectively, while the third group was untreated as a control. Treatment was conducted daily for short-term 14 days and was examined for another 14 days for post treatment observation. Normal goat’s pellet was fed to the goats and grass was fed with cut and carry system according to scheduled time-feeding; morning and afternoon, and water was given ad libitum. Fecal samples were collected every seven days during the experimental period and subjected to modified McMaster assay for fecal egg count. Results for this short-term preliminary anthelmintic trial had showed only limited effect on parasite eggs reduction in goats. Helminths eggs reduction after 14days in goats treated with fresh leaves was 42% and 40% for the goats treated with dried leaves with no significant difference between these two treatments (P > 0.05). Control goats did not showed reduction. For post-treatment period, there were no abnormalities on physiological observation of the goats from all groups. In conclusion, eventhough the reduction rate is not achieved more than 50% but there is still a potential for this plant to be use as a natural and safe dewormer for ruminant. Further studies are required and the treatment period should be extended to examine the anthelmintic efficacy of this plant.

**Keywords**: *Sesbania grandiflora* leaves, Modified McMaster assay, Helminths eggs reduction, Anthelmintic ability

**INTRODUCTION**

Goat is one of the important animal in livestock industry worldwide (Waller 1997; Wahab, 2003). However, a range of diseases become a major problem that can affect goats’ production. There are a lot of problems and diseases in goats. Bacterial infection such as pasteurellosis and gastrointestinal parasitic infection such as haemonchosis are major cause for production decreasing in livestock industry. Vaccines for bacterial infection are produced efficiently (Zamri-Saad et al., 1992). For helminth infection problem, anthelmintic drugs normally used to control the disease. Sani and Gray (2004) had summarized the parasites species found in ruminants in Southeast Asia region. There are *Haemonchus contortus* and *Trichostrongylus spp.* with huge percentage and other species are detected with small percentage; namely *Oesophagostomum spp.*, *Moniezia spp.*, *Dientamoeba spp.*, and *Trichuris suis*.
Trichuris spp., Cooperia spp., Fasciola spp. and Eimeria spp. A report by McLeod (2004) has been discussed about the economic losses evaluation for Southeast Asia countries and stated that in 1999, the most affected country is Indonesia followed by Philippines, Malaysia, Vietnam and Thailand.

The conventional method for gastrointestinal parasitic infection is using anthelmintic drugs such as closantel, oxendazole and ivermectin (Wahab, 2003). However, according to Hammond et al. (1997), these anthelmintic drugs are reported to have some disadvantages. Local farmers in developing countries were not able to buy all classes of the drugs. Thus, they bought only one or two drugs and kept repeating used it without simultaneously administered the drugs according to the right procedure. Many species of worms were successfully developed the resistance in their gene allele due to the repeatable usage of drugs. Based on this situation, local plant traditionally used to treat parasite problem could offer an alternative. Besides that, the use of plant as anthelmintic is both sustainable and environmentally acceptable (Hammond et al., 1997). Traditional practices using local plants that believe containing anthelmintic properties become the reference for scientific evaluation (Hoste et al., 2008). Currently, there is increasing of the interest in the exploration of potential local plants or their products for helminths control in small ruminants (Hammond et al., 1997). In tropical countries, there are variety of local plants which successfully tested for their efficacy on controlling parasitic infection for ruminant. Plant leaves such as cassava (Manihot esculenta) and neem (Azadirachta indica) were successfully used for helminth control (Chandrawathani et al., 2002, 2006; Nurulaini et al., 2007). Up to now, more local plants should be explored to provide scientific proof to the local farmers. Based on the ethnoveterinary medicine, Agati or Sesbania grandiflora also have anthelmintic properties and can be used to treat the parasitic infection (Gutteridge and Shelton, 1997).

Thus, the objective of this preliminary short-term study was to scientifically determine the anthelmintic potential of Agati (S. grandiflora) leaves in short-term daily-feeding trial.

MATERIALS AND METHODS

Plant materials. Plant used in this study was available and naturally grown in tropical region. The healthy S. grandiflora leaves were freshly collected using standard agronomic practices and bring up to the animal house every morning during the trial period.

Experimental animal. Experimental animals used in this study were Katjang goats breed. Goats with natural infection of gastrointestinal parasites were chose from local farm. Eighteen male goats, 2-4 months of age, and weighing approximately 10 kg were equally divided into three groups. Once the goats were bringing up to the animals house, they were let free for acclimatization at least a week before the experiment started. Goats were fed with normal goat’s pellet and water was given ad libitum.

Experimental design. Before started the trial, fecal samples were freshly collected from all goats and fecal egg count (FEC) were done to obtain the mean number of egg per gram (EPG) from all three groups. Then, from day-1 until day-14, goats from group 1 and group 2 were treated with fresh and dried S. grandiflora leaves respectively. Meanwhile for the goats in group 3, there were left untreated. Leaves were weighed specifically with the daily allowance of 300 g/day. During the trial period, normal goat’s pellet was given to all the animals only after the treated animals finished eating the experimental plant. Water was provided to all goats ad libitum.

Parasitological analysis. Fecal samples were freshly collected from the goat’s rectum once every seven days. This fecal sampling was done for each animal in the morning and was continued for four weeks. These samples were subjected to the modified McMaster fecal egg count technique,
using 3 g individual fecal samples (Christopher et al., 1992).

**Statistical analysis.** Fecal egg count (FEC) values during the experimental period were analyzed using ANOVA one-way and Dunnett’s Test as post-hoc test.

## RESULTS AND DISCUSSION

Results. For short-term preliminary test, *S. grandiflora* gave limited effect on reduction of internal parasites egg. The reduction percentage is range between 40% to 42% for both treatment groups. Mean of egg reduction was showed in Fig. 1 as below.

![Figure 1. Mean of fecal egg count; egg per gram (epg) for treatment and control group](image)

Discussion. From Fig. 1, percentage of reduction for number of gastrointestinal parasite eggs can be obtained by comparing the pre and post values. Reduction trend can be observed for two phases; the first one is after 14 days treatment period and next is summary of the reduction after post-treatment period on day-28. For goats treated with fresh leaves, reduction percentage after 14 days was 42% and for group treated with dried leaves was 40% reduction. Then, after another 14 days post-treatment period, the summary of egg reduction for both groups was slightly same. The percentage of reduction for the group treated with fresh leaves was slightly higher than the percentage of the reduction for the group treated with dried leaves. However, there is no significant difference among these two treated groups (P > 0.05).

In this preliminary study, it’s reported that both groups treated with fresh and dried *S. grandiflora* leaves respectively could not reduced the eggs up to 50%. When compared to previous studies using variety of plants, many of them are successfully reduced the parasites eggs more than 50% and some of them even can achieve 90% reduction. This limited effect might be happened due to the short experimental period. However this 14 days feeding trial was already gave more than 30% egg reduction. From previous reports, it’s found that plant secondary metabolites (PSM) such as tannins, alkaloids, glycosides and terpenes are involved in the anthelmintic properties that responsible to the anthelmintic potential of that various plants (Chadwick, 1992; Seigler, 1998; Hoste et al., 2008).

There are ranges of previous studies focusing on detection of tannins in *S. grandiflora* (Wagh, 2009; Bahera et al., 2012; Renji and Alphonse, 2013). It’s proven that they have found similar results which *S. grandiflora* contain tannins. In this short-term preliminary study, both groups treated with fresh and dried *S. grandiflora* leaves showed reduction of gastrointestinal parasites eggs more than 30% respectively. As concerned, the reduction values could achieve up to 60% until 80% if the feeding trial conducted longer in the future as compared with previous studies.
CONCLUSIONS

According to the results observed in this short-term preliminary study, it can be concluded that *S. grandiflora* leaves are proven to have anthelmintic efficacy against parasites infection in goats. Both fresh and dried leaves have a potential to be use as a natural anthelmintic for goats. This abundantly available tropical local plant can be use as alternative approach for controlling gastrointestinal nematodes infection in goats and can be widely promoted to the local farmers as natural anthelmintic. Future works are needed to be conducted with extension of the feeding period.

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REFERENCES


The Effect of Urea Treated Straws and Urea-Molasses Feed Blocks (UMB) on Reproductive Performance of Libyan Barbary Sheep

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ABSTRACT: This experiment was conducted to evaluate the effect of urea treated straws and urea-molasses feed blocks (UMB) on reproductive performance of Libyan Barbary sheep. Total of 78 head of weaned females Barbary sheep were assigned randomly to four groups. Control group received untreated straws, group 1 received straws treated with urea, group 2 received untreated straws in addition to urea-molasses feed blocks (UMB),and group 3 received straws treated with urea plus UMB. The straws were treated with urea (4%). Blood samples were collected for the analysis of progesterone hormone to detect the ovarian activity. The average concentration of progesterone for the three months of age (the seventh, eighth and ninth) was significantly different (P≤0.05) between the control (1.47 ng/ml) and the first group (1.76 ng/ml), and between the second (1.24 ng/ml) and each of the control and first groups and also between the first and the third group (1.56 ng/ml), it was not significant between the control and the third group. The results showed the percentage of animals reached puberty during the period of taking blood samples, where the female lambs in the first group recorded highest percentage of puberty during the seventh and eighth month of age (33.3%) and (28.57%) respectively, followed by the third group (31.57%) and (26.33%). The study showed highest conception rate, lambing % and twining % in the first group 33.3%, 38%, 4.7% followed by the third group 21, 21%, 0% respectively. The results also showed no significant differences (P≤0.05) in the birth weight of new born lambs between groups. The averages weights were 3.76, 3.63, 3.11 and 3.82 kg in the control, first, second and third groups, respectively. It is clear that urea has no negative effect on the reproductive performance, and can be used safely to increase the nutritional value of the straws.

Keywords: Sheep, straw, Urea, Progesterone.

INTRODUCTION

Straws are the main source of roughages for feeding ruminants in the tropics and subtropics, but do not provide sufficient nutrients even for maintenance. Many of these countries start looking for improving the nutritional value of these roughages by using chemical treatment, and urea was suggested as the best, cheaper and the available source.

Sepulveda et al., (1996) reported that lambs received urea reached puberty earlier than control group, and pregnancy percentage were 55.6 and 30.0 respectively. High levels of urea might retard puberty age and fertility in young growing lambs (Abi Saab, 2003). Miller (2005) had found the treatment of range straw with urea and molasses improved the nutritional value and production of new born lambs. Cereal straws can be treated with urea without negative effects on growth parameters of their lambs and reproductive performance (Akraim et al., 2009).

Using feed blocks in feeding ruminants is one of the strategies used to improve the diets high in fibers during dry season (Aganga et al.,2005). They reported that feed blocks consist of 47% molasses, 15% urea and 16% bran increased the body weight of the lambs by 94% compared to control group.
MATERIALS AND METHOD

This experiment was conducted at the sheep research station, faculty of agriculture, university of Tripoli, Libya. Total of 78 head of weaned female lambs of Libyan Barbary sheep (3-4 months of age) and with average weight of 19.42 kg were assigned randomly to four groups: control Group (18 head) received untreated straws, group 1 (21 head) received urea treated straws (4% urea), group 2 (20 head) received untreated straws plus urea-molasses feed blocks (UMB), and group 3 (19 head) received treated straws (4% urea) plus urea-molasses feed blocks (UMB). All groups supplied with concentrate diet started with 250 gm/head/day at age of 3-6 months and increased to 500 gm/head/day after 6 months until the end of experiment. Straws were given ad libitum and water was available at all times. Approximate chemical analysis (AOAC, 1990) of feeds used in the experiment is presented in table (1).

Table 1. Approximate analysis of feeds used in the experiment.

<table>
<thead>
<tr>
<th>Feeds/ Nutrients</th>
<th>Concentrates %</th>
<th>Untreated straws %</th>
<th>Treated straws %</th>
<th>Urea-molasses feed blocks (UMB) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Matter</td>
<td>88.48</td>
<td>91.8</td>
<td>92.8</td>
<td>81.32</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>76.24</td>
<td>47.23</td>
<td>43.11</td>
<td>30.4</td>
</tr>
<tr>
<td>Proteins</td>
<td>12.84</td>
<td>4.51</td>
<td>10.24</td>
<td>40.42</td>
</tr>
<tr>
<td>Fats</td>
<td>1.92</td>
<td>0.7</td>
<td>1.18</td>
<td>0.85</td>
</tr>
<tr>
<td>Crude fibers</td>
<td>4.46</td>
<td>39.65</td>
<td>38.24</td>
<td>2.55</td>
</tr>
<tr>
<td>Ash</td>
<td>4.54</td>
<td>7.91</td>
<td>7.23</td>
<td>25.78</td>
</tr>
</tbody>
</table>

Treatment of straws with urea

Straws treated with urea (4%) according to Bonomi et al., (1993) by dissolving 4 kg of urea in 40 liters of water and spraying it on 100 kg of barley straw (on DM basis) which spread on polyethylene sheet. The sprayed straw was covered with the same polyethylene sheet and well tight and subjected to urealysis by anaerobic storage for 3-4 weeks. The animals in treated groups were subjected to adaptation period for 15 days. The treated and untreated straws were given to the animals of treated groups by a ratio of 25%: 75% during the first 5 days, 50%: 50% during the next 5 days, and 75%: 25% for the last 5 days.

Preparation of urea-molasses feed blocks (UMB)

The molasses feed blocks were prepared by mixing molasses (42 kg) with urea (10 kg) 12 hours before mixing with another ingredients, then added 9 kg cement, 5 kg sodium chloride, 2 kg minerals, and 30 kg wheat bran. The ingredients were thoroughly and molded to rectangular blocks of an average of 8 kg, and left at least one week to solidify before feeding. Animals in treated groups subjected to adaptation period for 12 days. UMB were allowed to be licked by the animals for only one hour during the first 3 days, 3 hours for the next 3 days, then 5 hours for the next 3 days and 8 hours for the last 3 days before feeding them ad libitum.

Blood samples

Ten ml. of blood samples were collected from jugular vein of lambs in anti-coagulant vacutainer tubes 2 times per week for 3 months starting from the beginning of seventh until the end of ninth month of age. The collected samples were centrifuged for 10 minutes at 3000 rpm, and the obtained plasma samples were stored in deep-freezer for subsequent analysis of progesterone hormone to detect the ovarian activity of lambs. The analysis of progesterone hormone was carried out by ELISA technique in Biotechnology Research Center in Tripoli according to the procedure approved by BioCheck, Inc the producer of the standard kits.
Collection of data
The lambs were weighed at weaning age (3-4 months) and at one month intervals until they were 12 months of age. Consumption of treated and untreated straw also was recorded for one month. Age at puberty was determined through progesterone concentration in plasma. Conception rate, date of birth, weight of new born lambs and lambing % were determined.

Statistical analysis
The design used in the experiment based on complete randomized design (CRD) and the obtained data were analyzed according to Statistical Analysis system user’s Guide (SAS. 2013) for one way analysis of variance, and by using Duncan test (DUNCAN, 1955) to compare between means. According to the following model:

\[ Y_{IJk} = \mu + A_i + B_j + e_{IJk} \]

Where:  
\( Y_{IJk} \) = response,  
\( \mu \) = general mean,  
\( A_i \) = effect of urea,  
\( B_j \) = effect of UMB,  
\( e_{IJk} \) = random error.

RESULTS AND DISCUSSION

The concentration of progesterone hormone:
The concentration of progesterone hormone was measured during the period between the beginning of the seventh and the end of ninth months of age to detect the age of puberty. The average concentration of progesterone during the seventh, eighth and ninth month and the general mean are shown in table 2.

<table>
<thead>
<tr>
<th>Treat groups/ Age (month)</th>
<th>Control</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seventh</td>
<td>0.96±0.04\textsuperscript{ab}</td>
<td>1.24±0.09\textsuperscript{ab}</td>
<td>0.96±0.048\textsuperscript{ab}</td>
<td>0.96±0.025\textsuperscript{ab}</td>
</tr>
<tr>
<td>Eighth</td>
<td>1.18±0.111\textsuperscript{bcd}</td>
<td>1.51±0.157\textsuperscript{ae}</td>
<td>1.141±0.05\textsuperscript{bd}</td>
<td>1.36±0.121\textsuperscript{cd}</td>
</tr>
<tr>
<td>Ninth</td>
<td>2.26±1.84\textsuperscript{c}</td>
<td>2.54±0.214\textsuperscript{c}</td>
<td>1.59±0.089\textsuperscript{f}</td>
<td>2.36±0.137\textsuperscript{e}</td>
</tr>
<tr>
<td>General mean</td>
<td>1.47±0.1264\textsuperscript{b}</td>
<td>1.76±0.138\textsuperscript{a}</td>
<td>1.24±0.06\textsuperscript{e}</td>
<td>1.56±0.124\textsuperscript{ab}</td>
</tr>
</tbody>
</table>

\textsuperscript{abcde} Means with the different superscripts within row are significantly different at (P≤0.05).

The data shows that there were no significant differences (P ≤ 0.05) in the concentration of progesterone hormones between the groups during the seventh month (0.96, 1.24, 0.99 and 0.96 ng/ml respectively). During the eighth month there was only significant difference between the first group (1.51 ng/ml) and the second group (1.14 ng/ml). Progesterone concentrations during the ninth month were 2.26, 2.54, 1.59 and 2.36 ng/ml for the control, first, second and third groups respectively, and there were no significant differences (P ≤ 0.05) between the control group and the first and third groups, while there was difference between the second group and other groups. According to the general mean during the period between seventh and ninth months of age, we found that there was significant difference (P≤0.05) between the control (1.47ng/ml) and first group (1.76 ng/ml) and second group (1.24 ng/ml), and also between the first and third group (1.56 ng/ml), while there were no differences between the control and the third group and also between the second and the third group.
Overall, the concentrations of progesterone were higher in groups subjected to urea treatment compared with untreated groups, and the concentration increased.

![Figure 1](image.png)

**Figure 1.** The concentration of progesterone (ng/ml) during the seventh, eighth and ninth month of age.

As the lambs advanced in age and start cycling (figure 1), this result is not consistent with Santos (2001) who reported that the products of nitrogen metabolism (urea – nitrogen) may decrease progesterone concentration in plasma, and Akraiim *et al.*, (2012), who reported that progesterone concentration did not differ between treated and untreated groups in sheep. Mohammed *et al.*, (2012) reported that feeding urea 1-1.5 % had negative effects on number and diameter of ovarian follicles and the concentration of progesterone.

**Age of puberty:**

Table (3) shows the percentage of animals reached puberty during the period between the seventh and the ninth months of age and after ninth month. The lambs reached puberty during the seventh month were 33.33, 20.00 and 31.57 % for group 1, 2 and 3 respectively, and no lambs reached puberty in the control group.

The rams were introduced at early age (7 months) and the exposure was only for two months which resulted in low conception rate in all groups compared with other literatures (Edrees, 1997), and this is also reflected on lambing % and twinning %. The lambing % was 16.6, 38.0, 15.0 and 21.0 % for control, group 1, group 2 and group 3 respectively. Twinnings occurred only in animals received urea treated straw (group 1) and were no twinning in other groups (control, group 2 and group 3). The results show that conception rate and lambing % were better in animals received urea treated straw compared with other groups, which agreed with the findings of Edrees (1997) and Hoon *et al.*, (2000).

However, these percentages of lambs in puberty increased by advancing age in all groups, and less than 20 % of these lambs reached puberty after the ninth month of age. The results indicated that lambs received urea treated straw and urea-molasses feed blocks (UMB) reached puberty earlier than control group. This may be due to providing the rumen with energy source and nitrogen that causes the increase in activity of bacteria which increase the amount consumed and rate of digestion.
Table 3. Percentage of lambs reached puberty during the seventh, eighth, ninth and after ninth month of age.

<table>
<thead>
<tr>
<th>Treat. group / Traits</th>
<th>Control Group (18 lambs)</th>
<th>Group 1 (21 lambs)</th>
<th>Group 2 (20 lambs)</th>
<th>Group 3 (19 lambs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Seventh</td>
<td>00.00</td>
<td>33.33</td>
<td>20.00</td>
<td>31.57</td>
</tr>
<tr>
<td>Eighth</td>
<td>33.34</td>
<td>28.57</td>
<td>35.00</td>
<td>26.33</td>
</tr>
<tr>
<td>Ninth</td>
<td>50.00</td>
<td>23.82</td>
<td>30.00</td>
<td>26.32</td>
</tr>
<tr>
<td>After ninth month</td>
<td>16.66</td>
<td>14.28</td>
<td>15.00</td>
<td>15.78</td>
</tr>
</tbody>
</table>

This results agreed with the findings of Kobeisy et al., (2008); Ben Salem and Nefzaoui, (2003); and Sepulveda et al., (1996) when they reported that lambs reached puberty earlier in groups given straw treated with urea and feeding blocks (UMB) compared with the control groups, and they related that to the increase in digestibility of roughages and the improvement of live weights of the lambs. On the other hand Abi Saab et al., (2003) reported that using relatively high levels of urea may delay puberty age and fertility in growing lambs.

c) conception rate, lambing % and twinning %:

The effect of feeding treated and untreated straw and urea-molasses feed blocks (UMB) on conception % and lambing % are presented in table (4). The conception % were 16.6, 33.3, 15.0 and 21.0% for the control, first, second and third group respectively.

Table 4. Conception %, lambing % and Twinning % in control and treatment groups.

<table>
<thead>
<tr>
<th>Treat. group / Traits</th>
<th>Control Group (18 lambs)</th>
<th>Group 1 (21 lambs)</th>
<th>Group 2 (20 lambs)</th>
<th>Group 3 (19 lambs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conception %</td>
<td>16.6</td>
<td>33.3</td>
<td>15.0</td>
<td>21.0</td>
</tr>
<tr>
<td>Lambing %</td>
<td>16.6</td>
<td>38.0</td>
<td>15.0</td>
<td>21.0</td>
</tr>
<tr>
<td>Twinning %</td>
<td>00.0</td>
<td>04.7</td>
<td>00.0</td>
<td>00.0</td>
</tr>
</tbody>
</table>

d) weights of new born lambs:

Studying the weights of new born lambs to investigate the effect of urea and UMB on the growth of new born lambs during pregnancy period of mothers receiving urea and UMB.

Table 5. Mean ±SE of weight of new born lambs in control and treatment groups.

<table>
<thead>
<tr>
<th>Treat Groups/ Trait</th>
<th>Control</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weights of new born lambs( kg)</td>
<td>3.76±0.16a</td>
<td>3.63±0.26a</td>
<td>3.11±0.90a</td>
<td>3.82±0.18a</td>
</tr>
</tbody>
</table>

There were no significant differences (p≤ 0.05) in the weights of new born lambs between groups, and the means were 3.76, 3.63, 3.11 and 3.82 for the control, group 1, group 2 and group 3 respectively. This results are consistent with Edrees (1997), Akraim et al., (2009) and Sepulveda et al., (1996) when they reported that urea treatment had no effects on weights of new born lambs, and did not agree with Hendranto (1991) who reported that there were an increase in the body weights of new born of mothers fed straw treated with urea.
CONCLUSION

It is clear that urea has no negative effect on the reproductive parameters and weights of new born lambs, and most of the parameters studied were better in lambs received urea and UMB. So that urea can be used safely to increase the nutritional value of the straw without causing any undesirable effects on reproductive characteristics of the female lambs of Libyan Barbary sheep.

REFERENCES


A. Muñoz-Cuaute\(^1\), M.E. Ortega-Cerrilla\(^1\), J. Hernández-Bautista\(^2\), J. Herrera-Haro\(^1\), C. Gutiérrez-Olvera\(^3\), J.L. Figueroa-Velasco\(^1\)

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**ABSTRACT:** The aim of this study was to evaluate the productive performance, some rumen variables, carcass yield and physicochemical characteristics of meat, when growing sheep were fed dried bovine ruminal contents (DBRC). Thirty two weaned lambs (16 males, 16 females) of Pelibuey, Dorper and Katahdin breeds with an initial mean body weight of 19.5 ± 1.5 kg, were randomly assigned in a completely randomized design with factorial treatment arrangement, to four treatments with the inclusion of T1: 0, T2: 15, T3: 30, and T4: 45% of DBRC in their ration. The productive behavior trial lasted 60 days, rumen liquor was obtained by esophageal probe at the 60th day of the experiment, animals were slaughtered at the 60th day of the trial, carcass yield and meat quality were evaluated. Data were analyzed by analysis of variance and mean differences were calculated using the Tukey test. The results showed no differences (P>0.05) for DMI and DWG due to treatment, but there were differences (P<0.05) for DMI (1.88 kg males, 1.50 kg females) and DWG (0.33 kg males, 0.26 kg females) due to gender. Ruminal pH, rumen ammonia nitrogen, acetic, propionic and butyric acid were not affected (P>0.05) by treatment or gender. Carcass yield and meat quality indicators for color L*, a* and b*, were similar (P>0.05) among treatments. However there were differences (P<0.05) for a* (11.37 males, 13.69 females) and b* (11.27 males, 13.06 females) due to gender. No differences (P>0.05) were found for pH and water holding capacity (WHC) among treatments or between genders. It is concluded that the addition of DBRC up to 45% in the diet of growing sheep does not affect growth performance, ruminal pH, ammonia nitrogen, VFA concentration, carcass yield and physico-chemical characteristics of meat.

**Keywords:** Dried bovine ruminal contents, Growing sheep, Productive performance, Meat quality.

**INTRODUCTION**

Ruminal contents are abattoir waste material which in many countries causes environmental pollution, however they contain a considerable amount of crude protein, digested feed, as well as rumen microbes and the products of their metabolism (Olafadehan et al., 2014), which might been used for ruminant feeding. The aim of this study was to evaluate the productive response, as well as meat and carcass quality when dried bovine ruminal contents (DBRC) were included in the diet of growing sheep.
MATERIALS AND METHODS

Thirty two weaned lambs (16 males, 16 females) of Pelibuey, Dorper and Katahdin breeds with an initial mean body weight of 19.5±1.5 kg, were randomly assigned to four groups of eight animals (4 males, 4 females), with the same number of animals of each breed in each group, to four treatments, with the inclusion of T1: 0, T2: 15, T3: 30, and T4: 45% of DBRC in their ration. The productive behavior trial lasted 60 days, with a previous adaptation period of 20 days.

Lambs were housed in individual pens, and fed twice a day at 9:00 h and 14:00 h, with ad libitum access to feed and water. DM, ash, ether extract and crude protein were determined in the diets and refusals according to AOAC (2000), as well as FDN and FDA (Van Soest et al., 1991). Diets were isoproteic and isoenergetic. Initial body weight (IBW), DMI, DWG, feed conversion (FC), and final weight (FW) were recorded for each animal. At day 60 of the experiment, ruminal fluid samples were taken via esophageal probe, 3 h after the morning feeding. The samples were tested for pH, VFA (Erwin et al., 1961), and N-NH\textsubscript{3} concentration (McCullough, 1967).

Animals were slaughtered after the productive behavior trial. They had a 12 h fasting period before slaughtering. The characteristics of the carcass and meat were evaluated on five animals of each treatment. The pH was assessed 24 h post mortem in the Longissimus dorsi muscle, as well as color and water holding capacity (WHC). The experimental design used was a completely randomized with factorial arrangement 4 X 2, where the model included treatment, sex and the interaction effects. Data were analyzed by PROC GLM (SAS, 2002), and means were compared with Tukey test.

RESULTS AND DISCUSSION

No significant differences (P>0.05) were found on the IBW of the animals. Gender affected DMI, males consumed more feed (1.88 kg) than females (1.50 kg). Treatments had no effect on DWG, but the gender did (0.33 kg males, 0.26 kg females). FC was not different for any treatment, and no differences were found due to gender (P>0.05). FW was lower (P<0.05) in females (33.82 kg) than in males (40.49 kg) (Table 1). The results obtained in this study for DWG were higher (270, 300, 310 and 320 g for T1, T2, T3 and T4, respectively), than those reported by Lerma and Salinas (1990) in Pelibuey sheep, when sorghum straw was substituted for 0, 13, 26 and 39% of DBRC (193, 188, 201 and 201 g, respectively). The highest consumption of dry matter observed in T4 might explain that DWG was the highest for this treatment. Gender also affected DMI, being higher in males than in females. FC showed differences due to gender and treatment x gender interaction, mainly because dry matter intake was lower in the females.

There were differences for FW due to gender. Notter et al. (1991) mention that the higher weight gain in males compared to females can be attributed to their capability of utilizing nutrients in a more efficient manner, and that sexual hormones influence the growing pattern in lambs.

Table 1. Productive behavior of sheep fed DBRC

<table>
<thead>
<tr>
<th>Kg</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>SE</th>
<th>F</th>
<th>M</th>
<th>SE</th>
<th>T</th>
<th>S</th>
<th>T*S</th>
</tr>
</thead>
<tbody>
<tr>
<td>IW</td>
<td>19.25</td>
<td>19.50</td>
<td>19.05</td>
<td>19.16</td>
<td>1.44</td>
<td>18.15</td>
<td>20.12</td>
<td>0.81</td>
<td>0.992</td>
<td>0.098</td>
<td>0.996</td>
</tr>
<tr>
<td>DWG</td>
<td>0.27</td>
<td>0.30</td>
<td>0.31</td>
<td>0.32</td>
<td>0.01</td>
<td>0.26a</td>
<td>0.33b</td>
<td>0.01</td>
<td>0.308</td>
<td>0.0005</td>
<td>0.269</td>
</tr>
<tr>
<td>FC</td>
<td>5.57</td>
<td>5.55</td>
<td>5.77</td>
<td>5.78</td>
<td>0.22</td>
<td>5.76</td>
<td>5.59</td>
<td>1.59</td>
<td>0.877</td>
<td>0.470</td>
<td>0.600</td>
</tr>
<tr>
<td>DMI</td>
<td>1.52</td>
<td>1.70</td>
<td>1.80</td>
<td>1.85</td>
<td>10.87</td>
<td>1.50a</td>
<td>1.88b</td>
<td>76.20</td>
<td>0.122</td>
<td>0.001</td>
<td>0.622</td>
</tr>
<tr>
<td>FW</td>
<td>35.78</td>
<td>37.96</td>
<td>37.84</td>
<td>38.51</td>
<td>1.86</td>
<td>33.82a</td>
<td>40.49b</td>
<td>1.33</td>
<td>0.707</td>
<td>0.001</td>
<td>0.690</td>
</tr>
</tbody>
</table>

a,b,c Different letters in the same row indicate significant differences (P<0.05).
SE: Standard error of the mean., T: Treatment, S: Sex.
Ruminal pH, ammonia nitrogen, as well as the percentages of acetic, propionic and butyric acids were not different (P>0.05), due to the addition of DBRC in the diet, or animal gender. No differences were observed on treatment x gender interaction (Table 2). Ruminal pH was similar among treatments and gender. The values observed in this study are between those considered as physiological normal, in the range of 5.5 to 7.0 (Krause and Oetzel, 2006). No differences were found for VFA concentration among treatments or gender. These values coincide with those reported by Corona et al. (1999), when working with forages of similar fiber content to the diets offered to sheep in this research.

Table 2. Ruminal pH, ammonia N and VFA concentration in sheep fed DBRC

<table>
<thead>
<tr>
<th>TREATMENTS</th>
<th>P&gt;F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
</tr>
<tr>
<td>pH</td>
<td>6.06</td>
</tr>
<tr>
<td>NH3 (mg dl-1)</td>
<td>19.74</td>
</tr>
<tr>
<td>ACE (%)</td>
<td>65.32</td>
</tr>
<tr>
<td>PRO (%)</td>
<td>35.78</td>
</tr>
<tr>
<td>BUT (%)</td>
<td>13.78</td>
</tr>
</tbody>
</table>

a,b,c Different letters in the same row indicate significant differences (P<0.05).
SE: Standard error of the mean.

The hot (T1 57.90; T2 58.12; T3 57.92; T3 56.88%) and cold (T1 57.45; T2 57.55; T3 57.39; T4 56.45%) carcass yield was similar for all treatments (P>0.05), but different due to gender (P<0.05) (females 58.72, 58.18; males 56.98, 56.52%) for hot and cold carcass, respectively. Hot and cold carcass yield percentages were higher for females than males. These results can be related with the higher gastrointestinal content observed in males, which are similar to the results observed in other studies, in which carcass yield has been affected by the amount of gastrointestinal content (Dominguez-Vara et al., 2009; Ribeiro et al., 2011). Meat pH is related to the degree of stress the animal suffers during slaughter. Nevertheless mean 24 h post-mortem pH was 5.8, which is considered to be adequate (Oliete et al., 2006) to produce meat with appropriate color, texture and juiciness characteristics (Schiffner et al., 2005). The inclusion of DBRC to sheep diets did not affect meat quality, observing normal values for meat pH, color L*, a*, b* or WHC. However a* and b* color indicators were higher (P<0.05) in females (a*13.69, b*13.06) than males (a*11.37, b*11.27), females showed darker meat color as a consequence of a higher concentration of hemes pigments, due to a higher precocity (Sañudo, 1992).

CONCLUSIONS

The addition of DBRC in the diet of sheep did not affect the productive performance or rumen parameters. The hot and cold carcass yield percentage was not affected by the addition of DBRC to the diet of the sheep. However, gender did show differences, favoring females with higher yield percentage. The physiochemical variables of the carcass were within the normal ranges, the addition of up to 45% of DBRC did not affect carcass quality, meat pH, WHC, L*, a* and b* color indicators.
REFERENCES


Chemical Composition, Antioxidant Compounds and Antioxidant Capacity of Ensiled Coffee Pulp

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ABSTRACT: Coffee pulp is produced in large quantities and its disposal can pollute the environment. However, its nutritional value and antioxidant content make it a good option for feeding animals. Therefore, the objective of this study was to determine the chemical composition, the presence of phenolic compounds and the antioxidant capacity of coffee pulp: fresh (FCP), ensiled for 140 days (ECP), and ensiled for 140 days and sun dried (EDCP). Dry matter (DM), crude protein (CP), ash, acid detergent fiber (ADF), neutral detergent fiber (NDF), lignin, phenolic compounds and the antioxidant capacity of FPC, ECP and EDCP were determined. Data were analyzed by analysis of variance, and means were compared with the Tukey test. The percentage of CP, FDN and FDA was higher (P<0.05) in ECP and EDCP than in FCP (CP: 10.85, 13.10, 13.24; NDF: 49.33, 50.95, 55.18; ADF: 41.90, 46.60, 52.14). There were no changes (P>0.05) in lignin content (FCP 30.97 %, ECP 31.25 %, EDCP 31.50 %). Ensiling and sun drying did not decrease (P>0.05) caffeine or tannins in coffee pulp. No differences (P>0.05) were found for caffeic acid (2.03, 5.10, 4.913 mg g-1 DM in FCP, ECP and EDCP, respectively). Chlorogenic acid (2.59 FPC; 5.36 ECP; 4.87 EDCP mg g-1) increased (P<0.05) in concentration with the ensiling process, but it was not affected by sun drying. Ethanol decreased (P<0.05) in ECP and EDCP, relative to FPC (FPC 15.88 %; ECP 7.04 %; EDCP 0.00 %), while antioxidant capacity was not affected (P>0.05) (FCP 2594.7; ECP 2486.3; EDCP 2769.9 nmol Trolox-1 mL). It is concluded that the ensiling process and sun drying did not affect the nutritional value or antioxidant capacity of coffee pulp.

Key words: Phenolic acids, Antioxidant capacity, Coffee pulp

INTRODUCTION

After harvest, coffee berries need to be processed before their use and commercialization. This can be done by two methods: dry and wet. In the industrial wet process, approximately 29% (dry weight) of the coffee berries remain as the first by-product. The berries have been used to produce bioethanol, biogas, compost, substrate for mushrooms, and animal feed. In addition, coffee pulp is an excellent source of natural antioxidants, which can prevent or decrease peroxidation of fatty acids, reduce oxidative stress in animals at critical physiological stages (Salinas et al., 2015) and increase shelf life of the meat of animals when it is included in their diets. The objective of this study was to assess the chemical characteristics, presence of antioxidant compounds and antioxidant capacity of coffee pulp: fresh, ensiled with 5 % molasses, and ensiled and sundried.
MATERIALS AND METHODS

Coffee pulp was obtained from a de-pulping plant that uses the wet method to remove the berry from the coffee (Coffea Arabica) bean. The plant is located in the municipality of Huatusco, Veracruz, Mexico. The coffee pulp was allowed to drain for 12 h to eliminate the water it absorbs during the process. The pulp was then placed in four plastic 1100 L capacity containers and 5% molasses was added for fermentation during 140 days. When the silos were opened, samples were taken from the upper, middle and lower parts and mixed to obtain a single sample for later analysis. The silage from each container was sundried for 8 days. In this way, three treatments resulted (n=4): T1, fresh coffee pulp (FCP); T2, ensiled coffee pulp (ECP); and T3, ensiled sundried coffee pulp (EDCP).

FCP, ECP and EDCP were analyzed for dry matter (DM), crude protein (CP), ether extract (EE) and ash (AOAC, 1990), as well as neutral detergent fiber (NDF), acid detergent fiber (ADF) and lignin (Van Soest et al., 1991). Ethanol content was determined following the technique of Davies and Chace (1969).

Phenolic acids and caffeine were determined by HPLC. Caffeine was quantified by isocratic analyses using HPLC. Tannins were analyzed with a spectrophotometer at an absorbance wavelength of 725 nm.

FRAP (ferric reducing antioxidant power) was determined in extracts of FCP, ECP and EDCP (Benzie and Strain, 1999).

The experimental design used was completely randomized with three treatments. The software PROC GLM (SAS, 2002) was used, and means were compared with Tukey test (P<0.05). All of the variables were subjected to a normality test with the Univariate procedure.

RESULTS AND DISCUSSION

Table 1 shows the chemical composition of the treatments. Dry matter content was affected (P<0.05) by the ensiling and drying processes. The lowest value was observed in ECP. The DM value (22.95 %) in FCP is similar to the 23.20 % reported by other authors (Elías, 1978), as was the value found in ECP (18.84 %) which is close to the 15.40 % obtained by others (Bautista et al., 2005).

The concentrations of crude protein (CP) tended to increase (P<0.05) in FCP (10.85 %), ECP (13.10 %) and EDCP (13.24 %), although the last two were not different (P>0.05). Similar results have been reported, with increments in CP from FCP (9.12 %) to ECP (13.14 %) and 11.60% in FCP and 12.00% in ECP. The ensiling process increased the percentage of CP, probably due to a decrease in carbohydrates.

The ether extract of FCP was not affected by the ensiling and dehydration processes (P>0.05), FCP (1.20%), ECP (1.48%) and EDCP (1.72%). The results of ether extract in ensiled coffee pulp coincide to those found by other authors (Moreau et al., 2003). In sun dried coffee pulp, there were values of 2.8 and 1.34%, which are similar to those observed in our study, while in FCP, the value was below 3.86% but above 0.48 (Noriega et al., 2012).
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Integrated Approach in Developing Sustainable Tropical Animal Production
October 20-22, 2015, Yogyakarta, Indonesia

Table 1. Chemical composition of coffee pulp

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Coffee pulp</th>
<th></th>
<th></th>
<th>SEM</th>
<th>P &lt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>(%)</td>
<td>FCP</td>
<td>ECP</td>
<td>EDCP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry matter</td>
<td>22.95b</td>
<td>18.84c</td>
<td>91.13a</td>
<td>0.240</td>
<td>0.0001</td>
</tr>
<tr>
<td>Crude protein</td>
<td>10.85b</td>
<td>13.10a</td>
<td>13.24a</td>
<td>0.070</td>
<td>0.0001</td>
</tr>
<tr>
<td>Ether extract</td>
<td>1.20</td>
<td>1.48</td>
<td>1.72</td>
<td>0.357</td>
<td>0.6403</td>
</tr>
<tr>
<td>NDF</td>
<td>49.33b</td>
<td>50.95b</td>
<td>55.18a</td>
<td>0.864</td>
<td>0.0003</td>
</tr>
<tr>
<td>ADF</td>
<td>41.90c</td>
<td>46.60b</td>
<td>52.14a</td>
<td>0.667</td>
<td>0.0001</td>
</tr>
<tr>
<td>Lignin</td>
<td>31.50</td>
<td>30.97</td>
<td>31.25</td>
<td>0.282</td>
<td>0.4152</td>
</tr>
<tr>
<td>Ash</td>
<td>7.40c</td>
<td>8.76b</td>
<td>10.82a</td>
<td>0.107</td>
<td>0.0001</td>
</tr>
<tr>
<td>pH</td>
<td>4.25a</td>
<td>3.90b</td>
<td>ND</td>
<td>0.034</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

FCP: fresh coffee pulp, ECP: coffee pulp ensiled with 5% molasses, EDCP: coffee pulp ensiled and sun dried, NDF: neutral detergent fiber, ADF: Acid detergent fiber, ND: not determined.

a,b,c Different letters in the same row indicate significant differences (P<0.05).

SEM: Standard error of the mean

Values for NDF and ADF increased (P<0.05) in EDCP, although there were no differences (P>0.05) between FCP and ECP for NDF. The increase in ADF and NDF may be related to the presence of coffee stems or leaves in the silage, increasing cell walls. Although the percentage of lignin was similar (P>0.05) in FCP (30.50%), ECP (31.97%) and EDCP (30.25%), the results were higher than those published by other authors (Oliveira et al., 2007). The high content of lignin in the silage of this experiment may have been due to the presence of coffee plant residues in the silage, in addition to the age at harvest, environmental conditions and the variety of coffee used.

Ash content had significantly different (P<0.05) values in ECP (8.76%), EDCP (10.82%) and FCP (7.40%). The increase could be due to the contamination with soil where the coffee pulp was sun dried.

Table 2 shows the results for caffeine, tannins and ethanol. An increasing trend in caffeine content was observed in FCP, ECP and EDCP (18.60, 25.49 and 30.29 mg g⁻¹ DM, respectively), although the values were not statistically different (P>0.05). The ensiling and drying processes did not modify the initial levels of caffeine. However, even though caffeine is a factor that may limit coffee pulp as animal feed, no negative effects have been observed in ruminant productive variables when fed fresh or dehydrated coffee pulp in different proportions of the diet (Salinas-Rios et al., 2015; Bautista et al., 2005).

Tannin content was similar (P>0.05) in the three treatments, although there was an increase from FCP to ECP and a decrease in EDCP (3.5, 4.49 and 1.18 mg g⁻¹ DM, respectively). The lack of differences may have been because the fermentation process in the silo did not modify the tannins and their concentrations were maintained.

Differences (P<0.05) were observed in the quantity of ethanol in FCP and ECP (15.88 and 7.04 g 100⁻¹ DM, respectively), but none was detected in EDCP. The ethanol found in our study is within the acceptable range of 10 a 30 g kg⁻¹ DM for silage.

Eight phenolic acids were found (Table 2). Ferulic, caffeic and chlorogenic acids were found in greater proportion, which increased over the ensiling process, but decreased when silage was sun-dried. Differences (P<0.05) were found only for chlorogenic acid, although in ECP and EDCP it was similar (P>0.05). Chlorogenic acid was not the most abundant, as found in other studies (Murthy and Naidu, 2010) because the quantity varies with the degree of maturation, the species and other factors associated with coffee quality, such as altitude and the presence or absence of shade, as well as resistance to some diseases (Humphrey and Macrae, 1987).
Table 2. Caffeine, tannin, antioxidant compounds and antioxidant capacity (FRAP) in coffee pulp

<table>
<thead>
<tr>
<th></th>
<th>Coffee pulp</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FCP</td>
<td>ECP</td>
<td>EDCP</td>
<td>SEM</td>
<td>P &lt; F</td>
<td></td>
</tr>
<tr>
<td>Caffeine (mg g⁻¹ DM)</td>
<td>18.60</td>
<td>25.493</td>
<td>30.296</td>
<td>2.78</td>
<td>0.1014</td>
<td></td>
</tr>
<tr>
<td>Tannins (mg g⁻¹ DM)</td>
<td>3.50</td>
<td>4.490</td>
<td>1.189</td>
<td>0.945</td>
<td>0.1173</td>
<td></td>
</tr>
<tr>
<td>Ethanol (g 100 g⁻¹ DM)</td>
<td>15.880</td>
<td>7.040b</td>
<td>0.000c</td>
<td>0.307</td>
<td>0.0001</td>
<td></td>
</tr>
<tr>
<td>Antioxidants (mg g⁻¹ DM)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p-hydroxybenzoic acid</td>
<td>0.070a</td>
<td>0.018b</td>
<td>0.017b</td>
<td>0.010</td>
<td>0.0311</td>
<td></td>
</tr>
<tr>
<td>Chlorogenic acid</td>
<td>2.593b</td>
<td>5.368a</td>
<td>4.875a</td>
<td>0.34</td>
<td>0.0052</td>
<td></td>
</tr>
<tr>
<td>Ferulic acid</td>
<td>4.256</td>
<td>8.503</td>
<td>4.256</td>
<td>2.45</td>
<td>0.3642</td>
<td></td>
</tr>
<tr>
<td>Caffeic acid</td>
<td>2.031</td>
<td>5.103</td>
<td>4.913</td>
<td>0.851</td>
<td>0.0950</td>
<td></td>
</tr>
<tr>
<td>Syringic acid</td>
<td>0.062a</td>
<td>0.036b</td>
<td>0.039b</td>
<td>0.003</td>
<td>0.0037</td>
<td></td>
</tr>
<tr>
<td>Gallic acid</td>
<td>0.058b</td>
<td>0.144a</td>
<td>0.00b</td>
<td>0.018</td>
<td>0.0050</td>
<td></td>
</tr>
<tr>
<td>Vanillic acid</td>
<td>0.006</td>
<td>0.016</td>
<td>0.010</td>
<td>0.006</td>
<td>0.5326</td>
<td></td>
</tr>
<tr>
<td>p-cumaric acid</td>
<td>0.002</td>
<td>0.002</td>
<td>0.0004</td>
<td>0.001</td>
<td>0.2917</td>
<td></td>
</tr>
<tr>
<td>FRAP (nmol Trolox⁻¹ mL)</td>
<td>2769.9</td>
<td>2594.7</td>
<td>2486.3</td>
<td>136.47</td>
<td>0.4382</td>
<td></td>
</tr>
</tbody>
</table>

FCP: fresh coffee pulp, ECP: coffee pulp ensiled with 5% molasses, EDCP: coffee pulp ensiled and sun dried

a, b: Different letters in the same row indicate significant differences (P<0.05).

SEM: Standard error of the mean

Antioxidant capacity was not affected (P>0.05) by ensiling or sun drying (FCP: 2769.9; ECP: 2594.7; EDCP: 2486.3 nmol Trolox⁻¹ mL) (Table 2), coinciding with findings of other authors (Salinas et al., 2015) in fresh and ensiled coffee pulp. Using microorganisms (Aspergillus tamarii) to ferment the coffee pulp, extracts from fermented coffee pulp had greater antioxidant capacity despite the lower content of total phenolic compounds and hydroxycinnamic acids, which were metabolized by this fungus. Our study found no differences in some of the phenolic acids because no microorganism was added during ensiling or drying to favor fermentation.

CONCLUSIONS

Ensiling increased the percentages of CP, ADF, NDF and ash without affecting the content of lignin and EE. The highest concentrations of CP, ADF, NDF, ash and lignin were observed in ensiled sun-dried pulp. P-hydroxybenzoic and syringic acids decreased with the ensiling process and with sun drying afterward, but chlorogenic acid increased. Gallic acid increased with fermentation, but it was imperceptible in the sun-dried pulp. Ferulic, caffeic, vanillic and p-cumaric acids were not affected. Antioxidant capacity did not vary in fresh, ensiled or dried ensiled pulp. Therefore, it is recommended the use of fresh, ensiled, and dried ensiled coffee for feeding ruminants.
REFERENCES


Influence of Starch Type as Substrate Material in Dry Lactic Acid Bacteria Inoculant Preparation on Fermentation Quality and Nutrient Digestibility of King Grass Silage

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Papua University, Manokwari, West Papua, Indonesia
Corresponding email: santosob@lycos.com

ABSTRACT: The lactic acid bacteria (LAB) play an important role in silage fermentation and influence silage quality. The population of LAB is usually low and varies with standing crops. Thus, addition of LAB inoculant is needed to improve silage quality. Use of liquid LAB has limited time during storage, thus development of dry LAB inoculant is needed. The aim of this study was to evaluate fermentation quality and nutrient digestibility of king grass silage treated with dry L. plantarum inoculant prepared with different type of starch as substrate material. Five treatments used in this study were A. King grass without LAB inoculant as control; B. King grass + 3% liquid LAB; C. King grass + 3% dry LAB with cassava starch as substrate material; D. King grass + 3% dry LAB with sago starch as substrate material; E. King grass + 3% dry LAB with combination of cassava and sago starches as substrate material. About 1.5 kg of silage materials were packed into plastic silos and tied with a string. Three replicate silos were prepared for each treatment and stored in room temperature for 30 d. The results showed that the number of LAB in dry inoculants varied from $2.6 \times 10^7$ to $4.0 \times 10^7$ cfu/g. Addition of dry LAB inoculant containing cassava starch (C) significantly enhanced ($P<0.01$) lactic acid concentration. Otherwise, this treatment had the lowest N-NH₃ concentration compared to other treatments. In vitro dry matter and organic matter were higher ($P<0.01$) in silages treated with liquid and dry LAB inoculant (B, C, D, E) compared to control silage (A). However, silage treated with dry LAB inoculant containing cassava and sago starches (C, D) had higher ($P<0.01$) in vitro organic matter than liquid LAB inoculant (B). It was concluded that dry LAB inoculant prepared with cassava starch as substrate material had the best quality fermentation of king grass silage than other LAB inoculants.

Keywords: Silage, Lactic acid bacteria, King grass, Starch, In vitro

INTRODUCTION

It is recognized that tropical grasses have low water soluble carbohydrate content, high buffering capacity and low lactic acid bacteria (LAB) number (Yahaya et al., 2004). These properties result in low lactic acid production; hence it is difficult to produce good-quality silage from tropical grasses.

The LAB play an important role in silage fermentation and influence silage quality. Under natural circumstances LAB grows as epiphytic bacteria however the population of LAB is usually low and variable with standing crops (Muck, 1990). Thus addition of LAB inoculant is needed to improve silage quality (Bureenok et al., 2006). Inoculating silages with lactic acid bacteria (LAB) has improved silage fermentation (Bureenok et al., 2006; Santoso et al., 2011; Santoso et al., 2012). Inoculation with these microbes has increased the rate and extent of lactic acid production in silages, decreased proteolysis, and decreased the production of volatile organic acids (Santoso et al., 2011; Santoso et al., 2012).

In the previous studies, most researchers used liquid BAL in silage preparation. However,
the use of liquid inoculant has a limited in the time of storage so that it becomes a problem when applied to farmers. Hariadi et al. (2013) concluded that addition of dry LAB inoculant prepared by centrifugation method in king grass silage resulted a good fermentation as compared to silage added with dry LAB inoculant prepared by freeze dried method. The aim of this study was to evaluate fermentation quality and nutrient digestibility of king grass silage treated with dry L. plantarum inoculant prepared with different type of starch as substrate material.

MATERIAL AND METHODS

Forage Material

King grass (Pennisetum purpureophoides) was planted in a 9 m² plot without fertilizer at the experimental field of Faculty of Animal Science, Fishery and Marine Science, State University of Papua in Manokwari. Grass was harvested with a hand clipper in May 2009 after 50 days of regrowth defoliation. The experimental field is located at 134°04’ longitude and 00°48’ latitude. The area is located at an altitude of 110 m above sea level. The mean annual rainfall and temperature were 159.9 mm and 27.1 °C, respectively.

Preparation of Liquid LAB Inoculant

Preparation of liquid LAB inoculant according to modified of Bureenok et al. (2006) procedure as previously described by Santoso et al. (2009) and Santoso et al. (2012). The inoculant was prepared using 220 g of fresh king grass, which was macerated in 1000 ml of distilled water using a high-speed blender for 4 min. The macerated material was filtered through two layers of cheesecloths, and 600 ml of filtrate was collected in erlenmeyer glass containing 18 g of glucose. The filtrate was mixed well and incubated anaerobically for 48 h at 30 ºC. At the end of 48 h, extract was used as source of LAB. The number of LAB in the extract was counted before the experiments by using de Man, Rogosa, and Sharpe which were incubated for 3 days at 35 °C (Bureenok et al., 2006).

Preparation of Dry LAB Inoculant

Preparation of dry LAB inoculant based on modified of Jeni et al. (2010) procedure. Briefly, dry cassava and sago starches were sterilized using autoclave at pressure of 1 atm, temperature of 121 C for 2 hours. One litre of fresh LAB inoculant was centrifugated at 1000 rpm for 90 minutes. About 50 ml of supernatant was mixed with 1 kg of sterilized cassava or sago starches.

Silage Preparation and Treatments

The fresh king grass was wilted at room temperature (approximately 28 °C) for 24 h and chopped into 3-5 cm. The chopped grass was thoroughly mixed and a representative samples obtained. Total of 5 treatments were as follows (A) King grass without LAB inoculant as control; (B) King grass + 3% liquid LAB; (C) King grass + 3% dry LAB with cassava starch as substrate material; (D) King grass + 3% dry LAB with sago starch as substrate material; (E) King grass + 3% dry LAB with combination of cassava and sago starches as substrate material. The liquid LAB was sprayed onto silage materials using a hand sprayer and subsequently mixed by hand. Based on the concentration of LAB in FGE, the final application was 5.8 × 106 cfu/g of fresh forage. About 1.5 kg of silage materials were packed into plastic silos and tied with a string. Each treatment was prepared in triplicate and the silos were stored in room temperature for 30 days.

Chemical Analyses

Dried samples were used to determine DM, ash, and crude protein (CP) according to the procedure of AOAC (2005). Procedure of Van Soest et al. (1991) was used to determine
concentrations of neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL). NDF was determined without the use of  \( \alpha \)-amylase and sodium sulfite. A 20 g of silage was macerated with 70 ml of distilled water and stored at 4 °C for 24 h. It was than homogenized for 15 min by using a shaker and filtered through a Whatman No. 1542 filter paper. The filtrate was used to determine pH, VFAs, lactic acid and NH\(_3\)-N. The pH value was determined using a pH meter (Hanna Hi 9025). Concentrations of individual VFAs were analyzed using a gas chromatography (Varian CP-9002 GC, Shimadzu, Japan) equipped with flame ionization detector (FID) and stainless steel column (1500 mm × 3 mm i.d). The pressure of nitrogen was 1.25 kg/cm. The temperature of injector oven, column oven and detector were 220, 130, and 220 °C, respectively. Concentrations of lactic acid and NH\(_3\)-N were analyzed according to the method of Barker and Summerson (1941); Chaney and Marbach (1962), respectively.

**Statistical Analyses**

The data were subjected to analysis of variance for a completely randomized design. Duncan’s multiple range test was used to separate treatment means, when probability was less than 0.05.

**RESULTS AND DISCUSSION**

The initial LAB population in liquid inoculant, dry inoculant with cassava starch, dry inoculant with sago starch, and dry inoculant with combination of cassava and sago starches were \( 3 \times 10^6 \) cfu/ml, \( 2.6 \times 10^7 \) cfu/g, \( 4.2 \times 10^7 \) cfu/g and \( 4.0 \times 10^7 \) cfu/g, respectively. This population is consistent with the minimum target at the initial LAB population approximately 106 cfu/g. Chemical composition of king grass silages are presented in Table 1.

**Table 1. Chemical composition of king grass silages**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter</td>
<td>20.4c</td>
<td>22.0bc</td>
<td>24.4a</td>
<td>22.9ab</td>
<td>23.1ab</td>
</tr>
<tr>
<td>Organic matter</td>
<td>89.9b</td>
<td>92.7a</td>
<td>92.5a</td>
<td>90.8b</td>
<td>94.0a</td>
</tr>
<tr>
<td>Crude Protein</td>
<td>8.7b</td>
<td>10.2a</td>
<td>10.8a</td>
<td>9.8ab</td>
<td>9.9ab</td>
</tr>
<tr>
<td>NDF</td>
<td>73.5</td>
<td>71.7</td>
<td>71.4</td>
<td>73.1</td>
<td>72.7</td>
</tr>
<tr>
<td>ADF</td>
<td>47.3</td>
<td>46.8</td>
<td>45.3</td>
<td>45.7</td>
<td>46.2</td>
</tr>
</tbody>
</table>

Means in the same row with different superscript differ significantly (* P<0.05; ** P<0.01; NS: Non Significant)

Dry matter, OM and CP contents of silage were significantly affected by addition of inoculant LAB. Silage C had the higher DM content than other silages could be due to cassava starch is hygroscopic and contain more amylopectin chains, thus it is able to absorb more water. The DM content of all silages were lower than the value of 30% for ideal silage as suggested by Chamberlain and Wilkinson (1996). Silage C also contains a higher crude protein than other silage. This indicates that silage C has low degradation of CP to amino acids and ammonia during ensiling. The NDF and ADF contents in silage with addition of LAB inoculants were slightly lower than control silage. It has been reported that activity of cellulase and hemicellulase enzymes was high during ensilage (Yahaya et al., 2004). Similar results were also reported in other experiments using guinea grass and king grass silages (Ando et al., 2006; Santos et al., 2009 and Santos et al., 2011).
### Table 2. Fermentation characteristic of king grass silages ensiled with liquid or dry LAB inoculants addition

<table>
<thead>
<tr>
<th>Treatments</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>SEM</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactic acid (g/kg DM)</td>
<td>25.6&lt;sup&gt;c&lt;/sup&gt;</td>
<td>52.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>105.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>52.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>52.5&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.1</td>
<td>**</td>
</tr>
<tr>
<td>NH&lt;sub&gt;3&lt;/sub&gt;-N (g/kg Total N)</td>
<td>137.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>92.1&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>72.8&lt;sup&gt;c&lt;/sup&gt;</td>
<td>109.7&lt;sup&gt;b&lt;/sup&gt;</td>
<td>86.1&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>16.5</td>
<td>**</td>
</tr>
<tr>
<td>Acetic acid (g/kg DM)</td>
<td>45.1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>35.0&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>32.3&lt;sup&gt;c&lt;/sup&gt;</td>
<td>38.8&lt;sup&gt;b&lt;/sup&gt;</td>
<td>38.9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.4</td>
<td>**</td>
</tr>
<tr>
<td>Propionic acid (g/kg DM)</td>
<td>4.5</td>
<td>5.2</td>
<td>4.6</td>
<td>5.2</td>
<td>4.3</td>
<td>1.0</td>
<td>NS</td>
</tr>
<tr>
<td>Butyric acid (g/kg DM)</td>
<td>12.7&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.8&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.9&lt;sup&gt;c&lt;/sup&gt;</td>
<td>7.1&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.0&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>0.4</td>
<td>**</td>
</tr>
<tr>
<td>Total VFA (g/kg DM)</td>
<td>62.4&lt;sup&gt;a&lt;/sup&gt;</td>
<td>47.1&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>41.9&lt;sup&gt;c&lt;/sup&gt;</td>
<td>51.3&lt;sup&gt;b&lt;/sup&gt;</td>
<td>49.3&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.7</td>
<td>**</td>
</tr>
</tbody>
</table>

Means in the same row with different superscript differ significantly (** P<0.01); NS: Non Significant

Silage treated with dry or liquid LAB inoculants (B, C, D, E) had higher (P<0.01) lactic acid concentration than control silage (A). Meanwhile, concentrations of NH<sub>3</sub>-N, acetic acid, butyric acid and total VFA were lower (P<0.01) than control silage. Silage treated with dry LAB prepared by cassava starch (C) had the highest lactic acid concentration and the lowest concentrations of NH<sub>3</sub>-N, acetic acid, butyric acid and total VFA. The concentration of lactic acid in silage C was in the ideal range of lactic acid concentration from 80 to 120 g/kg DM. Chamberlain and Wilkinson (1996) concluded that ammonia-N is as an indicator of the proportion of the total N which has been completely degraded during ensiling. Hence, concentration of ammonia-N is the best indicator of secondary fermentation. The normal range of NH<sub>3</sub>-N concentration in silage is 50 to 150 g NH<sub>3</sub>-N/kg DM. However, the target value for NH<sub>3</sub>-N is less than 50 g/kg total N (Chamberlain and Wilkinson, 1996). Based on NH<sub>3</sub>-N concentration, all silages could be classified in normal range of NH<sub>3</sub>-N concentration. The VFAs comprise of acetic acid, propionic acid, butyric acid and other acids. The production of these acids is a reflection of an inefficient fermentation or of secondary fermentation of lactic acid to butyric acid and degradation of amino acids to ammonia with the production of acetic acid from the carbon skeleton of the amino acid (Chamberlain and Wilkinson, 1996). Based on data in Table 1, fermentation in silage was more efficient than other silage.

### Table 3. In vitro dry matter and organic matter digestibility (%) of king grass silages ensiled with liquid or dry LAB inoculants addition

<table>
<thead>
<tr>
<th>Treatments</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>SEM</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>IVDMD</td>
<td>46.3&lt;sup&gt;b&lt;/sup&gt;</td>
<td>51.7a</td>
<td>52.1a</td>
<td>51.9a</td>
<td>53.1a</td>
<td>0.6</td>
<td>**</td>
</tr>
<tr>
<td>IVOMD</td>
<td>52.7c</td>
<td>57.9b</td>
<td>61.8a</td>
<td>63.0a</td>
<td>59.7ab</td>
<td>0.5</td>
<td>**</td>
</tr>
</tbody>
</table>

Means in the same row with different superscript differ significantly (** P<0.01).

Addition of both liquid and dry inoculants increased (P<0.01) in vitro dry matter and organic matter digestibility as compared control silage. Increasing IVOMD in silages with addition of LAB inoculant in the present study could be due to the slightly lower NDF and ADF contents. This result was supported by previous study by Ando et al. (2006) that addition of LAB increased the digestibility of DM, OM and CP of guinea grass silage. Similar results has been reported by Santoso et al. (2014) that addition of epiphytic LAB in rice straw-based silage increased in vitro organic matter digestibility. When compared to control silage, the IVDMD and IVOMD in silage treated with LAB increased by average of 12.7% and 15.0%, respectively.
CONCLUSION

Addition of liquid or dry LAB inoculants increased lactic acid production, in vitro digestibility of dry matter and organic matter, otherwise decreased ammonia N, acetic and butyric acids, and total VFA. King grass ensiled with addition of dry LAB inoculant with cassava as substrate had the best fermentation quality as compared to other treatments.

REFERENCES

Responses of Growing-Female Crossbred Ettawa Goats Fed Concentrates Containing by-product of Traditional Fried Snack Industry with Different Levels of Urea

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ABSTRACT: The problem faced in West Nusa Tenggara (NTB) is lack of goats’ feed in dry season result in low productivity of the goats. Furthermore, the cost of the feed is very expensive, and therefore it is needed to find alternative feeds which locally available, cheap and non-competitive with human needs. The purposes of this experiment was to evaluate the utilization of by-product of traditional fried snack industry ("rontokan gorengan = RG") as a concentrate in combination with rice bran (1:1) and different levels of urea on dry matter (DM) intakes of each feeds, total nutrient intakes, water intakes, feed conversion ratio (FCR), average daily gain (ADG) and DM intake as percentage of body weight (BW) of growing-female crossbred Ettawa goats given a basal diet consisted of field grass and banana peel. Sixteen growing-female crossbred Ettawa goats with an initial of body weight of 19±2.8 kg were allocated into four group of 4 goats each and fed one of dietary concentrate treatments containing 0%, 2%, 3% or 4% urea and arranged according to Completely Randomized Design. The results show that there were no significant difference (P>0.05) on DM intakes of each feeds; total nutrient intakes, DM intake as percentage of BW; water intake; ADG; and FCR. Nitrogen (N) intake was enhanced (P<0.05) by increasing level of urea in the concentrates. The goats receiving diet with 3% urea in the concentrate tended to have the best response in ADG (95.9 g/head/day) followed by the highest of DM intakes of field grass, total DM and OM (organic matter) intakes, total N intakes and the lowest of FCR. It is concluded that adding 3% urea in the concentrate based on "rontokan gorengan" and rice bran (1:1) can maintain productivity of growing-female crossbred Ettawa goats.

Keywords: by-product of traditional fried snack industry; crossbred Ettawa goats, daily gain, urea, concentrate.

INTRODUCTION

Crossbred Ettawa Goats in Indonesia, particularly in West Nusa Tenggara are being developed as a dual purposes goat type (meat and milk) to enhance nutritional status of local people. Currently, the crossbred Ettawa Goats’ production is still low due to lack of feed availability, especially in dry season leading to slow growth of young goats which is very important in dairy goat selection. To obtain an optimum growth, the goats should be fed sufficient amount of good quality feeds. However, this is costly. Therefore, an exploration of potential locally available feed is needed. There are many home industries producing traditional snack called ‘gorengan’ in Mataram. Banana peel and “rontokan gorengan” (RG) are their by-products which are polluting the traditional market environments and the rivers around the Mataram city (Asih et al., 2014). RG is by-product rich in fermentable carbohydrate but lack of protein and can be properly used as a concentrate by combining it with rice bran and urea. Previous study showed that feeding crossbred lactating Ettawa goats a concentrate consisted of 1:1 rice bran and RG with 3% urea increased productivity (Asih et al., 2014). It is not clear if the result with lactating crossbred Ettawa goats applicable to
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Integrated Approach in Developing Sustainable Tropical Animal Production
October 20-22, 2015, Yogyakarta, Indonesia

growing-female goats. Therefore, an experiment was conducted to evaluate total dry matter (DM) intakes, DM intakes of each feeds, water intakes, average daily gain (ADG) and feed conversion ratio (FCR) in growing-female crossbred Ettawa goats fed field grass and banana peel as basal diets given concentrates based on rice bran and RG containing different levels of urea.

MATERIALS AND METHOD

Sixteen growing-female crossbred Ettawa goats (5 to 6 month old with the initial body weight of 19±2.8 kg) were divided into four groups of four goats and given one of four concentrates treatments (Table 1) according to Completely Randomized Design (Mead and Curnow, 1983).

Table 1. The composition of concentrate treatments as feeds

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Rice bran (%)</th>
<th>RG (%)</th>
<th>Urea (%)</th>
<th>Mineral (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1</td>
<td>49.0</td>
<td>49.0</td>
<td>0.0</td>
<td>2.0</td>
</tr>
<tr>
<td>U2</td>
<td>48.0</td>
<td>48.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>U3</td>
<td>47.5</td>
<td>47.5</td>
<td>3.0</td>
<td>2.0</td>
</tr>
<tr>
<td>U4</td>
<td>47.0</td>
<td>47.0</td>
<td>4.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Note: RG=Rontokan gorengan is by-product of traditional fried snack industry which is separated from the main products. Mineral is specific for goats and sheep produced by Eka Parma, Semarang.

The goats were penned individually and the feeding technique is shown in Table 2. Daily DM intakes of each feed types, total daily nutrient intake and daily water intake were measured for 10 weeks, while the average daily gain (ADG) of the goats was measured by weighing each goat weekly. The feed conversion ratio (FCR) was calculated as the amount of DM consumed (kg) over one kg weight gain, and DM intake was expressed as percentage of body weight. Data were analyzed using PROC ANOVA (Sas, 1990) and differences between treatment means were separated with Duncan multiple range test.

Table 2. Frequency, feeding time and amount of feed given of each goat in different dietary treatments

<table>
<thead>
<tr>
<th>Feeds</th>
<th>U1</th>
<th>U2</th>
<th>U3</th>
<th>U4</th>
<th>Frequency and feeding time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field grass (g)</td>
<td>ad-lib</td>
<td>ad-lib</td>
<td>ad-lib</td>
<td>ad-lib</td>
<td>Thrice a day (morning; noon; evening)</td>
</tr>
<tr>
<td>Concentrate (g)</td>
<td>300</td>
<td>300</td>
<td>300</td>
<td>300</td>
<td>Once a day (in the morning)</td>
</tr>
<tr>
<td>Banana peel (g)</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>Once a day (in the morning)</td>
</tr>
<tr>
<td>Water (ml)</td>
<td>ad-lib</td>
<td>ad-lib</td>
<td>ad-lib</td>
<td>ad-lib</td>
<td>Once a day (in the morning)</td>
</tr>
</tbody>
</table>

RESULTS AND DISCUSSION

Nutrient intakes, water consumption, ADG, and FCR are presented in Table 3. Nutrient and water intakes of growing-female crossbred Ettawa goats were not significantly (P>0.05) influenced by increasing urea levels in the concentrate. However, DM intake of field grass enhanced significantly (P= 0.054) with increasing urea levels in the concentrate, except for the goats received 2% urea treatment. It reduced due to one of the goats receiving this treatment suffered from diarrhea for one week. This reduced the appetite of that goat leading to a decrease its total DM and OM intakes,
although its concentrate consumption was numerically higher. Therefore, its ADG was lower than that of 0% urea treatment in the concentrate (Table 3). Vice versa, the goats received a concentrate containing 3% urea gave the highest response of the ADG followed by the highest responses of nutrient intakes and the lowest of FCR. This might be due to better fermentation and production of ammonia and volatile fatty acids (Galina et al. 2004). They reported an improvement in ammonia and volatile fatty acids production in goat kids pasturing Mexican rangeland given slow-intake urea supplementation. Furthermore, these results were in line with results of our previous experiment (Asih et al., 2014) that feeding a concentrate containing 3% urea to lactating does gave the highest responses on crude fiber and N digestibility. There was a tendency that further increase of level of urea in the concentrate up to 4% reduced the value of measured variables, although those were not significantly different (P>0.05).

The best responses of the 3% urea level in the concentrate on growing-female crossbred Ettawa goats are in accordance to the results of the previous similar experiment on lactating crossbred Ettawa does that incorporating 3% urea in the similar concentrate gave the best responses on milk production, positive body weight change at the end of the experiment, ADG of the pre-weaning offspring and nutrient digestibility (Asih et al., 2014). In other word, 3% urea level in the concentrate based on “RG” and rice bran (1:1) is applicable to growing-female crossbred Ettawa goats for maintaining the crossbred Ettawa goats’ production in Mataram city where “RG” is polluting the environment. The more we utilize “RG” as a concentrate for various physiologies of goats, the more we reduce pollution of the environment. Therefore, it is necessary to conduct similar experiment on other physiologies of goats such as on growing and adult male goats, dried does and pre-weaning goats.

Table 3. Nutrient intakes, water consumption, ADG, and FCR of growing-female crossbred Ettawa goats.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>U1</th>
<th>U2</th>
<th>U3</th>
<th>U3</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM Intake of feed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field grass (g/day)</td>
<td>565.2b</td>
<td>460.3b</td>
<td>624.0a</td>
<td>562.5ab</td>
<td>36.965</td>
<td>0.0540</td>
</tr>
<tr>
<td>Banana peel (g/day)</td>
<td>122.5a</td>
<td>112.3b</td>
<td>123.8a</td>
<td>120.9a</td>
<td>1.5691</td>
<td>0.0009</td>
</tr>
<tr>
<td>Concentrate (g/day)</td>
<td>98.08a</td>
<td>119.4a</td>
<td>109.5a</td>
<td>116.6a</td>
<td>8.6822</td>
<td>0.3510</td>
</tr>
<tr>
<td>Total intake of nutrient</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DM (g/day)</td>
<td>785.8ab</td>
<td>691.9b</td>
<td>857.3a</td>
<td>800.0ab</td>
<td>40.993</td>
<td>0.0850</td>
</tr>
<tr>
<td>OM (g/day)</td>
<td>719.4a</td>
<td>635.5b</td>
<td>784.2ab</td>
<td>733.0ab</td>
<td>37.013</td>
<td>0.0870</td>
</tr>
<tr>
<td>N (g/day)</td>
<td>6.98b</td>
<td>7.49b</td>
<td>9.72a</td>
<td>10.49a</td>
<td>0.4792</td>
<td>0.0005</td>
</tr>
<tr>
<td>Crude Fiber (g/day)</td>
<td>30.45a</td>
<td>28.19a</td>
<td>33.54a</td>
<td>31.83a</td>
<td>1.6708</td>
<td>0.1963</td>
</tr>
<tr>
<td>Fat (g/day)</td>
<td>36.12a</td>
<td>39.16a</td>
<td>40.06a</td>
<td>40.57a</td>
<td>2.3986</td>
<td>0.5759</td>
</tr>
<tr>
<td>Ash (g/day)</td>
<td>66.34a</td>
<td>56.39a</td>
<td>73.10b</td>
<td>67.04b</td>
<td>4.0007</td>
<td>0.0733</td>
</tr>
<tr>
<td>Water (ml/day)</td>
<td>260a</td>
<td>320a</td>
<td>333a</td>
<td>283a</td>
<td>23.430</td>
<td>0.1623</td>
</tr>
<tr>
<td>ADG (g/day)</td>
<td>80.38a</td>
<td>75.00a</td>
<td>96.43a</td>
<td>83.93a</td>
<td>10.503</td>
<td>0.5426</td>
</tr>
<tr>
<td>DM intake/BW (%)</td>
<td>4.32a</td>
<td>3.80a</td>
<td>4.33a</td>
<td>4.15a</td>
<td>0.1686</td>
<td>0.1466</td>
</tr>
<tr>
<td>FCR (kg feed/kg BW change)</td>
<td>9.77a</td>
<td>9.22a</td>
<td>8.89a</td>
<td>9.53a</td>
<td>0.0905</td>
<td>0.0601</td>
</tr>
</tbody>
</table>

U1= 0% urea; U2= 2% urea; U3= 3% urea and U4= 4% in the concentrates
The ADG of growing-female crossbred Ettawa goats were not influenced by the urea levels in the concentrates since the total nutrient intakes (DM, OM, fiber, fat and ash) were not significantly different (P>0.05) among different levels of urea (Table 3). Consequently, the FCR of those goats was also not significantly different. However, the FCR of the goats received concentrate treatment containing 3% urea level gave the lowest FCR. This might be caused by significant increase in digestibility of fiber and N when the goats were fed that concentrate. These findings were in accordance with those reported previously (Asih et al. 2014) that increasing levels of urea in those concentrates up to 3% improved the digestibility of dietary fiber and protein significantly (P>0.05) and tended to have the highest DM and OM digestibility. This means that the 3% urea level in the concentrate based on RG and rice bran (1:1) could improve the nutrient content of feeds. This was supported by the previous finding that different protein sources (soy bean meal, cotton seed meal and urea) in the concentrates contained similar amount of energy did not affect microbial protein synthesis in the rumen of the goats (Asih et al. 2011) and there is still an opportunity to utilize urea to enrich certain unconventional by-product for goats.

CONCLUSIONS

By-product of traditional snack industry is a potential feedstuff for goats. Feeding growing-female crossbred Ettawa goats a basal diet of field grass and banana peel with concentrate consisted of 1:1 rice bran and “rontonk gorengan” with 3% urea can maintain the goats’ productivity.

REFERENCES


Restriction Feed and Refeeding Evaluation for Consumption, Feed Cost, Income Over Feed Cost, Percentage of Carcass and Meat Quality of Kacang Goat

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*Author for correspondence e-mail: bsuwignyo@ugm.ac.id

ABSTRACT: This study aims to determine the effect of restriction feed and refeeding for consumption, feed cost, income over feed cost, percentage of carcass and meat quality of Kacang goat. A total of nine male Kacang goats average age of 12 months with an average weight of 14.96 kg fed consisting of hay forage peanut (rendeng) and concentrate. Goats were divided into three treatment groups. Three goats control (P0) fed based on the needs of dry matter (DM) 3.5% of body weight, three goats feed restriction treatment 50% (P1) and three goats feed restriction treatment 60% (P2) of the requirement by BK for 30 day. The variables measured were intake of dry matter (DM), intake of organic matter (BO), feed cost, the percentage of carcass and meat quality. Data were analyzed by the method of completely randomized design (CRD) pattern unidirectional followed by least significant different (LSD). The result showed that restriction feed and refeeding significant effect on intake of dry matter (DM), intake of organic matter (BO), but did not affect feed cost, percentage of carcass and meat quality. It is concluded that with the effect of restriction feed and refeeding for consumption can produce a similar growth of male Kacang goats.

Keywords: feed restriction, refeeding, Kacang goat, feed cost, percentage of carcass

INTRODUCTION

Forage production usually depends on the season. Fluctuations on tropical countries, where the rainy season forage availability of abundant, but whereas during the dry season there is a shortage of forage. Constraint availability of feed, particularly forages can be a factor in the development problems of ruminants such as goats. Suwignyo, et al., (2012) stated forage fodder is one requirement that is integral in the development of livestock, especially ruminants. Utomo (2003) states forage supply constraints continuously throughout the season is a constraint in the development of animal husbandry. Consequently, many cattle are experiencing indigestion. The ability of an animal to consume feed depends on the type of forage, ambient temperature, body size livestock and animal physiology. Feed restriction management, based on research Aboelmaaty, et al. (2008) that the feed is not provided ad libitum, but restricted in accordance with the needs of feed restriction, followed by providing refeeding, causing a compensatory effect following growth or growth as a result of feed restriction.

MATERIALS AND METHODS

Materials

The materials used in the study was 9 Kacang goats with an average age of 12 months, with initial weight average of 14.96 kg. Cage-shaped stage experiments with individual plots measuring 1.5 m x 0.75 m are equipped with a feed and water place, with the cage floor height of 60 cm from the ground. Forage (60%) in the form of peanut hay (rendeng) and concentrates in the form of pellets (40%) Gemuk A. Drinking water provided ad libitum. The composition of forage and concentrates are presented in Table 1.
Table 1. The chemical composition of feed research

<table>
<thead>
<tr>
<th>Feed material</th>
<th>Composition (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DM</td>
</tr>
<tr>
<td>Peanut hay (rendeng)</td>
<td>53.14</td>
</tr>
<tr>
<td>Concentrates</td>
<td>95.74</td>
</tr>
</tbody>
</table>

The tools used are scales sit EK3651 brand Camry models with a capacity of 5 kg sensitivity 1 g to weigh the feed given and the rest (forage and concentrates). Scales cattle brands Camry models EB9872 capacity of 150 kg with a sensitivity of 100 g to weigh goats. Willey mill with a hole diameter of 1 mm sieve to grind feed and feces samples. Digital analytical balance brands Denver instrument XL 410 with a capacity of 500 g and 0.001 g sensitivity that is used to weigh the feed and feces samples for analysis. A set of tools and a set of tools proximate analysis of physical and chemical testing of meat.

Pre-research

Pre-research was conducted during one month for the purpose of adaptation livestock. Nine goats were randomized to 3 treatment groups, 3 goats as a control (P0), 3 goat as a treatment 50% of feed restriction (P1) and 3 goats as a treatment 60% of feed restriction (P2). Goats weighed initially, placed in cages appropriate treatment plots. Feed with forage and concentrate with ratio of 40:60 is given twice a day, morning and afternoon at 07.00 a.m at 04.00. p.m.

Research stage

The research was carried out in two stages. Phase feed restriction for 30 days. Livestock are given 50% and 60% of the total daily requirement DM. The second stage of refeeding for 30 days where the feed was given ad libitum. The transition phase from stage to stage adaptations made gradual restriction, which is done gradually decrease in feed for one week. The same is done when changing from stage to stage refeeding restriction.

Variables Observed

Variables observed during the study were feed consumption, body weight, carcass weight, carcass percentage, water holding capacity, cooking losses, tenderness and texture of meat.

Data Analysis

This study uses data analysis in the form of completely randomized design (CRD) unidirectional pattern (Hanafia, 2010).

RESULT AND DISCUSSION

Nutrient Consumption

Consumption of nutrients in goat on stage feed restriction and re feeding shown in Table 2, is calculated based on the reduction of nutrients in the feed and food remains. Feed given as much as 3.5% of the body weight of goats. At this stage of feed restriction, there is no residual feed in the feed place. This also occurs at the stage of refeeding.
Table 2. Consumption of nutrients Kacang goat (g/kg/day)

<table>
<thead>
<tr>
<th>Variabel</th>
<th>Goats</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control (P0)</td>
</tr>
<tr>
<td></td>
<td>Restriction 50% (P1)</td>
</tr>
<tr>
<td></td>
<td>Restriction 60% (P2)</td>
</tr>
<tr>
<td>Restriction stage</td>
<td></td>
</tr>
<tr>
<td>DM Consumption</td>
<td>35.49 ± 1.63b</td>
</tr>
<tr>
<td></td>
<td>16.67 ± 0.64a</td>
</tr>
<tr>
<td></td>
<td>17.06 ± 6.01a</td>
</tr>
<tr>
<td>OM Consumption</td>
<td>32.05 ± 1.47b</td>
</tr>
<tr>
<td></td>
<td>15.05 ± 0.58a</td>
</tr>
<tr>
<td></td>
<td>15.59 ± 5.58a</td>
</tr>
<tr>
<td>Refeeding stage</td>
<td></td>
</tr>
<tr>
<td>DM Consumption</td>
<td>36.65 ± 1.81a</td>
</tr>
<tr>
<td></td>
<td>37.93 ± 0.78ab</td>
</tr>
<tr>
<td></td>
<td>54.40 ± 14.33b</td>
</tr>
<tr>
<td>OM Consumption</td>
<td>33.09 ± 1.64a</td>
</tr>
<tr>
<td></td>
<td>34.25 ± 0.71ab</td>
</tr>
<tr>
<td></td>
<td>49.75 ± 13.49b</td>
</tr>
</tbody>
</table>

*Values shown as mean ± standard deviation
ab superscript in the same row indicate differences (P <0.05)

Based on the results of statistical analysis showed that treatment of feed restriction of 50% and 60% real impact on the consumption of DM and OM in Kacang goats. According to Arora (1995), feed consumption is fundamental that will determine the level of nutrients, function and response of cattle as well as the use of nutrients in feed for livestock body needs.

**Dry matter intake**

Consumption of DM in Kacang goats showed significantly different results between the control goats (P0) with goat restriction (P1 and P2). Table 2 shows the DM intake in goat’s treatment decreased compared with control. DM intake goat P0 at restriction stage is 35.49 g/head/day, whereas P1 and P2 goat consumes DM as much as 16.67 g/head/day and 17.06 g/head/day. This difference occurs because the goat’s clear treatment given amount of feed limited to 50% and 60% of the needs should be.

Feed consumption returns to normal when treatment is stopped the feed restrictions. P0 goat consumes DM as much as 36.65 g/head/day, whereas P1 and P2 goat feed consume as much as 37.93 g/head/day and 54.40 g/head/day. Increasing the number of feed consumption resulting in an increase in weight, resulting in an increased need for feed. Apart from the restrictions on the amount of feed given, the level of consumption of nutrients is influenced by several factors. According to Tillman, et al. (1998) the rate of digestion of feedstuffs in the digestive tract, the rate of spending the rest of feed consumed and the level of compliance with feed ingredient consumed nutrients affect the amount of consumption of feed materials on goats.

**Consumption of organic materials**

Consumption of OM in the control and treatment of goat shows the effect of feed restriction. In Table 2 shows that the consumption of OM per kilogram of body weight a goat is affected by the amount of DM intake, the higher the amount of DM intake, the higher the consumption of OM. Consumption of OM on the P0 goat feed restriction phase is 32.05 g/head/day, whereas P1 and P2 goat is 15.05 g/head/day and 15.59 g/head/day. The difference between the DM intake and OM at this stage is from 1 to 2 g, is the same difference between the control and treatment of goat. Increased consumption of OM occurs when feed restriction is stopped and feeding back according to need. At this stage, goat feed P0 consume as much as 33.09 g/head/day, whereas P1 and P2 goats consume OM as much as 34.25 g/head/day and 49.75 g/head/day. The difference in DM intake and OM at this stage is 3 to 5 g. According Chakra, et al. (2005) OM is part of the dry ingredients and contains the largest portion of the composition of DM, so that the consumption of OM is determined by the amount of DM intake.
Body Weight Changes

Changes in body weight of goats affected by the amount of feed consumed for each animal. As shown in Figure 1, goats P0 without limitation feed showed normal growth pattern indicated by weight gain continues to increase. Current consumption of livestock feed each restricted by 50% and 60% in goats P1 and P2 as a result of restriction feed, then the weight loss and when the feed is given back as normal by the method of ad libitum, feed consumption increase followed by compensatory growth or growth following a compensation of feed given to each goat. That is the treatment of feed restriction can reduce feed intake, thus saving feed requirements.

Figure 1. Graph of body weight of Kacang goats

Weight loss P1 goat average 21.91 g per day, while the P2 goats decreased an average of 16.19 g per day. Weight loss occurs as a result of feed restriction is done. Figure 1 shows that 50% of feed restriction treatment is better than 60% of feed restriction treatment. Which is expected to supply the nutritional needs of the feed are not fulfilled for various purposes livestock activities of the body, resulting in weight loss goat P1 and P2. Factors that lead to a decrease in body weight gain during periods of food restriction among other things because of the limited supply of nutrients and energy to support the growth of the network, so the cattle need to be taken from the body of livestock activity itself. As a result of cattle being thin (Hornick, et al. 2000).

Carcasses Percentage

The resulting carcass of a Kacang goat treated controls and restrictions feed shows the results are not much different. Table 3 shows the data cut weight, carcass weight and carcass percentage goats.

Table 3. The weight cut, weight and percentage of Kacang goat carcass

<table>
<thead>
<tr>
<th>Variabel</th>
<th>Control (P0)</th>
<th>Restriction 50% (P1)</th>
<th>Restriction 60% (P2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight cut ns</td>
<td>16.85 ± 4.87</td>
<td>20.30 ± 2.62</td>
<td>20.90 ± 1.31</td>
</tr>
<tr>
<td>Weight carcass ns</td>
<td>07.47 ± 2.90</td>
<td>09.42 ± 1.73</td>
<td>09.91 ± 0.90</td>
</tr>
<tr>
<td>Carcass presentation ns</td>
<td>43.67 ± 4.56</td>
<td>46.25 ± 3.40</td>
<td>47.38 ± 1.75</td>
</tr>
</tbody>
</table>

Values shown as mean ± standard deviation
ns not real or non significant

Goats treated feed restriction has a slightly superior carcass percentage when compared with control. Control goat carcass percentage is 43.67%, while the goat carcass P1 and P2 is 46.2% and 47.38%. Even statistically relatively equal or no real difference, but if the note contained carcass percentage difference between control and treatment restriction is 3% to 4% means goat carcass treated feed restriction has advantages when compared with controls.
The greater the weight cut, the greater the resulting carcass weight. Goats by feeding on a limited basis will experience slow growth or stop, but after getting enough fodder, goats will grow back faster than normal growth rate. According to Soeparno (2009), growth is called compensatory growth, or growth that is followed. According to Triyantini, et al. (2002), administration of two different types of feed at different conditions on Kacang goat carcass can produce almost the same percentage.

**Meat Quality**

Meat quality determined from before and after the animal was cut. Statistical tests showed no significant difference in cooking shrinkage testing, tenderness and Water Holding Capacity (WHC), while at pH testing there is a real difference. Table 5 shows the results of physical tests Kacang goat meat treated controls and restrictions.

<table>
<thead>
<tr>
<th>Variabel</th>
<th>Control (P0)</th>
<th>Restriction 50% (P1)</th>
<th>Restriction 60% (P2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking lose</td>
<td>33.59 ± 9.57</td>
<td>36.55 ± 3.90</td>
<td>33.07 ± 5.06</td>
</tr>
<tr>
<td>Tenderness</td>
<td>06.48 ± 0.83</td>
<td>07.85 ± 6.29</td>
<td>06.50 ± 3.70</td>
</tr>
<tr>
<td>WHC</td>
<td>30.00 ± 0.01</td>
<td>31.00 ± 0.01</td>
<td>30.00 ± 0.00</td>
</tr>
<tr>
<td>pH</td>
<td>06.36 ± 0.24</td>
<td>06.25 ± 0.19</td>
<td>06.55 ± 0.16</td>
</tr>
</tbody>
</table>

) Values shown as mean ± standard deviation

a, b Superscript in the same row indicate differences (P <0.05)

ns Not real or non significant

Treatment of feed restriction made on goat not be the determining factor for the quality of the meat based on the results of this study. According to Martin, et al. (2004) the quality of the meat is affected by two factors, first downstream factors that included the technology before and after the cutting process, the content of nutrients and microbial content of the meat and the second is the upstream factors include livestock genetics, physiology and nutritional feed.

**Cooking shrinkage**

The test results show that the shrinkage cook P0 is 33.59%, while the cooking shrinkage goat P1 and P2 are 36.55% and 33.07%. Cooking shrinkage values between control and treatment restriction is no real difference. Cooking too long or high temperatures during cooking resulting in greater levels of meat lost fluid levels, thus lowering the quality of meat produced. According Soeparno (2009), shrinkage cookware is an indicator of nutritional value of meat associated with higher levels of meat juice, which is the amount of water that is bound within and between muscles. The meat juice is a component of the texture that will determine the tenderness of meat. Widiati, et al., (2002) adds that the discharge of meat due to the occurrence of muscle shrinkage during cooking and heating.

**Tenderness**

Based on testing performed, the value of goat meat tenderness P0 of 6.48, while mutton P1 and P2 are 7.85 and 6.50. Kacang goat meat tenderness value has no real difference. The smaller the value of tenderness, the more tender the meat produced, expressed by Forrest, et al. (1975). Goat tenderness value P0 to P2 only has a difference of 0.02, which means that the more a minimum of feed, can produce quality that is superior tenderness. Treatment restrictions feed on livestock is not a major factor in deciding the value of tenderness, expressed by Soeparno (2009),
that the tenderness of meat is influenced by factors before and after cutting, factors before cutting includes genetic, species, race, type of animal, sex, age when cut, the nutrients contained in the feed and livestock stress conditions. After cutting factors include methods of withering, electrical stimulation, a method cooking, pH carcass and meat.

**Water Holding Capacity (WHC)**

The value of the test result value WHC on goat’s meat P0 is 30.00, while the goat meat treated with P1 and P2 are 31.00 and 30.00. These results indicate that goat meat control and treatment had no significant difference. Value WHC is one of the factors that will determine the delicacy and meat in consumer acceptance. Treatment restrictions that do not feed into a major factor in deciding the value of WHC, but a decrease in the pH value becomes the deciding factor WHC values. According to Lawrie (2003), a decrease in WHC of meat proteins caused by a decrease in pH and as a result of damage sarcoplasmic proteins. Soeparno (2009) argues that WHC is affected by pH, the pH is higher or lower than the point isoelectric proteins of meat, and WHC will increase.

**pH value**

pH value has real difference between the value of goat meat P0, P1 and P2. P0 goat meat has a pH value of 6.36, while goat’s meat treatment P1 and P2 has a pH value of 6.25 and 6.55. The pH value of the smallest owned by goat’s meat P1, then P0 and P2. Factors that because the size of the pH value is a factor before and after cutting. The pH value of the test results higher than normal pH value of carcass and meat goats. According to the research Sunarlim and Setiyanto (2005), the average pH value of carcass and meat Kacang goat is 5.53. Soeparno (2009), argued that the normal pH is 5.4 to 5.8.

**Feed Cost**

<table>
<thead>
<tr>
<th>Variabel</th>
<th>Goat’s</th>
<th>Feed conversion</th>
<th>Feed Cost/Gain (IDR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control (P0)</td>
<td>Restriction 50% (P1)</td>
<td>Restriction 60% (P2)</td>
</tr>
<tr>
<td>Feed conversion</td>
<td>10.15±3.09</td>
<td>9.89±1.11</td>
<td>16.46±6.58</td>
</tr>
<tr>
<td>Feed Cost/Gain (IDR)</td>
<td>48,542.66±9,591.83</td>
<td>44,529.78±4,116.32</td>
<td>56,441.71±8,779.02</td>
</tr>
</tbody>
</table>

. Values shown as mean ± standard deviation

a, b Superscript in the same row indicate differences (P <0.05)

m Not real or non significant

**Feed conversion**

Feed conversion ratio (FCR) or conversion of the feed is obtained by dividing the ration dry matter intake with an average body weight gain. Average feed conversion for each treatment and control, restriction of 50%, 60% restriction is 10.15; 9.89; 16.46. Based on these values, the values of feed conversion of the treatment of the most good at 50% restriction. At the 60% restriction resulted in higher feed conversion due to body weight gain is relatively small. The feed conversion rate means to increase body weight by 1 kg, requiring ration respectively to control as much as 10.15 kg, 9.89 kg for a restriction to 50%, and 16.46 kg of 60% restriction. According to Hadi (2008), the smaller the feed conversion rate, the more efficient utilization of feed by livestock (conversion rate of about 4-6).

**Feed cost per gain**

Feed cost per gain value is calculated based on the cost of feed and the resulting weight. Price feeder goats were used for fattening is IDR 30,000/kg live weight, the price of concentrate feed IDR 5,500/kg, the price of hay peanut IDR 750/kg and the price for the goats that had been fattened is IDR 54,500/kg of live weight. Statistical analysis between the control treatment, restriction of
50% and 60% restriction does not show significant differences. The average feed cost per gain (IDR) generated in this study respectively for the control, restriction of 50% and 60% restriction is $48542.66 \pm 9591.66; 44529.78 \pm 4116.32; 56441.71 \pm 8779.02$. Results of the study indicated that restriction and refeeding can produce feed cost per gain was not significantly different ($P <0.05$). Although in general, restriction and refeeding can produce feed cost per gain cheaper than without treatment. Therefore, restriction and refeeding can be used as an alternative to solve the problem during the dry season.

**CONCLUSIONS**

Based on the results of research that has been done, it can be concluded that the restriction of feed (feed restriction) and refeeding (compliance with feed back) significantly affected the rate of consumption of dry matter (DM) and organic matter (BO). However, the percentage of carcasses, quality of goat meat between the controls feed cost of feed restriction treatment with 50% and 60% not significant.

**REFERENCES**


Characteristics of Polyunsaturated Fatty Acids and Nutrient Digestibility
Feed Cattle of the Fermented Rumen Fluid by One and Two Stage in Vitro

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 Indonesia,
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 3 Faculty of Animal Science, Gadjah Mada University, Indonesia
 Corresponding email: jokoriyanto19@yahoo.com

ABSTRACT: The objective of this research was to determine the effect of supplementation with polyunsaturated fatty acids (PUFA) protected in the feeding beef cattle based on the content of PUFA and the nutrients digestibility parameters by in vitro one-stage and two-stage. Fatty acid supplement derived from soya and lemuru fish oil. Soya groats and lemuru fish oil (SoyLem) both mixed with a ratio of 4: 1 are protected by an aldehyde of the formaldehyde concentration 37% as much as 2% of the dry matter. Fermentation was observed at one stage (48 hours) and two stage (96 hours) after incubation by in vitro. Rumen fluid were taken from the Ongole crossbred cow fistulated. Feed treatments including T1 = 30% elephant grass + 30% rice straw + 25% basal concentrate + 15% SoyLem unprotected, T2 = 30% elephant grass + 30% rice straw + 25% basal concentrate + 7.5% SoyLem unprotected + 7.5% SoyLem protected, and T3 = = 30% elephant grass + 30% rice straw + 25% basal concentrate + 15% SoyLem protected. The results of this study were the rumen fermentation in vitro showed palmitic C16:0), linoleat (C18:2), linolenat (C18:3), gama linolenat (C20:3) and arachidonat (C20:4) fatty acid content significantly different (P<0.05) at one stage of the incubation while gama linolenat (C20:3) dan arachidonat (C20:4) fatty acid content significantly different (P<0.05) at two stage of the incubation. Digestibility of dry matter, organic matter and crude protein were significantly different (P<0.05) in both the incubation one stage and two stages. The conclusion of research is a mixture of soya groats and lemuru fish oil (4: 1) protected aldehydes can be used as a supplement of up to 15% in cattle feed rich in fatty acids and without disturbing the digestibility by in vitro one-stage and two-stage.

Keywords: polyunsaturated fatty acids (PUFA), digestibility, protected, one stage invitro, two stage invitro

INTRODUCTION

Soybean groats and lemuru fish oil are both rich in linoleic acids. Both of fatty acids should be provided from the feed. Linoleic fatty acids undergo elongation and desaturation during biosynthesis. Linoleic fatty acid produces PGF2 in soybean groats through Arachidonic acid. PUFA that escape from ruminal hydrogenation enters circulatory system and subsequently stimulates ovarian cyclicity and corpus luteum function, therefore contributes to the estrous cycles, ovulation, and fertility (Dirandaeh et al., 2013). During the digestive process in the rumen, PUFAs undergo hydrogenation by rumen bacteria to become saturated fatty acid, thus affect the post-ruminal PUFA availability that will be absorbed by circulatory system (Mahadevan et al., 1983). For the PUFA to escape from ruminal hydrogenation process, protection is necessary in the rumen. Protection can be conducted, among other, by encapsulation of fat using protein-bond that have been protected from formaldehyde using aldehyde (Lourence et al., 2010). The present study employs encapsulation protection method that is conducted by mixing soybean groats and lemuru fish oil and blending them evenly until they form capsules and then added with formaldehyde. Encapsulation protection is intended to escape PUFA from hydrogenation and feed protein in the rumen.
MATERIALS AND METHODS

The research is conducted at Laboratory of Nutritional Biochemistry Faculty of Animal Science of Gadjah Mada University. Rumen fluid were taken from the Ongole crossbred cow fistulated. Three ruminally fistulated Ongole crossbred cow were employed in this study as the ruminal fluid donors. The three of them were fed with 60% forages and 40% basal concentrate. Forage is composed of 30% elephant grass and 30% rice straw. The basal concentrate is composed of 10% rice bran, 5% wheat bran, 3.5% coffee husks, 5% soybean meal, 1% minerals-vitamins, and 0.5% salts. Soya groats and lemuru fish oil (SoyLem) both mixed with a ratio of 4:1 are protected by an aldehyde of the formaldehyde concentration 37% as much as 2% of the dry matter.

Feed treatments including T1 = 30% elephant grass + 30% rice straw + 25% basal concentrate + 15% SoyLem unprotected, T2 = 30% elephant grass + 30% rice straw + 25% basal concentrate + 7.5% SoyLem unprotected + 7.5% SoyLem protected, and T3 = 30% elephant grass + 30% rice straw + 25% basal concentrate + 15% SoyLem protected. Experimental design used was randomized. If the variance of the test results mean different then the average difference was tested using the Duncan multiple range test (DMRT).

Parameters of rumen fermentation includes Saturated and unsaturated fatty acid composition is determined using Gas Chromatography (Plummer, 1987). Digestibility test include dry matter content, organic matter, crude fat, and crude protein using methods Tilley and Terry (1963) fermentation was observed at one stage (48 hours) and two stage (96 hours) after incubation by in vitro.

RESULTS AND DISCUSSION

Fatty acid level in parent beef cattle feeds that contain soybean groats and lemuru fish oil (at a 4:1 ratio), protected and unprotected from formaldehyde, respectively. Fermented ruminal fluid (in vitro) of one-stage (48 hours) and two-stages (96 hours) can be seen in Table 1.

Table 1. Fatty acid level (mg/100g) in cattle beef feeds contain protected and unprotected soybean groats and lemuru fish oil resulted from fermented ruminal fluid in vitro one-stage (48 hours) and two-stages (96 hours).

<table>
<thead>
<tr>
<th>Fatty acids (mg/100g)</th>
<th>Treatment</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>in vitro one-stage (48 hours):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laurat C12:0 &amp;ns</td>
<td></td>
<td>1.9918±1.20</td>
<td>3.9506±2.11</td>
<td>2.6352±0.92</td>
</tr>
<tr>
<td>Miristat C14:0 &amp;ns</td>
<td>0.0503±0.01</td>
<td>0.0788±0.04</td>
<td>0.1622±0.09</td>
<td></td>
</tr>
<tr>
<td>Pentadecanoat C15:0 &amp;ns</td>
<td>0.1174±0.07</td>
<td>0.2417±0.16</td>
<td>0.1210±0.04</td>
<td></td>
</tr>
<tr>
<td>Palmitat C16:0</td>
<td>2.1783±1.23</td>
<td>4.0725±2.38</td>
<td>1.8125±0.56</td>
<td></td>
</tr>
<tr>
<td>Heptadecanoat C17:0 &amp;ns</td>
<td>0.1100±0.08</td>
<td>0.0821±0.07</td>
<td>0.0612±0.01</td>
<td></td>
</tr>
<tr>
<td>Stearat C18:0 &amp;ns</td>
<td>0.0489±0.03</td>
<td>0.0341±0.03</td>
<td>0.0189±0.00</td>
<td></td>
</tr>
<tr>
<td>Behenat C22:0 &amp;ns</td>
<td>0.0171±0.01</td>
<td>0.0181±0.02</td>
<td>0.0024±0.00</td>
<td></td>
</tr>
<tr>
<td>Lignocerat C24:0 &amp;ns</td>
<td>0.0259±0.01</td>
<td>0.0352±0.03</td>
<td>0.0290±0.01</td>
<td></td>
</tr>
<tr>
<td>Palmitoleat C16:1 &amp;ns</td>
<td>0.0377±0.02</td>
<td>0.0753±0.03</td>
<td>0.0356±0.01</td>
<td></td>
</tr>
<tr>
<td>Oleat C18:1 &amp;ns</td>
<td>1.1305±0.69</td>
<td>1.5844±0.99</td>
<td>2.2212±0.84</td>
<td></td>
</tr>
<tr>
<td>Ersusat C22:1 &amp;ns</td>
<td>0.0348±0.02</td>
<td>0.0182±0.01</td>
<td>0.0156±0.01</td>
<td></td>
</tr>
<tr>
<td>Nervonat C24:1 &amp;ns</td>
<td>0.0244±0.01</td>
<td>0.0543±0.06</td>
<td>0.0086±0.00</td>
<td></td>
</tr>
</tbody>
</table>
Linoleat C18:2 0.0259±0.01^a 0.0382±0.02^a 0.1112±0.02^b
Linolenat C18:3^ns 0.0306±0.03 0.0418±0.02 0.0226±0.01
Gama Linolenat C20:3 0.0373±0.01^a 0.0980±0.08^a 0.2246±0.04^b
Arachidonat C20:4 0.0420±0.05^a 0.0504±0.03^ab 0.1692±0.02^b
Eicosapentanoic C20:5^ns 0.0054±0.00 0.0111±0.01 0.0036±0.00

in vitro one-stage (96 hours)
Laurat C12:0^ns 2.6187±1.55 3.077±1.45 3.2966±0.60
Mirisat C14:0^ns 0.1785±0.03 0.1825±0.11 0.2838±0.08
Pentadecanoat C15:0^ns 0.1634±0.05 0.2038±0.08 0.2527±0.07
Palmitat C16:0^ns 1.9381±0.23 1.4675±0.83 2.8529±0.64
Heptadecanoat C17:0^ns 0.0766±0.05 0.1050±0.04 0.1540±0.01
Stearat C18:0^ns 0.0299±0.00 0.0210±0.00 0.0288±0.00
Behenat C22:0^ns 0.0170±0.00 0.0614±0.00 0.0707±0.03
Lignocerat C24:0^ns 0.0116±0.00 0.0323±0.01 0.0406±0.01
Palmitoleat C16:1^ns 0.0900±0.02 0.0483±0.01 0.1006±0.03
Oleat C18:1^ns 2.3958±0.38 2.8937±1.24 4.1782±0.02
Eurat C22:1^ns 0.0110±0.00 0.0418±0.01 0.0433±0.02
Nervonat C24:1^ns 0.0148±0.00 0.0266±0.01 0.0233±0.01
Linoleat C18:2^ns 0.0659±0.03 0.0551±0.01 0.1319±0.11
Linolenat C18:3^ns 0.0346±0.01 0.0649±0.02 0.0343±0.00
Gama Linolenat C20:3 0.0547±0.06^a 0.0643±0.04^a 0.2280±0.08^b
Arachidonat C20:4 0.0325±0.01^a 0.0735±0.03^a 0.1783±0.02^b
Eicosapentanoic C20:5^ns 0.0185±0.00 0.0237±0.01 0.0658±0.04

^ns different superscripts in the same row showed highly significant differences (P<0.01), ^a not significantly different (P>0.05), T1 = 30% elephant grass + 30% rice straw + 25% basal concentrate + 15% SoyLem unprotected, T2 = 30% elephant grass + 30% rice straw + 25% basal concentrate + 7.5% SoyLem unprotected + 7.5% SoyLem protected, and T3 = 30% elephant grass + 30% rice straw + 25% basal concentrate + 15% SoyLem protected.

The result indicates that cattle feeds containing 15% protected polyunsaturated fatty acid (PUFA), especially arachidonic and linoleic fatty acids in hinger level than that of other treatment, both in one-stage (48 hours) fermentation and two-stages (96 hours) incubation of invtro fermentation. Both fatty acids have been proven to escape biohydrogenation by ruminal bacteria, therefore available post-ruminally. Protection is conducted by encapsulation of fat using matrix protein protected by aldehyde of formaldehyde. Matrix protein serves to bind aldehyde in formaldehyde in order for PUFA to escape ruminal hydrogenation so that PUFA can still be obtained post-ruminally and absorbed by small intestine as PUFA source. Linoleic fatty acids underwent elongation and desaturation in the process of biosynthesis. Linoleic fatty acid in soybean groats generates PGF2 using arachidonic acids. PUFA that escapes ruminal hydrogenation enters into circulatory system and subsequently stimulates ovariom cyclecity and corpus luteum function, therefore contributes to estrous cycle, ovulation, and fertility. Formaldehyde protection in fat using aldehyde binding with matrix can escape fatty acids from ruminal metabolism by up to 90% through the changes in three dimensional structure of aldehyde (Emanuele and Putnam, 2006). Protected fish oil supplements as sources of fatty acid can improve the duodenal conjugated linoleic acids (CLA) flow (Duckett and Gilis, 2010). Supplementation of fish oil, soya oil, and fish oil: soya oil (1:1) affects the differences in concentration of plasma glucose, triglyceride, and total cholesterol (Ghasemzadeh-Nava et al., 2011). Protective treatment in soybean meal can protect ruminal microbial fermentation, reducing digestibility of organic matters in vitro and decreasing gas
production during incubation significantly lower than that of protected fat supplements (Palizdar et al., 2012). Feed with higher level of linoleic acid affect the reproduction of beef cattle, feed rich in linoleic acids (C18:2) increase arachidonic acid concentration (C20:4) in the tissue and feed rich in linoleic acids (C18:3) increase the concentration and constitute a competitive inhibitor of enzyme complex involved in prostaglandin synthesis of arachidonic acids (C20:4) (Scholljegerdes et al., 2004).

Dry matter, organic matter and crude protein digestibility of beef cattle feeds contain soybean groats:lemuru fish oil (4:1) protected and unproctected against formaldehyde produced by ruminal liquid in vitro in single phase (48 hours) and two phases (96 hours) are presented in Table 2.

Table 2. Dry matter, organic matter and crude protein digestibility of beef cattle feeds contain soybean groats, protected and unprotected lemuru fish oil produced from ruminal liquid fermentation in vitro in single phase (48 hours) and two phases (96 hours)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
</tr>
<tr>
<td>in vitro one-stage (48 hours):</td>
<td></td>
</tr>
<tr>
<td>dry matter digestibility (%)</td>
<td>30.73±2.17&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>organic matter digestibility (%)</td>
<td>29.69 ±3.90&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>crude protein digestibility (%)</td>
<td>40.67±4.64&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>in vitro one-stage (96 hours)</td>
<td></td>
</tr>
<tr>
<td>dry matter digestibility (%)</td>
<td>37.29±3.56&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>organic matter digestibility (%)</td>
<td>50.68±6.23&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>crude protein digestibility (%)</td>
<td>57.91±7.66&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>b different superscripts in the same row showed significant differences (P<0.05), T1 = 30% elephant grass + 30% rice straw + 25% basal concentrate + 15% SoyLem unprotected, T2 = 30% elephant grass + 30% rice straw + 25% basal concentrate + 7.5% SoyLem unprotected + 7.5% SoyLem protected, and T3 = 30% elephant grass + 30% rice straw + 25% basal concentrate + 15% SoyLem protected.

The results of the study indicate that differences in the treatment of soybean groats and lemuru fish oil supplements protected and unproctected against formaldehyde affect the digestibility of dry matter, organic matter, and raw protein (P<0.05) generated from ruminal liquid fermentation in vitro in single phase (48 hours) and two phases (96 hours). Cattle feed supplemented with soybean groats and lemuru fish oil by 15% protected against formaldehyde have lower digestibility of dry matter, organic matter, and raw protein than those unprotected (P<0.05) resulted from ruminal liquid fermentation in vitro in one phase (48 hours) and two phases (96 hours). Table 1 indicates that the digestibility of dry matter, organic matter, and raw protein generated from ruminal liquid fermentation in vitro in one phase (48 hours) of the three is lower than that in two phases (96 hours). Decreased dry matter digestibility is due to the strength of protection so that ruminal digestive microbes and enzymes are not strong enough to digest dry matters during in the rumen, therefore ruminal microbes activities run optimally and improve the whole process of fermentation in the rumen. Riyanto et al., (2011) notes that dry matter digestibility affects organic matter digestibility. The digestibility of organic matter is proportional to that of dry matter as the former is the constituent of the latter. Cattle feed with protein level that provides sufficient nitrogen such as NH3 for microorganism and energy source that also sufficient for ruminal microbes will help organic matter digestion run normally. According to Stanton et al., (1983), soybean meal protected against 0.3% formaldehyde indicates decrease in ruminal nitrogen digestibility compared to the control, 0.2% and 0.6%. The use of formaldehyde has decreased raw protein digestibility, which is proportional to the decrease in dry matter digestibility. Proteins that have not been degraded
in the rumen are those that escape the 48 hours incubated ruminal degradation. Increased protein digestibility post-ruminally, more precisely in the abomasums with 96 hours incubation can be caused by protein bounded to formaldehyde that previously degraded in the rumen, finally can be degraded post-ruminally. Maynard and Loosly (1979) note that digestion coefficients are not similar for each food or cattle beef as they are influenced by several factors: chemical composition, food processing, amount of feed and the animal breed. Jayanegara et al., (2006) elucidate that concentrate rich in raw protein will activate ruminal microbes, therefore increasing the number of proteolitic bacteria and increased deaminase that increase the digestibility value of organic matter. Feed rich in linoleic acids (C18:2) will increase the arachidonic acid concentration (C20:4) in the tissue and feed rich in linoleic acid (C18:3) increases the concentration and is the competitive inhibitor of enzyme complex involved in prostaglandin synthesis from arachidonic acid (C20:4) (Scholljegerdes et al., 2004).

CONCLUSIONS

The conclusion of research is a mixture of soya groats and lemuru fish oil (4: 1) protected aldehydes can be used as a supplement of up to 15% in cattle feed rich in fatty acids and without disturbing the digestibility by in vitro one-stage and two-stage

REFERENCES


Maynard dan Loosly (1979)


Performance and Economic Efficiency of Young Anglo-Nubian Goat Fed Different Protein and Energy

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ABSTRACT: The aim of this study was to assess the economic efficiency as well as the performance of young Anglo-Nubian goat fed different protein and energy on its concentrate. Twelve young female Anglo-Nubian goats weighing on average (± SE), 35.03 ± 3.91 kg, were divided into three groups (R1, R2 and R3), and received different levels of crude protein (CP) and energy (as total digestible nutrient-TDN) in concentrate diets for 12 weeks trial. R1=16% CP, 62%TDN; R2= 15% CP, 65%TDN and R3= 14% CP, 68%TDN. All animal also offered King-grass ad-libitum and 1kg of mixed forages. Feed intakes measured daily but live weights weekly. The experiment conducted in a completely randomized design. Input and output analysis applied in order to assess the economic efficiency. The result showed that The concentrate diets had significant effects on CP and TDN intakes (p<0.05) but had not significantly (p>0.05) influenced the DMI, ADG and FCR. The DMIs were 1338, 1358 and 1369 g/d for R1, R2 and R3, respectively. The CP and TDN intakes for R1, R2 and R3 were 230 and 961 g/d, 228 and 1000 g/d, 223 and 1036 g/d. The ADGs for R1, R2 and R3 were 150.9, 134.5 and 112.3 g/d with the FCR values were 8.87, 10.09 and 12.20, respectively. Economic analysis from the use of higher protein concentrate was having most profitable with an average of income over feed cost (IOFC) of IDR 2000/head/day. Therefore, it can be concluded that the concentrate (R1) can be used for growing young Anglo-Nubian goats.

INTRODUCTION

Population of goat in Indonesia was around 17.483 thousand heads, and increases gradually about 4.6% per year involving 3.5 million household farmers in 2011 (DGLS 2012). In Indonesia there are many goat breeds such as the etawah cross breed, gembrong, jawa randu, kacang, kosta and saanen. Farmers usually keep the animals for dual purpose, milk and meat, but only a few of them raise goats for milk.

Anglo-Nubian goat is a newly introduced breed in Indonesia, the information on the feed intake, nutrient utilization and its performance of this breed are scant in Indonesia. However, a few attempts have been made to determine their requirements for growth and maintenance of tropical breeds of goats such as Etawah goat grade, based on the nutrient requirement adopted from Kearl (1982).

Feed costs typically represent 70% of the production cost in animal production. As a necessary step to remain profitable goat producers should be monitoring and making decisions based initially on the ‘income over feed costs’ (IOFC).

Income over feed cost (IOFC) is a gross margin concept that can be used as a preliminary indicator of whether the fattening operation is viable in the short run. Ishler (2010) reported that income over feed cost could be used to manage profitability in dairy cattle operation with large seasonal variation milk production. It would be expected that the measurement would be similarly useful in beef cattle fattening operation.
The objective of this study was to analyze the economic efficiency on Anglo Nubian goat fed different protein and energy.

MATERIALS AND METHODS

The experiments were conducted in IRIAP. Twelve young female Anglo-Nubian goats between 12-18 months of age and pre-trial average live weight of 35.03 ± 3.91 kg were divided into three treatment groups in a completely randomized design with 4 replications. Three experimental concentrates diets were formulated at different crude protein (CP) and total digestible nutrient (TDN) levels: R1= 16%CP, 62%TDN, R2=15% CP, 65%TDN and R3=14%CP, 68%TDN. Animals were offered King grass ad libitum, 1 kg of mixed forages and 1 kg of concentrate diets for 12 week’s trial. Table 1 shows the chemical composition of feed. Each animal was housed in a pen. Water were provided through a nipple in each pen. Feed intakes were measured daily, and live weights were measured by weekly. Parameters measured were nutrient (DM, CP and TDN) intake, average daily gain (ADG), feed conversion ratios (FCR) and Income Over Feed Cost (IOFC).

IOFC was measured in Indonesian rupiah per kid per day. Following Bailey et al. (2009), the IOFC is defined by the equation:

\[ \text{IOFC} = \text{PKW} \times \text{ADG} - \text{DFC}, \]

where

- \( \text{IOFC} \) = Income over feed cost (IDR/kid/day)
- \( \text{PKW} \) = Kid price of live weight (IDR/kg)
- \( \text{ADG} \) = Average daily gain (kg)
- \( \text{DFC} \) = Daily feed cost (IDR/kid)

Table 1. Chemical composition of feed (%)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Grass</th>
<th>Mixed forages</th>
<th>Concentrate diets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>R1</td>
</tr>
<tr>
<td>Dry matter</td>
<td>29.38</td>
<td>40.56</td>
<td>88.94</td>
</tr>
<tr>
<td>Crude protein</td>
<td>9.09</td>
<td>20.56</td>
<td>16.21</td>
</tr>
<tr>
<td>Total digestible nutrient</td>
<td>67.20</td>
<td>74.44</td>
<td>62.15</td>
</tr>
<tr>
<td>Neutral detergen fiber</td>
<td>63.65</td>
<td>56.24</td>
<td>36.75</td>
</tr>
<tr>
<td>Acid detergen fiber</td>
<td>48.27</td>
<td>50.71</td>
<td>29.03</td>
</tr>
<tr>
<td>Calcium</td>
<td>0.34</td>
<td>1.39</td>
<td>0.91</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.29</td>
<td>0.16</td>
<td>0.84</td>
</tr>
</tbody>
</table>

\( \text{R1}=16\%\text{CP 62}\%\text{TDN}, \text{R2}=15\%\text{CP 64}\%\text{TDN, R3}=14\%\text{CP 68TDN}\% \)

Statistical analysis. Feed intake, ADG, FCR and IOFC of goats were subjected to analysis of variance using General Linear Model (GLM) procedure of SAS (SAS Institute Inc., 2002). Differences between means were determined by Duncan’s multiple range tests at significant level of \( p<0.05 \).

RESULTS AND DISCUSSION

Kid Performance

Feeding of Anglo-Nubian goats with different levels of dietary protein and energy in concentrates had no effects on the DMI of grass and mixed forages \( (p>0.05) \), but had effects on the DMI of concentrates \( (p<0.05) \). Total DMI (grass, concentrate and mixed forage) were not different significantly \( (p>0.05) \) among the treatment diets. The DMI in this trial was in the range values...
of Kearl’s recommendation, which the requirement for goats 40-50 kg of BW and 125 g ADG was 1.05–1.40 kg. In contrast, Aregheore (2003) reported that the total DMI intake (concentrate and forage) reduced with the increase in the levels of dietary energy and decrease in the levels of protein in crossbred Anglo-Nubian goats in Samoa. Abdelrahman (2013) also observed that decreasing the dietary level of protein from one to 0.75 time NRC’s recommendation decreased the total feed intake in Shami goats.

Table 2. Nutrient intakes and performances of goats fed different levels of protein and energy.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Intakes, g</th>
<th>Treatment of concentrate diets</th>
<th>SE</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass</td>
<td></td>
<td>R1</td>
<td>R2</td>
<td>R3</td>
</tr>
<tr>
<td>Mixed forages</td>
<td></td>
<td>220</td>
<td>207</td>
<td>212</td>
</tr>
<tr>
<td>Concentrate</td>
<td></td>
<td>827</td>
<td>847b</td>
<td>863a</td>
</tr>
<tr>
<td>Total DM</td>
<td></td>
<td>1338</td>
<td>1358</td>
<td>1369</td>
</tr>
<tr>
<td>Crude protein</td>
<td></td>
<td>230</td>
<td>228ab</td>
<td>223b</td>
</tr>
<tr>
<td>TDN</td>
<td></td>
<td>961</td>
<td>1000b</td>
<td>1034a</td>
</tr>
<tr>
<td>ADG (g/h)</td>
<td></td>
<td>150</td>
<td>134.50</td>
<td>112.25</td>
</tr>
<tr>
<td>FCR</td>
<td></td>
<td>9.34</td>
<td>10.55</td>
<td>12.30</td>
</tr>
</tbody>
</table>

R1=16%CP 62%TDN, R2=16%CP 65%TDN, R3=16%CP 68%TDN%
SE= standard error

abcValue followed by different superscripts in the same row differ significantly (p<0.05).

Daily CP intakes of goats decreased with a decrease in the level of protein concentration (p<0.05) (Table 2). There were significant differences on CP intakes between goats on R1 and R3 treatments; however, and the differences were not significant between goats on R1 and R2 (p>0.05).

The mean protein intakes in this study was 227 g (14.12 g/BW0.75) that were higher compared to Kearl’s recommendation. Furthermore, the CPIs in this trial were higher compared to the total protein requirements for maintenance and gain as recommended earlier for young goats (Aregheore et al. 2003, Chobtang et al. 2009, Sahlu et al. 2004).

The TDN intakes of goats increased with a decrease the level of protein and increased the level of TDN in concentrates (p<0.05). The highest TDN intakes obtained at the concentrate R3, followed by R2 and R1. The means TDN intakes in this study were higher compared to Kearl’s recommendation for TDN intakes for goats but lower to previous results (Aregheore et al. 2003, Sahlu et al. 2004). Aregheore et al. (2003) estimated the optimal energy requirements in the diet for optimum performance of crossbred Anglo-Nubian goats was 13.4 MJ GE/kg BW (80.87% TDN). Sahlu et al. (2004) reported that the ME requirement of dairy goats for maintenance (MEm) and gain was 580 kJ/kg BW0.75 and 23.1 kJ/g ADG, respectively; these equal with 12.22 MJ/kg (80.91% TDN) for 40 kg of BW and 125 g of ADG. Similar result, Yagoub and Babiker (2008) observed, that the dietary energy level at 11.5 MJ/kg (72.2% TDN) produced the best performance of the female goat.

The ADG and FCR of the (R1), (R2) and (R3) were not statistically significant (p>0.05). (R1) was better in ADG and FCR values than those goats on (R2) and (R3). Decrease of dietary protein by one % and increase TDN by three % levels slightly induced a reduction in growth rate and FCR. These changes in live weight might be due to the better response on the changing of

**Income over feed cost (IOFC)**

Weller (1994) reported that live weight gain is highly correlated with feed efficiency for growing animals. The average daily growth rates had a direct effect on the IOFC achieved in these growing operations. Table 3 shows the result for IOFC for Anglo Nubian kid. Group (R1) which was fed highest protein content was almost two time higher IOFC than two others group but not significantly different among other group (P>0.05) at 2000 IDR/day. This was because the growth rate of group R1 was higher than group R2 and group R3 and this growth rate was more than sufficient to offset the greater expenditure on feed.

**Table 3.** IOFC of goats fed different levels of protein and energy

<table>
<thead>
<tr>
<th>Variables</th>
<th>Treatments</th>
<th>SE</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R1</td>
<td>R2</td>
<td>R3</td>
</tr>
<tr>
<td>Diets</td>
<td>King grass</td>
<td>749</td>
<td>705</td>
</tr>
<tr>
<td></td>
<td>Mix Forages</td>
<td>1.072</td>
<td>1.128</td>
</tr>
<tr>
<td></td>
<td>Concentrate</td>
<td>3.719</td>
<td>3.581</td>
</tr>
<tr>
<td></td>
<td>Total Feed Cost</td>
<td>5.541</td>
<td>5.413</td>
</tr>
<tr>
<td></td>
<td>ADG</td>
<td>151</td>
<td>135</td>
</tr>
<tr>
<td></td>
<td>Total Income</td>
<td>7.545</td>
<td>6.725</td>
</tr>
<tr>
<td></td>
<td>IOFC</td>
<td>2.004</td>
<td>1.312</td>
</tr>
</tbody>
</table>

SE= standard error
abcValue followed by different superscripts in the same row differ significantly (p<0.05)

This IOFC finding was lower to previous study by Krisnan (2013) that shown on boer goat fed 13% protein concentrate has given IOFC 2945 IDR/head/day. Supriyati et al. (2015) had reported that Etawah Goat grade given the highest IOFC of 1387 IDR/head/day being fed by Zn on its concentrate. These figures indicated that changes in feed price due to changes in feedstuff influenced goat performance, i.e. growth rate, and was a significant factor contributing to fluctuations in goat fattening cost of gains and its profit.

**CONCLUSIONS**

The different level of protein in the concentrates affected the nutrient intake but did not affect the ADG and FCR of young female Anglo-Nubian goats. Economic analysis from the use of higher protein concentrate was having most profitable with an average of income over feed cost (IOFC) of IDR 2000/head/day.

**REFERENCES**


Kearl, L.C. 1982. Nutrient Requirement of Ruminants in Developing Countries. International Feedstuffs Institute, Utah Agricultural Experiment Station, Utah University, Logan Utah. USA.


Effect of Choline Chloride Supplementation on Productive Performance of Ettawa Crossbred Goats

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Indonesian Research Institute for Animal Production, Bogor, 16720, Indonesia
Corresponding email: skompiang@yahoo.co.id

ABSTRACT: We evaluated the effect of supplementation with choline chloride through forced drinking technique on productive performance of Ettawa Crossbred (EC) does. Choline chloride is an essential component in ruminant diet required for fat metabolism and a methyl group donor for the formation of methionine. The experiment was conducted in a randomized block design with three treatments (T0, T1 and T2) and eight replications. The trial had two successive experimental periods: during the last eight weeks of gestation and the first 12 weeks of lactation. The treatments were: T0–control, T1-supplemented with 4 g choline chloride/head/2days, and T2-supplemented with 8 g choline chloride/head/2days. Choline chloride was given to the animals through force drinking technique, after dissolving it in 60 ml drinking water. The initial body weight of does were 38.81 ± 3.66 kg. The does were penned individually, and given fresh chopped King Grass (3 to 4 kg/head/day) and concentrate (700 g/head/d) during feeding trials. Water is available ad libitum through nipple. Variables of productive performance observed were DMI, ADG, FCR and productivity of does at kidding. Results showed that supplementations of choline chloride had no significant effects on the DMI, ADG and FCR during the late gestation. However, supplementations of choline chloride at both levels significantly increased the DMI (P<0.017) and ADG (P<0.003) during the lactation. There was no difference between choline chloride levels. The productivity of does at kiddings (number of kids, an average of birth weight, total birth weight and litter size) were not affected by treatments. In conclusion, supplementations of choline chloride through forced drinking technique increased the DMI and ADG during the lactation period of EC does.

Keywords: Choline chloride supplementation, Ettawa Crossbred does, Productive performance

INTRODUCTION

Choline is chemically known as P-hydroxy ethyl trimethylammonium ion (Baldi and Pinotti, 2006), an essential component in ruminant diet, required for fat metabolism and a methyl group donor for the formation of methionine (Sales et al., 2010). Choline or choline compounds can not entirely synthesized in the body. Therefore, it is necessary to supplement choline in the feed or drinking water, especially during the transition period. Choline can be absorbed from the lumen of the small intestine. The addition of choline chloride in feeds improved nutrient digestibility, feed efficiency, milk production, and milk quality in dairy cows (Sales et al., 2010; Mohsen et al., 2011) and dairy goats (Pinotti et al., 2008). The choline chloride supplementation also increased conception rate and pregnancy rate in cows (Oelrichs et al., 2004) and increased productive performance in goats (Savoini et al., 2010).

Choline is available in market in the form of choline chloride compounds. Choline chloride is a white crystalline solid, in the form of an aqueous solution that is approximately 70-75% w/w in water. Also, there are in the choline chloride medium feed ingredients such as wheat pollard or corn cobs meal containing 60% choline chloride. Choline found in barley, corn, corn gluten meal, fish meal, soybean meal, cotton meal, and alfalfa hay; which the level of choline is less than
0.68 mg/g of dry matter and digestibility values varying from 0.80-0.84 (Sharma and Erdman, 1989). In ruminant, choline is extensively degraded in the rumen (Atkins et al., 1988; Sharma and Erdman, 1988a). To improve the utilization of choline in ruminants, administration were carried out by dissolving choline chloride in water, through abomasal infusion (Sharma and Erdman, 1988a; Kerri et al., 1998), duodenal infusion (Sharma and Erdman, 1988b), or supplementation with rumen-protected choline (Mohsen et al., 2011). In this research, we evaluated the effect of supplementation with choline chloride through forced drinking technique on productive performance of EC does.

MATERIALS AND METHODS

Commercial choline chloride, containing 60% choline chloride was used as a source of choline chloride. Twenty-four EC does from the second gestation period, with initial body weight of 38.84 ± 3.66 kg were used in this experiment. The experiment was conducted in a randomized block design with three treatments (T0, T1 and T2) and eight replications. The trial had two successive experimental periods: during the eight weeks of late pregnancy and the first 12 weeks of lactation. The treatments were: T0 – control, T1-supplemented with 4 g choline chloride/head/2days, and T2 supplemented with 8 g choline chloride/head/2days. Choline chloride was given through force drinking technique, after dissolving it in 60 ml drinking water. The does were penned individually, and given fresh chopped King Grass (3 to 4 kg/h/d) and concentrate (700 g/h/d) during feeding trials. The chemical composition of grass and concentrate is presented in Table 1. Water is available ad libitum through nipple. Total feed intake was measured daily, and the animals were weight every two weeks. The variables of productive performance observed were body weight (BW) changes, dry matter intake (DMI), average daily gain (ADG) of does and the productivity of does at kiddings (number of kids, an average birth weights, total birth weights and litter size). Grass and treatment diets were analysed by using AOAC methods for dry matter, crude protein, acid detergent fiber, calcium, phosphorus (AOAC, 2005) and neutral detergent fiber (AOAC, 1995). Gross energy was determined by using bomb calorimeter and the result used for total digestible nutrients (TDN) calculation (NRC, 1981).

### Table 1. Chemical composition of grass and the concentrate diets (on DM basis)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Grass</th>
<th>Level of supplementation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>T0 (0 g)</td>
</tr>
<tr>
<td>Crude protein (%)</td>
<td>10.51</td>
<td>14.49</td>
</tr>
<tr>
<td>Gross energy (kcal/kg)</td>
<td>3871</td>
<td>4088</td>
</tr>
<tr>
<td>Total digestible nutrients (%)</td>
<td>66.48</td>
<td>70.21</td>
</tr>
<tr>
<td>Neutral detergent fiber (%)</td>
<td>71.03</td>
<td>26.27</td>
</tr>
<tr>
<td>Acid detergent fiber (%)</td>
<td>49.35</td>
<td>12.82</td>
</tr>
<tr>
<td>Calcium (%)</td>
<td>0.26</td>
<td>2.72</td>
</tr>
<tr>
<td>Phosphorus (%)</td>
<td>0.18</td>
<td>0.55</td>
</tr>
</tbody>
</table>

Data were evaluated statistically by a standard analysis of variance (SAS 2002). If there was a significant difference between treatments, the difference then was compared using Duncan’s Multiple Range Test.
RESULTS AND DISCUSSION

Results showed that the supplementations of choline chloride did not affect the DMI, ADG and FCR values during the last eight weeks of gestation. The supplementation also increased DMI and ADG (P<0.05) during the first 12 weeks lactation period (Table 2).

Table 2. Body weight, DMI, ADG and FCR performance of goats during trial

<table>
<thead>
<tr>
<th>Variables</th>
<th>Level of supplementation</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T0 (0 g)</td>
<td>T1 (4 g)</td>
<td>T2 (8 g)</td>
</tr>
<tr>
<td>Gestation period:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial body weight (kg)</td>
<td>38.88</td>
<td>38.75</td>
<td>38.81</td>
</tr>
<tr>
<td>Body weight pre-parturition (kg)</td>
<td>45.38</td>
<td>45.25</td>
<td>44.83</td>
</tr>
<tr>
<td>Dry matter intake (g/d)</td>
<td>1177</td>
<td>1248</td>
<td>1187</td>
</tr>
<tr>
<td>Average daily gain during late pregnancy (g)</td>
<td>116.07</td>
<td>119.07</td>
<td>107.14</td>
</tr>
<tr>
<td>Feed conversion ratio</td>
<td>10.14</td>
<td>10.48</td>
<td>11.08</td>
</tr>
<tr>
<td>Lactation period:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body weight at kidding (kg)</td>
<td>36.75</td>
<td>37.13</td>
<td>35.80</td>
</tr>
<tr>
<td>Body weight decreased at kidding (kg)</td>
<td>8.63</td>
<td>8.13</td>
<td>9.01</td>
</tr>
<tr>
<td>Body weight at 12 weeks lactation (kg)</td>
<td>37.38</td>
<td>40.44</td>
<td>40.06</td>
</tr>
<tr>
<td>Dry matter intake (g/d)</td>
<td>1168b</td>
<td>1233a</td>
<td>1229a</td>
</tr>
<tr>
<td>Average daily gain 12 weeks (g)</td>
<td>7.44b</td>
<td>39.44a</td>
<td>50.74a</td>
</tr>
</tbody>
</table>

SEM= standard error of means

*Values followed by different superscripts in the same row differ significantly (P<0.05).

Supplementations of choline chloride did not affect DMI and BW during the last eight weeks of gestation. These results were in agreement with those obtained by earlier researchers (Piepenbrink and Overton, 2003; Guretzky et al., 2006; Mohsen et al., 2011) who supplemented cows’ diets with choline during the late pregnancy. Furthermore, the additions of choline chloride increased DMI (P<0.05) during the first 12 weeks lactation period. These results agree with those obtained by earlier researchers (Piepenbrink and Overton, 2003; Guretzky et al., 2006; Mohsen et al., 2010). They found that rumen-protected choline supplementation for cows affected nutrient intakes during the first three weeks postpartum. The improvement of nutrient intake might be due to the better nutrient digestibility, as reported by Mohsen et al. (2010). The supplementation of choline chloride did not affect BW at kiddings and 12 weeks lactation of does (P>0.05). But the supplementation increased ADG (P<0.05) of does during lactation periods. The different levels between 4 g/h/2d and 8 g/h/2d dissolved choline chloride in water gave no differences in DMI and ADG during the lactation period. The level of 8 g/h/2d choline chloride in this trial was similar with the level as reported by Pinotti et al. (2008) who supplemented of 4 g/h/d of choline to dairy goats. The productivity of does at kiddings (number of kids, an average birth weight, total birth weight and litter size) were not influenced by supplementation of choline (P>0.05) (Table 3). Birth weight and litter size of EC kids in this study were similar to average birth weight of 2.9 to 3.5 kg and litter size of 1.5 reported in previous studies (Sutama et al. 2008; Supriyati et al. 2008).
Table 3. The productivity of does at kiddings

<table>
<thead>
<tr>
<th>Variables</th>
<th>Level of supplementation</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T0 (0 g)</td>
<td>T1 (4 g)</td>
<td>T2 (8 g)</td>
</tr>
<tr>
<td>Number of kids (n/doe)</td>
<td>12</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Average birth weight (g/h)</td>
<td>3.22 ± 0.59</td>
<td>3.00 ± 0.60</td>
<td>3.20 ± 0.73</td>
</tr>
<tr>
<td>Total birth weight (kg/doe)</td>
<td>4.83 ± 1.58</td>
<td>4.50 ± 1.24</td>
<td>5.28 ± 1.20</td>
</tr>
<tr>
<td>Litter size</td>
<td>1.50 ± 0.53</td>
<td>1.50 ± 0.53</td>
<td>1.63 ± 0.52</td>
</tr>
</tbody>
</table>

Values are expressed as mean ± sd
SEM= standard error of means

CONCLUSION

Supplementation of choline chloride at both levels (4 or 8 g/head/2days) through forced drinking technique did not affect the DMI, ADG and FCR values during the last eight weeks of gestation. But the addition of choline chloride increased the DMI and ADG during the first 12 weeks lactation period. The productivity of does at kiddings (number of kids, an average birth weight, total birth weight per doe and litter size) were not affected by treatments of choline chloride.

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Body Weight Gain of Donggala Bull Given Supplement Feed on Basis of Cocoa Pod Husks Fermentation

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ABSTRACT: Donggala cattle is one of native cattle in Indonesia which has the largest contribution in meat providers for the local and other provinces. One of livestock management is by improving the feeding management with feed supplement on basis of cocoa pod husk (CPH) fermentation with natural microbes. The aims of the research was to determine the effect of feeding supplement on basis of CPH fermentation on the body weight gain of Donggala bulls. CPH was fermented using natural microbes (anaerobic condition). The total of Donggala bulls used were 12 heads. Daily feed treatment for every bull, P₀: CPH without fermenting+natural grass ad-libitum (farmer method), P₁: CPH fermentation 30% on diet and P₂: CPH fermentation 60% on diet. The content of CPH nutrients were analyzed by proximate method. Feed supplement on basis of CPH fermentation was feeding trials on beef cattle with total of crude protein content about 12%. Adaptation of feeding supplement on Donggala bull was done for 15 days and continued with feeding trials during 3.5 months. The measurement of body weight was done every two weeks, in the morning before feeding. Statistical analysis used a complete randomized design (CRD) and tested with the smallest real difference (SRD) test. The result of statistical analysis shown that average daily gain (ADG) of beef cattle for P₂ was significant (P<0.05) higher than P₁ and P₀ which were 0.93 kg, 0.70 kg and 0.36 kg, respectively. It was concluded that the highest of ADG with feeding on basis of CPH fermentation with added 60% on feed supplement.

Keywords: Donggala Bull, Body Weight, FCR, CPH, Fermentation

INTRODUCTION

Donggala cattle is one of native cattle in Indonesia which has the largest contribution in meat providers for local and other provinces. However, the development of Donggala cattle is not optimal due to general system maintenance extensively and intensively. Semi intensive rearing system, farmers put in the animals in the simple pen and give them natural grass only. Feeding the animals are not concerned to fulfill their feed nutrients needs. This is caused by ignorance of farmers in feeding management for primarily calculating the needs of beef cattle (for main live, production, and reproduction) so that, it lower the increase of the beef cattle body weight and low erreproductive performance (Rusdin et al., 2009).

One of livestock management is by improving the feeding management with feed supplement on based on cocoa pod husk (CPH) fermentation with natural microbes. It because the agricultural by-products are usually characterized by their low nutritional quality, they also contain highly fibrous materials and low protein content (Laconi and Jayanegara, 2015). Fermentation using natural microbes is expected to guarantee continuation of fermentation process of the feed materials particularly in the rural areas and easier with a cheap cost. However, the fermentation process with natural microbes in anaerobic condition is a longer fermentation time compared with commercial microbes, but changes in the chemical composition is relatively the same. The
The anaerobic fermentation process is commonly types of natural microbes such as lactic acid bacteria (LAB) and yeast (Yang et al., 2006). During the ensilage process, LAB decomposes the cellulose become hemiselulose into simple sugars. Some bacteria change simple sugars into lactic or acetic acid, and butyric. The perfect fermentation process must produce a product in the form of lactic acid, because lactic acid is produced by lactic acid bacteria which will avoid the feed materials from damage and also attack the decomposer bacteria, so that the feed materials are more durable and long lasting. Lactic acid contained in the silage is consumed by the ruminants, are used as energy source and also as probiotics (Widyastuti, 2008).

The CPH fermentation process uses natural microbes is expected to improve nutrient and digestibility and to be stored in long period of time. CPH Fermented with *Phanerochaete chrysosporium* and added 3% molasses (w/w) with crude protein content to increase up to 10.0% and crude fiber to decrease become 45.6%, while CPH without any treatment is crude protein content only 8.4 % and crude fiber about 55.7% (Laconi and Jayanegara, 2015). The aims of the research was to determine the effect of feeding supplement on based of CPH fermentation on the body weight gain of Donggala bulls.

**MATERIALS AND METHODS**

The research was conducted on June-November 2013 in Tanah Mpuulu Village, South Banawa Sub-District, Donggala Regency, Central Sulawesi Province. The total of Donggala bulls (the local cattle) used were 12 heads whose age were about 1.5-2.0 years old. Every feeding trial used four head animals. Daily feeding trial for group bull, P₀: CPH without fermenting+natural grass *ad-libitum* (farmer method), P₁: CPH fermentation 30% on diet and P2: CPH fermentation 60% on diet. The content of CPH nutrients were analyzed by proximate method. Feed supplement on based of CPH fermentation was feeding trials on beef cattle with total of crude protein content was about 12%. Additional of feed materials as a protein and energy sources for P₁ and P₂ were fish mill 0.1 kg and rice bran 1.2 kg. Basal feed was given fresh natural grass about 10-15 kg, while P₀ in range was 25-35 kg. Adaptation of feeding supplement on Donggala bull was done for 15 days and continued with feeding trial during 3.5 months.

CPH was placed under the solar sun in the whole day during 3-5 days. Later, the grinded CPH was fermented using natural microbes in anaerobic condition during 21 days. Moisture content of CPH during fermentation process was estimated about 35-40%. The urea was added 1% of a total CPH (on dry matter basis) as nitrogen source for microbial activity. Nutrient content of feed materials were analyzed by proximate method (AOAC, 2005) in Laboratory of Feed Science, Faculty of Animal Science, Universitas Gadjah Mada, Yogyakarta. Data and information were collected and analized in both of quantitative manner. Computation of feed conversion ratio (FCR) according to the formulation by Kellems and Church (1998) and suppoted by Shike (2013) namely:

\[
FCR = \frac{\text{weights the feed consumed}}{\text{unit of a product produced}}
\]

The measurement of body weight was done every two weeks, in the morning before feeding treatment. Statistical analysis used a complete randomized design (CRD) and tested with the smallest real difference (SRD) test according to the procedure of Gomez and Gomez(1984).
RESULTS AND DISCUSSION

Chemical Composition of Feed Materials

Chemical composition of feed materials for the animals with material base on CPH anaerobic fermentation is showed on Table 1 below.

**Table 1. Chemical Composition of Feed Materials**

<table>
<thead>
<tr>
<th>Feed Materials</th>
<th>Chemical Composition (%)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DM</td>
<td>OM</td>
</tr>
<tr>
<td>Natural Grass</td>
<td>85.35</td>
<td>75.09</td>
</tr>
<tr>
<td>CPH non Fermentation</td>
<td>87.97</td>
<td>74.23</td>
</tr>
<tr>
<td>CPH Anaerobic Fermentation</td>
<td>88.70</td>
<td>76.25</td>
</tr>
<tr>
<td>Fish Mill</td>
<td>89.54</td>
<td>41.89</td>
</tr>
<tr>
<td>Rice Bran</td>
<td>90.17</td>
<td>64.14</td>
</tr>
<tr>
<td>Feed (Anaerobic Fermentation)</td>
<td>88.94</td>
<td>71.57</td>
</tr>
</tbody>
</table>


Feed Intake, Body Weight Gain and Feed Conversion Ratio

The feed intake, body weight gain and feed conversion ratio of animals with feed material based on CPH anaerobic fermentation was seen on Table 2 below.

**Table 2. Feed Intake, Body Weight Gain and Feed Conversion Ratio**

<table>
<thead>
<tr>
<th>Description</th>
<th>Treatment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed intake (kg DM)</td>
<td>(P_0)</td>
<td>(P_1)</td>
</tr>
<tr>
<td></td>
<td>23.17±7.36</td>
<td>11.33±0.94</td>
</tr>
<tr>
<td>Initial body weight</td>
<td>181.00±57.54</td>
<td>204.25±10.40</td>
</tr>
<tr>
<td>Find weight (kg)</td>
<td>218.75±65.77</td>
<td>277.75±12.97</td>
</tr>
<tr>
<td>Increasing body weight (kg)</td>
<td>37.50±8.89</td>
<td>73.50±10.41</td>
</tr>
<tr>
<td>Average daily gain (kg/day)</td>
<td>0.36±0.085</td>
<td>0.70±0.099</td>
</tr>
<tr>
<td>Feed conversion ratio (FCR)</td>
<td>63.61b±10.61</td>
<td>16.49a±2.61</td>
</tr>
</tbody>
</table>

ab Different superscripts in the same columns denote significant differences (P<0.05)

The results of Donggala bulls weighing every two weeks showed that giving of feed supplement on basis of CPH anaerobic fermented may be raising weights of animals. This can be showed at the end of the research which is \(P_1\) and \(P_2\) occur increasing of body weight. While body weight of \(P_0\) was sometimes given CPH without fermenting (CPH chop) also increasing relatively low which it can be seen in Table 2. Development of body weight every two weeks the animal was conducted measurements. Measurements result showed that tend to increasing of body weight (Figure 1).
The increase of average daily gain (ADG) of Donggala bull on P$_2$ 0.93 kg was significant differences (P<0.05) compared to that of P$_1$ and P$_0$ with ADG 0.70 kg and 0.36 kg, respectively. The high of ADG was feeding on basis of adding CPH 60% which is the highest portion than other treatments. The high of CPH fermented portion (60%) in ration did not influence the animals’ feed consumption because CPH in anaerobic fermentation has a good odor and flavor. This condition made the animals more interested in consuming the feed supplement. Preston and Leng (1987); Baumont (1996) reported that taste, odor and flavor were importance factors in feed. Animal can refuse the feed given without tasting it first because they dislike the flavor. FCR of P$_2$ 11.76 was significant differences (P<0.05) more efficient than P$_1$ and P$_0$ 16.49 and 63.61, respectively. Bertram and Oliver (1990) reported that feed conversion was affected by feed quality (particle size, processing, and nutritional levels), cattle body weight, sex, cattle temperament, growth promotant and rumen modifiers. According to Siregar (2008) that feed conversion that is good for the beef cattle is ranging between 8.56 to 13.29. P$_2$ has FCR in ideal range which gather fewer feed need for raising body weight per unit than P$_1$ and P$_0$. This condition was caused by P$_2$ that consumed more feed supplement on basis of CPH with portion of 60% but fewer to consume natural grass which is more efficient to raise body weight per unit. Feed intake of P$_2$ was only 10.56 kg (DM) lower than P$_1$ 11.33 kg (DM) and P$_0$ 23.17 kg (DM) or lower 0.77 kg (P2 versus P1) and 12.61 kg (P2 versus P$_0$), respectively.

**CONCLUSIONS**

It was concluded that the highest of ADG with feeding on based of CPH fermentation with high percentage (60%) in feed supplement which was followed by FCR was the most efficient.

**REFERENCES**


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Influence of Cellulolytic Bacteria from Rumen Fluid on in Vitro Gas Production of Fermented Robusta Coffee Pulp (*Coffea canephora* sp.)

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**ABSTRACT:** The experiment was done to evaluate the influence of robusta coffee pulp fermented by rumen cellulolytic bacteria on in vitro gas production. The first step of this experiment was cellulolytic inoculum production by using fluid fermentation with cellulose as substrat. The inoculum produced was then used for coffee pulp fermentation. Cellulolytic bacteria was added into 200 g coffee pulp as much as 0%, 5% and 10% based on dry matter. Each treatment had three replicates. Fermentation was carried out at room temperature during 21 days anaerobically. At the end of fermentation, samples were taken out for nutrient determination including physical, chemical qualities, and in vitro gas production. Data obtained were analyzed by one way design and continued by Duncan’s new multiple range test to examine the differences between mean values. The results showed that 5% and 10% cellulolytic bacteria addition decreased pH value, and crude fiber (CF) content as much as 12.89% and 16.32% compared to control (0% of cellulolytic bacteria). Whereas addition of 10% inoculum increased nitrogen free extract (NFE) content. However, cellulolytic bacteria addition up to 10% had no effect on crude protein (CP), extract ether (EE), dry matter (DM), organic matter (OM), glucose, and lactic acid content, as well as in vitro gas production. It could be concluded that cellulolytic bacteria addition in level 5% decreased CF content but did not give positive effect on in vitro gas production.

**Keywords:** Cellulolytic Bacteria, Chemical Composition, Coffee Pulp, In Vitro Gas Production

**INTRODUCTION**

Coffee pulp is an abundant agricultural by-product derived from wet processing of coffee berries from the coffee industry. Coffee pulp is the most important by-product of the so called wet coffee processing, as it represents about 40% of the fruit on a fresh weight basis, and 29% on a dry weight basis (Gaime-Perraud *et al*., 1993). Coffee pulp is the first product obtained during processing, and it represents on a dry-weight basis about 29% of the weight of the whole berry (Ellas, 1979). This may constitute a source of severe contamination and a serious environmental problem. For this reason, efforts have been made to develop methods for its utilization as a raw material for the production of feeds. Fermented coffee pulp is a valid alternative to handling and storing the huge amounts of coffee pulp.

Limitations for the use coffee pulp in animal feeding are connected to its high contents on tannins and caffeine. However, coffee pulp contains proteins, carbohydrates and minerals that may favor its utilization in animal feeding (Mazzafera, 2002). Taking into account the average contents of about 50, 10, 2.5 and 18% for carbohydrate, protein, fat and fibres, coffee pulp appear to be a useful feed supplement for animals (Orozco *et al*., 2008). Ellas (1979) reported the dried coffee pulp has about 10% crude protein, 21% crude fibre, 8% ash, and 44% nitrogen-free extract, as well as 1.80-8.56 % tannins, and 1.3 caffeine. Due to the presence of these compounds (caffeine,
tannins and polyphenols), these organic solid residues show toxic nature and thus have not been utilized beneficially. This has also led to the problem of environmental pollution (Parani and Eyini, 2012).

Several biological treatments including the use of microorganisms such as yeast, filamentous fungi and bacteria are being applied to improve the nutritional value of coffee pulp. Although solid-state fermentation (SSF) has been used for specific biological detoxification of coffee pulp using filamentous fungi at laboratory scale, no data on the suitability of streptomycetes for this purpose has been reported. The ability of these microorganisms to colonize agro-industrial residues and to produce a wide range of enzyme activities related with lignocellulose degradation make them good candidates for biotechnological recycling of coffee pulp (Orozco et al., 2008). In most cases, the processes have been designed to render coffee pulp suitable for animal feeding, either in the form of silage or as a dried product (Bressani, 1979). Cabezas et al., (1979) reported ensiled coffee pulp produces better performance than dehydrated pulp, due possibly to its better palatability, better digestibility, and lower content of caffeine and tannins.

In this paper, the experiments were conducted to evaluate the influence of robusta coffee pulp fermented by rumen cellulolytic bacteria on in vitro gas production. The effect of the different levels of rumen cellulolytic bacteria on chemical composition and in vitro digestibility were investigated.

**MATERIALS AND METHODS**

**Culture conditions**

Following heat sterilization (121 °C for 30 min), the enrichment medium according Omelianski (1902) cit. Skinner (1971), with cellulose as substrate, was inoculated with 10% of rumen liquor. The culture was grown at temperature 39°C, pH 7 for 7 d anaerobically under submerged culture condition. The the culture was then inoculated in growth medium according Omelianski (1902) cit. Skinner (1971), with cellulose as substrate, in the same condition with enrichment culture, and continued by inoculation for fermentation of coffee pulp. The primary bacteria in this product was cellulolytic bacteria.

**Fermentation of coffee pulp**

After growing for 7 d, the culture of cellulolytic bacteria was mixed to 200 g of air-dried coffee pulp, and incubated anaerobically at room temperature for 21 d. The culture was added to achieve final concentrations of 0, 5, or 10% based on DM of coffee pulp. The final water content of fermentation was 45% for all treatments by adding distilled water. At the end of the fermentation period, pH, glucose and lactic acid was determined. Then, sample was collected, dried at 55°C for 72 h, ground through a 1-mm screen Wiley mill and analyzed for chemical composition as well as for in vitro digestibility gas production.

**Analysis of Fermentation Parameters**

- **pH of fermentation.** pH of coffee pulp was immediately recorded using a pH meter after fermentation process.
- **Glucose content.** Glucose content was measured according procedure Nelson-Somogyi (Plummer, 1971).
- **Lactic acid content.** Lactic acid content was analyzed following Baker and Summerson method (Hawk et al., 1976)
- **Chemical composition.** The samples, before and after fermentation, were analyzed for chemical composition including dry matter (DM), organic matter (OM), crude fiber (CF), crude
protein (CP), ether extract (EE), and nitrogen free extract (NFE) according to AOAC procedure (2005). These analyses were carried out for original and fermented sample of coffee pulp to determine the effect of fermentation on chemical composition and in vitro digestibility gas production.

In vitro digestibility gas production technique. Determination of in vitro digestibility gas production technique was conducted following procedure described by Menke and Steingass (1988). In vitro incubations were carried out with rumen fluid from two fistulated Ongole Cross Breed previously fed with 40% concentrate feed (rice bran) and 60% Penicetum purpuroides at 5% body weight. The rumen liquor was collected from the beets before they were offered the morning feed into the thermo flask that had been pre-warmed to a temperature of 39°C and was squeezed through four layers of surgical gauze into an Erlenmeyer flask and flushed with CO2 in the laboratory. One part rumen fluid was mixed with two parts buffered mineral solution (1:2 volume/volume) and maintained at 39°C. Approximately 0.300 g of air-dried fermented coffee pulp of known chemical composition that was previously ground through a 1 mm screen was carefully dropped into a 100 ml glass syringe and thereafter, 30 ml this buffered rumen fluid under continuous flushing with CO2 pipetted into incubation syringes containing the ground test substrate. The syringe was tapped and pushed upward by the piston in order to completely eliminate air in the inoculums. The silicon tube in the syringe was then tightened by a metal clip so as to prevent escape of gas. Incubation was carried out at 39±1°C and the volume of gas production was measured at 1, 2, 4, 6, 8, 12, 24, 36, 48 and 72 h, and 72-h cumulative gas production in vitro measured following fitcurve method (Chen, 1994). Blanks were run in triplicates throughout the incubation process.

Experimental Design and Statistical Analysis

Treatments were arranged in a one way design, with the main factors being levels of rumen cellulolytic bacteria (containing 0, 5, or 10% DM basis). Fermentation experiments were separately conducted for each treatment with three replicates each treatment. Air-dried coffee pulp was utilized as substrate for solid state fermentation. The data were analyzed as a one way design. The differences of mean value were analyzed by Duncan’s new multiple range test (Rosner, 1990).

RESULT AND DISCUSSION

Chemical composition of fermented coffee pulp

The chemical composition including DW, OM, CP, CF, EE, and NFE of coffee pulp was 66.00%, 87.01%, 23.27%, 42.73%, 1.46%, and 19.54%, respectively. Fermented coffee pulp had low pH value 5.91, 5.81 and 5.57 with addition of 0, 5, or 10% of rumen cellulolytic bacteria respectively. Addition 10% cellulolytic bacteria decreased pH value of fermented coffee pulp significantly (P<0.05). However, it did not affect lactic acid content, those were 0.12-0.15%.

| Table 1. Chemical composition (% DW) and glucose content (mg/g) of fermented coffee pulp with different level of rumen cellulolytic bacteria |
|--------------------------------------------------|---------|---------|---------|
| Chemical composition          | Level of inoculum addition (%) | 0       | 5       | 10      |
| Dry materials                  | 58.73±0.04 | 59.90±0.01 | 63.19±0.01 |
| Organic materials             | 86.97±0.63  | 87.09±1.20 | 86.61±1.87  |
| Crude proteins                | 25.42±1.15   | 25.19±0.27  | 23.87±0.86  |
| Crude fibers**                | 41.36±0.80    | 36.03±0.80    | 34.61±0.56    |
Ether extracts | 2.32±0.30 | 2.85±0.48 | 2.62±0.33
NFE* | 17.87±2.57 | 23.02±1.62 | 25.50b±0.74
Glucose (mg/g)* | 0.09±0.03 | 0.07±0.05 | 0.06±0.01

** not significantly different
* (P<0.05)
** (P<0.01)

Fermentation of coffee pulp using 5 or 10% rumen cellulolytic bacteria decreased CF content 12.89 or 16.32%, and increased NFE content 28.82 or 42.70% compare without inoculum (Table 1). The decrease of the CF content was due to inoculum had cellulases activity (data not shown).

**In vitro digestibility gas production**

As shown in Table 2, fermented coffee pulp with addition of cellulolytic bacteria did not show significant effect and resulted low cumulative gas production in vitro at 72-h incubation, it means low digestibilty of substrate, eventhough CF content of fermented coffee pulp decreased.

**Table 2.** Cumulative gas production in vitro (ml/300mg DW), fraction a (ml/300mg DW), b (ml/300mg DW), and c (ml/h) of fermented coffee pulp with different level of rumen cellulolytic bacteria 72-h incubation

<table>
<thead>
<tr>
<th>Level of inoculum addition (%)</th>
<th>0</th>
<th>5</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total gas productionns</td>
<td>12.22</td>
<td>12.11</td>
<td>13.63</td>
</tr>
<tr>
<td>a*</td>
<td>-0.63</td>
<td>0.02</td>
<td>0.26</td>
</tr>
<tr>
<td>b*</td>
<td>12.50</td>
<td>12.01</td>
<td>14.19</td>
</tr>
<tr>
<td>c*</td>
<td>0.06</td>
<td>0.05</td>
<td>0.04</td>
</tr>
</tbody>
</table>

** not significantly different

This phenomenon was due to limitations for the use coffee pulp in animal feeding are connected to its high contents on tannins and caffeine. Tannins are known to confer astringency to foodstuffs and complex proteins, affecting food digestibility and decreasing nitrogen utilization animals (Mazzafera, 2002). Getachew et al. (2004) reported some feeds, such as forage legumes and cottonseed, contain phenolics, alkaloids and saponins that have negative biological effects on microbes and reduce microbial growth in rumen. Tannins are naturally occurring polyphenolic compounds found in plants, which form complexes with feed and microbial proteins and can depress feed digestibility in the rumen.

**CONCLUSION**

The addition of 5% cellulolytic bacteria improved chemical composition of fermented coffee pulp especially decreased CF content.

**REFERENCES**


Growth and Productivity of *Brachiaria brizantha* cv MG 5 under the effect of different dose of NPK fertilization

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**ABSTRACT:** This research aimed to investigate the influence of a different dose of NPK fertilization to growth, productivity, and nutrient content of *Brachiaria brizantha* cv. MG 5. The research was conducted at the Green House of Faculty of Animal Science Universitas Gadjah Mada. Regosols added with manure as basic fertilizer was placed in the poly bag with diameter 25 cm and capacity up to 10 kg. Germination was performed on the poly tray then its results were moved to the poly bag. NPK fertilization was treated on three levels with five replications. The treatment was as follows: given NPK fertilizer level 0 kg ha\(^{-1}\) (P0), 150 kg ha\(^{-1}\)(P1) and 300 kg ha\(^{-1}\) (P2), respectively. Fertilization was performed twice during the cultivation period on the 15 and 30 days old. The primary and secondary tillers, the plant’s height, and length were observed once a week in 60 days. Devoliation was performed on the 60th day, with the plants’ height of 10 cm from the soil surface. The variable observed was the plants’ height and length, root biomass production, the ratio of stem and leaves, and dry and organic matter contents. The data was analyzed using analysis of variance. Further, the significantly different result was tested with Duncan’s New Multiple Range Test. The research data showed that the average of the growth of the plants’ length per week for *Brachiaria sp* age 60 days fertilization level 300 kg/ha resulted the longest plant of 130.7 cm and different (P<0.1) than the others. The number of tillers resulted in no difference, but the biomass production showed that fertilization 150 kg/ha and 300 kg/ha resulted in higher production than 0 kg/ha (P<0.1). The research showed that fertilization 150 kg/ha resulted in higher biomass production than 0 kg/ha, but that of 300 kg/ha did not show a significant difference.

**Keywords:** *Brachiaria sp* grasses, NPK fertilizer dose, nutrient content, growth, production

**INTRODUCTION**

*Brachiaria brizantha* grasses are very productive and suitable for continuous or rotational grazing. *Brachiaria brizantha* is resistant to animal’s step and chomp, and also resistant to drought. Miles *et al.* (1996) states that the nutrient value of *Brachiaria brizantha* grass depends on the soil fertility, fertilizing and the plant regrowth. The crude protein content of *Brachiaria brizantha* in the tropics is 7 to 16%, and the digestibility is 51 to 75%. This grass grows well in the dry season with DM production about 8 to 20 tons/ha/year.

*Brachiaria brizantha* grass is very responsive to nitrogen fertilizer, grows well at an altitude of 0 to 1200 m above sea level with an annual rainfall of over 1500 mm, but is not resistant to waterlogging. This grass grows quickly and forms a vertical and horizontal stretch with the high reaches 60 to 150 cm, resistant to drought, have high productivity and palatable (Ishigaki *et al.*, 2012). Hartadi *et al.* (2005) reports that *Brachiaria brizantha* contains nutrients 10.9% of
Ash, 1.35% of ether extract, 32.2% of crude fiber, 49.1% of BETN and 6.6% of crude protein. Tekletsadik et al. (2004) finds that devoliation of Brachiaria brizantha with the remaining 10 cm above the ground can affect the nutritional value of the grass. It is in agreement with who states that leaving the grass 1 to 10 cm above the ground provides 20% rather than that 15 to 20 cm above the ground.

The success of forage cultivation depends on several factors such as the type of forage, climatic conditions, water and soil fertility. Soil fertility is one of the factors that determine whether the forage results will be good or not. Soil fertility can be identified by the availability of nutrients in the soil. The availability of nutrients in the soil can be fulfilled with fertilization. Marassing (2013) states that the amount of fertilizer given to the plant depends on its response to fertilizer. The complete nutrient supplied in the right amount, the better and maximum the results will be.

Fertilization improves the soil fertility by supplying nutrient content to the soil. This opinion is in agreement with Hardjowigeno (1987) who states that fertilization is the addition of materials that is used to improve the soil fertility. Novizan (2007) states that nutrients N, P, and K in the soil is not sufficiently available and continuously reduced for the plants growth and taken away at the harvest time, washed, evaporated and erosion. By this reason, fertilization is necessary to be conducted. N, P, and K contents are absolute macro nutrients in the soil that is beneficial for the plants growth.

Production of Brachiaria sp grass will result in better production when it is planted on the right and appropriate dose of fertilizer. Therefore, a study on the effect of doses of NPK fertilizer to the growth, production, and nutrient content of some varieties of Brachiaria sp that has not previously been conducted is necessary. The results of this study are expected to provide information for the farmers about the ideal dose of fertilizer for Brachiaria brizantha.

**MATERIAL AND METHODS**

Some seeds were germinated in the pot tray filled with soil. Brachiaria brizantha cv MG 5 was germinated for two weeks. During those weeks, the plants were watered and observed the days of their germination, the leaves emerge, the plant height and number of leaves. The soils were filled into polybags and randomly divided into three treatments with five replications. The soils were put into the polybags as much as ¾ capacities of the polybags with diameter 25 cm. The row spacing used was 50 x 50 cm.

After the preparation for planting medium was completed, planting process was carried out. The germination results were then moved into the polybags 5 cm from the soil surface and then closed again with soil. One polybag contained one plant. Watering was done every day once in the morning. Weeding was done every week.

Fertilization was done twice during the period of cultivation on 15 and 30 days after planting. The treatment consisted of a combination of the level of NPK fertilizer (25-5-7), which consisted of: not given or 0% NPK fertilizer as control (P0) (0 g/polybag), given NPK fertilizer with a dose of 150 kg/ha (P1) (3.75 gram/polybag), and given NPK fertilizer with a dose of 300 kg/ha (P2) (7.5 gram/polybag). Fertilization was made after weeding process.

Harvesting was carried out on the 60th day after planting with the cutting length of 10 cm from the ground. Plants in each polybag were weighed immediately to obtain the fresh weight of biomass canopy. The roots were also weighed to measure the root biomass. The stems and leaves were separated then weighed and chopped and put in the paper bags. The dried samples were weighed, stems and leaves samples were ground using Willey mill equipped with a 1 mm porosity of sieve.
Stem and leaf samples were mixed then proximately analyzed including the dry matter, organic matter, crude protein, crude fiber and crude fat (AOAC, 2005). The variables measured were growth (the height of germinated plant, the number of germinated leaves, the day of germination and leaf germination, the height of the plant, the number of leaves); productivity (production of fresh plants, dry matter production of stem, organic matter production of leaf, production of dry matter and organic matter) and chemical composition.

RESULTS AND DISCUSSION

The quality of the soil that used in the research contained nutrients (C, OM, total-N, total-P, and C/N) had a low value. The variable of the soil quality is usually determined by the content of organic matter and total-N in the soil so that it can increase the productivity of the plant biomass.

The values of total-N, total-P and total-K contained in the soil were 0.26%, 18.75%, and 1.26% respectively. The nutrients value N, P and K in the soil was relatively low. The addition of NPK fertilizer 25-5-7 was expected to increase the nutrient content of the soil for growing Brachiaria grass. Element N is an element that is easily leached and evaporates into the air so that it may take the element N in greater numbers. This is in agreement with Novizan (2007) who finds that nutrients N, P, and K in the soil is not sufficiently available and continuously reduced for the plants growth and taken away at the harvest time, washed, evaporated and erosion. By this reason, fertilization is necessary to be conducted. Nitrogen is the element that is most absorbed by the plants and provides a real and rapid effect on the plant growth such as increasing the number of tillers.

The growth rate of the plant height, leaf numbers and plant length of Brachiaria brizantha CV. MG5 per week until the age of 60 days given NPK fertilizer with a dose level of 0 kg/ha, 150 kg/ha and 300 kg/ha, listed in Table 1.

Table 1. The average growth of the plant height, leaf numbers and plant length per week several varieties of Brachiaria sp with different levels of fertilization.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Fertilization level</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant height (cm)</td>
<td>0 kg/ha</td>
<td>6.74±1.56</td>
</tr>
<tr>
<td></td>
<td>150 kg/ha</td>
<td>7.86±1.16</td>
</tr>
<tr>
<td></td>
<td>300 kg/ha</td>
<td>10.13±1.69</td>
</tr>
<tr>
<td>Number of leaves</td>
<td>0 kg/ha</td>
<td>4.87±1.38</td>
</tr>
<tr>
<td></td>
<td>150 kg/ha</td>
<td>6.62±0.78</td>
</tr>
<tr>
<td></td>
<td>300 kg/ha</td>
<td>10.12±1.98</td>
</tr>
<tr>
<td>Plant length (cm)</td>
<td>0 kg/ha</td>
<td>12.32±1.4</td>
</tr>
<tr>
<td></td>
<td>150 kg/ha</td>
<td>12.4±1.95</td>
</tr>
<tr>
<td></td>
<td>300 kg/ha</td>
<td>14.02±1.88</td>
</tr>
</tbody>
</table>

ns: non significant

Based on statistics analysis of NPK fertilization with different levels, it showed a not real difference to the length of the plant, number of leaves and the plant height per week. Supporting a research that was conducted by Karti et al. (1999), she suggests that Brachiaria decumbens cv Basilisk is responsive to phosphate fertilizer, so that at the level of 300 kg/ha, it has the highest rates of the plant height increment.

The Production of the Plants

The Production of fresh plants, dry matter production of Brachiaria brizantha cv MG 5 under different levels of fertilization is shown in Table 2.
Table 2. Average production of fresh, dry matter, Brachiaria sp under different levels of fertilization (ton/ha)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Fertilization levels</th>
<th>0 kg/ha</th>
<th>150 kg/ha</th>
<th>300 kg/ha</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production of fresh plants (ton/ha)</td>
<td>5.02±1.59</td>
<td>6.85±3.16</td>
<td>7.64±1.43</td>
<td>6.5±2.33</td>
<td></td>
</tr>
<tr>
<td>Production of dry matter</td>
<td>0.78±0.35</td>
<td>1.13±0.53</td>
<td>0.99±0.28</td>
<td>0.97±0.39</td>
<td></td>
</tr>
</tbody>
</table>

From the research results, it shows that production of fresh plants with level of 300 kg/ha provides production of fresh plants with different results (P <0.05) rather than the level 0 kg/ha. It because the nutrients contained in the NPK fertilizer were absorbed by the root so that it can increase the production of the fresh Brachiaria brizantha MG 5. Phino (2014) suggests that the concept of NPK fertilization can increase the production and nutrient levels as it contains nutrients that are absorbed by the plant roots. Sondari (2011) states that the concept of the flow of nutrients to the root is composed of three mechanisms: interception, mass flow, and diffusion. NPK fertilization of 150 kg/ha resulted in the highest production of dry matter. On the other hand, giving NPK fertilizer of 300 kg/ha to Brachiaria brizantha cv MG 5 resulted in the decrease in its ability to absorb nutrient as it contains high phosphor and potassium. Novizan (2007) states that many factors determine the availability of phosphorus and potassium in the soil, but the most important is the soil pH. At low pH soil (acid), phosphorus ions will react with iron and aluminum. This reaction forms iron phosphate or aluminum phosphate that are difficult to dissolve in the water, so plants cannot absorb it. The land with a high pH (alkali), phosphorus reacts with calcium ions, and this reaction forms calcium phosphate that are soluble and cannot be absorbed by plants too. Thus, without considering the pH, phosphorus fertilization won’t be effective for the plant growth.

CONCLUSIONS

Based on the research results, it can be concluded that fertilization under different levels of the dose of fertilizer to Brachiaria brizantha MG 5 can increase the dry matter production and dry matter of Brachiaria grass.

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Indigofera Sp as a Source of Protein in Forages for Kacang Goat in Lactation and Weaning Period

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ABSTRACT: Study was conducted to investigate the effects of Indigofera as a source of protein in forages for Kacang goat in Lactation and weaning goat. The research were performing by observing 12 heads of Kacang goat (lactation period) with three different treatments and five replications in Randomized Experimental Design. Treatment I (R1): 100% of natural grass, (R2): 60% of natural grass and 40% of Indigofera sp, (R3): 40% of natural grass and 60% Indigofera sp. Proximat analysis was found crude protein of Indigofera 27%, fat 6.15, crude fiber 15.25%, ash 6.41%. Treatment of R3 showed the amount of average daily gain lactated Kacang goat is highest (90.74 gr/head/day) compare than R2 of 81.48 gr/head/day) while R1 is the lowest which only 32.59 gr/head/day. Meanwhile the that treatment of R3 is the highest in enhancing average daily gain of goat kids 75.88 grs/head/day while the treatment of R2 almost similar of 72.44 grs/head/day. It is, however, R1 is the lowest compare other treatments (56.66 grs/head/day).

Keywords: Indigofera, Kacang goat, forages, sources of protein,

INTRODUCTION

Kacang goat is indigenous breed and it has an important role in supplying meat in Indonesia. The benefits in rearing Kacang goat in Indonesia is based by several reasons. First, it has ability to adapt in dried climate and consume a low quality of forages. Second, it has a high level of litter size. Third, almost 80% of farmer rears Kacang goat in a dry land. It is, however, Kacang goat has not been explored optimally.

In South Sulawesi province, the population of Kacang goat increased moderately in a period of 2009 to 2013 from 437,918 to 644,583 heads (Indonesia National Statistic Services, 2013). The enhancement of Kacang goat in this area is supported by agro ecosystem and it can substitute the losses of farmers when harvest fail in main plantation occurred.

Low level quality of forages is said to be a major problem in rearing Kacang goat in dry land so introducing both grass and tree legumes, which consist a high level of nutrient such as Indigofera sp, as a way in enhancing the nutrient quality of forages. Indigofera is well known as tarum plant, has about 700 species, including Indigofera zollingeriana. These plants are leguminous species that have high nutrient content and production as well as tolerant to abiotic stresses. This plant originated in tropical Africa, Asia, Australia, and North and South America, then spread to arid zone of Africa and Asia. In early 1900, it was brought by Europeans colonial to Indonesia. Indigofera can grow well at altitudes between 0-2,200 m above sea level, with rainfall between 600-3,000 mm/year. It can be used as a fodder crop because it has high nutrient content and production. It can be harvested at the age of eight months with an average production of 2,595 kg of fresh biomass/tree, with a total production of fresh approximately 52 tons/ha (Herdiawan and Krisnan, 2014).
Ruminant productivity is largely determined by the quality of forage. Forage in Indonesia, particularly grasses contain lower crude protein (average 7%-11%) and TDN (50%-60%) than those nutrients required by animal. This means, farmers have to add other sources of nutritious feed in ration in order to meet nutritional needs and sustain their animal performance. Appropriate feeding management by introducing fodder legume such as Indigofera in ruminant ration may improve nutrient intake and animal production. Inclusion of Indigofera in ruminant ration needs to be considered due to its high nutritional value (Abdullah, 2008).

A research conducted by Kotten et al, (2014) that Indigofera sp contains a high value of nutrient (protein, calcium, and phosphor). They found that in one year plantation and three month of interval defoliation, crude protein contain average of 23.20%, 90.68 of organic matter, NDF, phosphor, and Calcium is about 36.72%, 0.83%, and 1.23% respectively. Similarly with research conducted by Yumiaty (2006), these forages are fitted as a source of protein, especially for goat lactation period.

MATERIALS AND METHODS

This research is performed in Gowa experimental farm (Assessment Institute of Agriculture Technology) by observing 12 heads of Kacang goat (lactation period) with three different treatments and four replications in Randomized Experimental Design. Treatment I (R1): 100% of natural grass, (R2): 60% of natural grass and 40% of Indigofera sp, (R3): 40% of natural grass and 60% Indigofera sp. Goats is placed in an individual stable and reared for three months which fed two times a day and ad libitum of water. Research goats reared in individual cages equipped with a feed and a drink. Feeding is done 2 times a day that is at 7 am and 17 pm. Kacang goat gets forage and indigofera research at 3.5 months during the study period of adaptation which divided the study for 2 weeks and retrieval of data for 3 months.

Data were analyzed by using a completely randomized design (CRD). The parameters are collected is the mother and the kid’s body weight, daily weight gain, consumption and feed conversion, body weight gain mother and kid pre weaning.

RESULT AND DISCUSSION

Nutrition Value

Quality of nutrient of feeding is seen by chemical composition of forages which consisted such dry matter, crude protein, crude fiber, fat, and nitrogen free extract. Analysis resulted indicates that nutritive contents also similar to body of animal. In this regard, animal consumes natural grass which relatively low of nutrient so adding to such legume is said as a best way in enriching the value of nutrient.

The main forages used are natural grass available in field or in common land while add with legume which contain a high nutrition of crude protein. Table 1 shows proximate analysis of forages using in this research.

Table 1: Proximate Analysis of Forages

<table>
<thead>
<tr>
<th>Material</th>
<th>Water</th>
<th>Crude Protein</th>
<th>Fat</th>
<th>Crude Fiber</th>
<th>Nitrogen Free Extract</th>
<th>Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Grass</td>
<td>6.00</td>
<td>6.46</td>
<td>6.93</td>
<td>47.0</td>
<td>23.9</td>
<td>20.4</td>
</tr>
<tr>
<td>Indigofera sp</td>
<td>12</td>
<td>27.9</td>
<td>6.15</td>
<td>15.25</td>
<td>20.0</td>
<td>6.41</td>
</tr>
</tbody>
</table>
Based on proximate analysis on natural grass used in this research indicated that protein contain is very low (only 6.46%). Similarly, Ella et al (2004) also found the same result as the natural grass need to be added with legume which has a high level of protein such Indigofera sp. In this point, it will enhance nutritive value of feeding.

**Average Daily Gain**

The successful in rearing goats depends upon by the equilibrium of composited value of forages nutrient. Adding legumes such Indigofera sp is said to be a best way in enhancing the quality of feeding. Enhancement of daily gain as a one of few criteria in analyzing the quality of forages due to daily gain indicates the value of nutrient.

Goats in lactation period need a high protein compare to other period (about 14-16%) to recover post partum. The research was performe by Teh et al, (1994) that great amounts of nutrient goats in feeding during early lactation when the feed intake capacity is limited, leading the animals to mobilize their body energy reserves,. Thus, it is important to provide lactating goats with palatable feed containing a high protein energy density. Average daily gain of Kacang goats shows in table 2 is as follows:

**Table 2. Average Daily Gain of Lactated Kacang Goats**

<table>
<thead>
<tr>
<th>Material</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (beginning – kgs/head)</td>
<td>21.73</td>
<td>21.17</td>
<td>25.83</td>
</tr>
<tr>
<td>Weight (Ending – kgs/head)</td>
<td>24.67</td>
<td>28.50</td>
<td>34.0</td>
</tr>
<tr>
<td>Average Daily Gain (gr/head/day)</td>
<td>32.59&lt;sup&gt;b&lt;/sup&gt;</td>
<td>81.48&lt;sup&gt;a&lt;/sup&gt;</td>
<td>90.74&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Different superscripts in the same row shows a significantly different effect (P <0.05)

Referring to table 2 above, treatment of R3 showed the amount of average daily gain is highest (90.74 gr/head/day) compare than R2 of 81.48 gr/head/day) while R1 is the lowest which only 32.59 gr/head/day. The average of daily gain of R2 and R3 is statistically not significant. Another research performed by Tarigan et al, (2011) found that the average daily gain of Boerka breed goats for 52.4 gr per head per day by feeding them with contain of 45% Indigofera. The benefits of Indigofera enhance milk production of Sannen goat breed (Morand et al, 1991).

**Table 3. The Average Daily Gain of Kid Goats**

<table>
<thead>
<tr>
<th>Material</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (beginning – kgs/head)</td>
<td>1.4</td>
<td>1.28</td>
<td>1.4</td>
</tr>
<tr>
<td>Weight (Ending – kgs/head)</td>
<td>6.5</td>
<td>7.8</td>
<td>9.6</td>
</tr>
<tr>
<td>Average Daily Gain (gr/head/day)</td>
<td>56.66&lt;sup&gt;b&lt;/sup&gt;</td>
<td>72.44&lt;sup&gt;a&lt;/sup&gt;</td>
<td>75.88&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Different superscripts in the same row shows a significantly different effect (P <0.05)

Referring to Table 3 above indicated that treatment of R3 is the highest in enhancing average daily gain of 75.88 grs/head/day while the treatment of R2 almost similar of 72.44 grs/head/day. It is, however, R1 is the lowest compare other treatments (56.66 grs/head/day). These results indicated that the availability of milk for weaning goat is determined by score body condition of goat.
Figure 1. Average daily gain of Kacang goats lactation period of three months

As showed from figure 1 above, all treatments indicated the enhancement of daily gain which both R3 and R2 are the highest rather than R1.

**Consumption and Feed Conversion**

Productivity of animal is influenced by consumption and feed conversion. In this research, feed consumption in R1 is highest compare to R2 and R3. However the number of average daily gain in R3 and R2 is highest rather than R1. It means feeding which contains Indigofera enhancing daily gain rather than without adding it’s legume.

**Table 4. Consumption and Feed Conversion of Goat Lactation Period.**

<table>
<thead>
<tr>
<th>Feed consumption (grs/head/day)</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural grass</td>
<td>724.5</td>
<td>363.5</td>
<td>210</td>
</tr>
<tr>
<td>Indigofera</td>
<td>0</td>
<td>331</td>
<td>485.5</td>
</tr>
<tr>
<td>Total Amount</td>
<td>724.5</td>
<td>694.5</td>
<td>695.5</td>
</tr>
<tr>
<td>Average Daily Gain (grs/head/day)</td>
<td>56.66</td>
<td>72.44</td>
<td>75.88</td>
</tr>
<tr>
<td>Feed Conversion</td>
<td>12.80</td>
<td>9.58</td>
<td>9.16</td>
</tr>
</tbody>
</table>

As showed from table 3 above, the lowest level of feed consumption in R3 is of 695.5 grs/head/day followed by R2 is about 694.5 grs/head/day. Meanwhile, the highest level of feed consumption (724.5 grs/head/day) is in R2 treatment. The highest value of feed conversion (see table 4 above) is in R1 treatment followed by R2 and R3 (9.58 and 9.16 respectively). Feed conversion in this research is similar with research conducted by Siregar (2008) which found for 8.56 – 13.29. Another research performed by Mide (2007) that the lowest level of feed conversion for goats will efficiently enhance the amount of daily gain.

**CONCLUSION**

Based upon the results of the study concluded substitution indigofera of 60% on the Kacang goat feed are breastfeeding can increase body weight gain mother and kid pre weaning.
REFERENCES


Supplementing Energy and Protein at Different Degradability to Basal Diet on Total Protozoa and Microbial Biomass Protein Content of Ongole Grades Cattle

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²Faculty of Animal Husbandry Gadjah Mada University, Yogyakarta
³Research Institute for Animal Production, Ciawi
Corresponding email: dpamungkas2000@yahoo.com

ABSTRACT: This research aimed to determine energy and protein proportion as feed supplement on total protozoa (TP) and microbrial biomass protein (MBP) in the rumen of cattle fed by basal diet of corn ear and coffee pods. In vivo research was done at barn and laboratory of Animal husbandry faculty of GMU. As of four fistulated Ongole Grades Cows (aged I2, live weight 250 + 15 kg) were used. Animal were placed into individual pens. Research was held in four period (P1, P2, P3 and P4), each period consisted of 10 days including adaptation. Feed was the basal diet (BF) and supplement at ratio of 60:40 (3% of LW). At P1= animal-1 fed by BF without supplement (feed A), animal-2 fed by BF supplemented by HDE+LDP (feed B), animal-3 fed by BF supplemented LDE+LDP (feed C) and animal-4 fed by BF supplemented HDE+HDP (feed D). Within P2, P3 and P4, simultaneously animals were received the same feed. Feed was given two times a day and water was given ad libitum. Rumen fluid was taken at 0700, 1200, and 1600. Determination of TP according to Diaz et al., (1993). Meanwhile the Lowry methods was followed by to evaluate MBP. The data of each sample were analysed by One way analysis of variance using SPSS program ver13.0. Result showed that amount of TP at before feeding (0700) was vary from 17.3 to 47.7 cell x 10³/ml. Within feed treatments was no significant different, but it can be indicated that the high increase of amount of TP was occur at four hours after feeding time. The feed treatments was also had same yield of MBP which was vary from 195.21 mg/ml to hingga 297.84 mg/ml. The highest of MBP yields was at BF + (HDE+HDP) (297.84 mg/ml), followed by BF + (LDE+LDP) (269.56 mg/ml), BF + (HDE+LDP) (215.59 mg/ml), and BF (189.25 mg/ml). There was indicated that supplementing energy and protein source of high degraded at basal diet had the best response to the amount of TP and MBP.

Keywords: Supplementation, Protozoa, Microbial biomass protein, Ongole grades.

INTRODUCTION

The weakness of crop residues as feed was low palatability and low digestibility aside low quality. The feedstuff of agricultural crop residues were rich of cell wall content but low nitrogen and there was imbalance nutrient. So its rumen degradability were low (Soeharto, 2004; Ginting, 2005). These characteristics led to decrease and digestibility. The level of digestibility, consumption and nutrient use efficiency of feed material origin of crop residue is influenced by the levels of some chemicals that are inhibiting compounds (inhibitors). Supplementation is usually also carried out in order to meet the need of metabolic energy for maintenance and production. Supplementation of the feed materials in the form of energy and protein theoretically was able to increase the use of N in feed (Broderick, 2003).
Microbial proteins represent 50 - 75% protein actual (true protein) that is absorbed from the small intestine and is the main supply of amino acids (Preston and Leng, 1987; AFRC, 1992). The presence of Protozoa highly considered in determining the digestibility of feed ingredients high in fiber. Protozoa in the rumen is dominated by ciliate. As well as bacteria, ciliate able to ferment almost plant components contained in the rumen as cellulose, hemicelluloses, fructose, pectin, starch, sugar and fat soluble.

According to the statement above this research aimed to determine energy and protein proportion as feed supplement on total protozoa (TP) and microbial biomass protein (MBP) in the rumen of cattle fed by basal diet of corn ear and coffee pods as basal diet which supplemented by different character of degradation of the mixture of energy and protein sources. This will be the initiate action in order to confirm the best option of feed formulation in the form of total mix ration.

MATERIALS AND METHODS

The study was conducted in four periods (P1, P2, P3 and P4). Each period consisted of 10 days including adaptation period. Feed given was in the form of basal feed (BF) and supplements at 60:40 (3% weight of DM). At P1, Animal-1 was given BF or without supplementation (A), Animal-2 was fed BF supplemented by HDE + LDP (B), Animal-3 fed by BF and supplemented by LDE + LDP (C) and Animal-4 was fed BF and supplemented by HDE + HDP (D). At P2, P3 and P4 in sequence all animal received the same feed in accordance with the design of the experiment, as shown in Table 1. The rumen fluid sampling was done three times as follows: one hour before feeding in the morning, four hours after feeding in the morning and one hour after feeding in the afternoon. Feeding was done twice a day, at 08.00 and 15.00. Samples of rumen fluid were taken directly using an aspirator for the determination of microbial protein biomass and protozoa. Feed regimes given were BF which consisted of corn pericarps (80) and coffee pods (20) , known as BF (treatment A). Meanwhile treatment B consisted of BF + (HDE:LDP = 50:50) = 60:40, treatment C = BF + (LDE : LDP= 50:50) = 60:40, and treatment D = BF + (HDE : HDP= 50:50) = 60:40. HDE: high degraded energy, LDE : low degraded energy, HDP : high degraded protein, LDP : low degraded protein.

Tabel 1. Layout of the experiment

<table>
<thead>
<tr>
<th>Period</th>
<th>Animal</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>P2</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>P3</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>P4</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

Legend:

A : BF (TJ : KK = 80:20) ,
B : BF + (HDE : LDP= 50:50) = 60:40
C : BF + (LDE : LDP= 50:50) = 60:40,
D : BF + (HDE : HDP= 50:50) = 60:40
Table 2. Chemical composition basal feed supplement (%DM)\textsuperscript{1}

<table>
<thead>
<tr>
<th>Feedstuff</th>
<th>DM</th>
<th>OM</th>
<th>CP</th>
<th>CF</th>
<th>TDN2</th>
<th>NDF</th>
<th>Ca</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>BF</td>
<td>87.70</td>
<td>77.10</td>
<td>8.20</td>
<td>0.85</td>
<td>50.55</td>
<td>61.9</td>
<td>0.46</td>
<td>0.10</td>
</tr>
<tr>
<td>BF + (HDE+LDP)</td>
<td>90.35</td>
<td>88.39</td>
<td>11.38</td>
<td>1.52</td>
<td>62.64</td>
<td>57.37</td>
<td>0.56</td>
<td>0.16</td>
</tr>
<tr>
<td>BF + (LDE+LDP)</td>
<td>88.28</td>
<td>85.10</td>
<td>8.71</td>
<td>2.11</td>
<td>60.99</td>
<td>55.39</td>
<td>1.86</td>
<td>0.51</td>
</tr>
<tr>
<td>BF + (HDE+HDP)</td>
<td>89.37</td>
<td>85.51</td>
<td>13.67</td>
<td>1.74</td>
<td>65.60</td>
<td>51.54</td>
<td>3.44</td>
<td>0.50</td>
</tr>
</tbody>
</table>

\textsuperscript{1} Result from Feed and Nutrition Laboratory of Beef Cattle Research Station

Microbial Biomass Protein. Determination of the protein content of microbial biomass using Lowry method according to Plummer (1987).

Total Number of Protozoa. Determination of the total protozoa carried out by following the procedure performed by (Diaz et al., 1993)

Data analysis. Data of microbial protein biomass and total protozoa at three sampling points each animal were analyzed by One way analysis of variance using SPSS ver 13.0.

RESULTS AND DISCUSSIONS

Total Number of Protozoa

The total number of protozoa at before feeding time (07.00) ranged from 17.30 to 47.72 x 103 cells / ml. Inter respective feed showed no difference, but there are indications that an increase in the total number of protozoa during the four hours after feeding (12.00). Such circumstances reflect that the growing population of protozoa is affected by the conditions of time after feeding and additional substrates derived from supplementation of the basal feed.

Table 3. The total number of protozoa in the rumen of cattle fed basal PO and supplement different sources of energy and protein degradation (cells x 103 / ml)

<table>
<thead>
<tr>
<th>Feedstuff</th>
<th>Average (mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>07.00</td>
</tr>
<tr>
<td>BF</td>
<td>26.82 ± 12.09</td>
</tr>
<tr>
<td>BF + (HDE+LDP)</td>
<td>21.31 ± 6.64</td>
</tr>
<tr>
<td>BF + (LDE+LDP)</td>
<td>17.30 ± 5.74</td>
</tr>
<tr>
<td>BF + (HDE+HDP)</td>
<td>26.97 ± 9.27</td>
</tr>
</tbody>
</table>

These results were relate to a report of Faichney et al. (1996) that the proportion of rumen protozoa would increase three times (61-76%) when the concentrate is added in the basal feed hay to the sheep, along with the increasing contribution of duodenal N flow by 15%. Veira (1986) adds that protozoa have an indirect role in the formation of methane gas. Number of protozoa and methanogenesis decreased at low pH.
Microbial biomass protein

The feed given to cattle did not give a different effect on the protein content in the rumen microbial biomass, which varied between 195.21 mg / ml up to 297.84 mg / ml. The highest result found in BF + (HDE + HDP) (297.84 mg / ml), followed by BF + (LDE + LDP) (269.56 mg / ml), BF + (HDE + LDP) (215.59 mg / ml), and BF (189.25 mg / ml). When compared with the results of the analysis of the chemical composition of the feed mixture basal and supplements (as shown in Table 1), there is the same relationship, that the addition of the BF supplements increased the content of microbial biomass protein.

Table 4. The microbial protein biomass content in cow rumen microbial biomass PO by basal feed supplements and different sources of energy and protein degradation (mg/ml)

<table>
<thead>
<tr>
<th>Feedstuff</th>
<th>Time of Observation</th>
<th>Average (mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BF</td>
<td>07.00</td>
<td>189.26 ± 52.16</td>
</tr>
<tr>
<td></td>
<td>12.00</td>
<td>242.76 ± 97.00</td>
</tr>
<tr>
<td></td>
<td>16.00</td>
<td>153. ± 28.85</td>
</tr>
<tr>
<td>BF + (HDE+LDP)</td>
<td>07.00</td>
<td>191.86  ± 76.00</td>
</tr>
<tr>
<td></td>
<td>12.00</td>
<td>235.71 ± 86.00</td>
</tr>
<tr>
<td></td>
<td>16.00</td>
<td>219.21  ± 92.27</td>
</tr>
<tr>
<td>BF + (LDE+LDP)</td>
<td>07.00</td>
<td>225.61 ± 77.88</td>
</tr>
<tr>
<td></td>
<td>12.00</td>
<td>284.01 ± 89.86</td>
</tr>
<tr>
<td></td>
<td>16.00</td>
<td>299.06 ± 50.77</td>
</tr>
<tr>
<td>BF + (HDE+HDP)</td>
<td>07.00</td>
<td>270.71 ± 88.84</td>
</tr>
<tr>
<td></td>
<td>12.00</td>
<td>312.11 ± 37.41</td>
</tr>
<tr>
<td></td>
<td>16.00</td>
<td>310.71 ± 71.65</td>
</tr>
</tbody>
</table>

At one hour before feeding (0700), microbial biomass protein was the lowest and this was occurring in all feedstuff. Meanwhile the highest protein content of microbial biomass was found in the observation of four hours after feeding time except the BF + (LDE+LDP). This reflected the mass activity of microbes to ferment in the rumen. Rumen microbial biomass that is left is the supply of protein for ruminants. Sauvant et al. (1995) mentions that the 2/3 - 3/4 part of the protein which is absorbed by ruminant derived from microbial protein.

There was an indication that the feed of BF + (HDE + HDP) generate the highest microbial biomass protein content compared with other feed, is supported by the results of the rumen fermentation and VFA concentration of NH3 high rumen. Such circumstances appear to be associated with higher digestibility in sacco DM at 24 h incubation (63.06%) and BO (53.92%). Wanderley et al. (1999) reported that in the determination of in situ digestibility, microbial colonization were determined based on the percentage of BK increases with incubation time in the rumen nylon bag and it is influenced by the kinds of feed ingredients and its crude fiber content.

CONCLUSION

Basal feed which received supplementation mix of high degraded energy and high degraded protein was the best result and can be used in the in vivo test in related to confirm the animal responses.

REFERENCE


Nutritive Evaluation of Pineapple Peel Fermented by Cellulolytic Microbe and Lactic Acid Bacteria by In Vitro Gas Production Technique

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Corresponding email: yusiati@yahoo.com

ABSTRACT: The research was conducted to evaluate the nutritive value of pineapple peel fermented by rumen cellulolytic microbes and followed by addition of lactic acid bacteria (LAB) at the 4th, 8th, 12nd and 16th days of fermentation. Cellulolytic microbes was added as much as 5% of dry matter (DM) into 300 g of pineapple peel with three replicates for each treatment. Fermentation without addition of cellulolytic microbes and LAB was carried out as control. Fermentation was done up to 21 d and the sample of fermented pineapple peel were taken out for physical quality measurements including odor, color, the presence of fungi, as well as the lactic acid content. The sample was dried at 55°C, and then prepared for chemical composition analysis including dry matter (DM), organic matter (OM), crude fibre (CF), crude protein (CP), extract ether (EE) and nitrogen free extract (NFE). The samples were also prepared for evaluation of kinetic fermentation by in vitro gas production technique proposed by Menke and Steingass. The data obtained were analyzed by analysis of variance using one way design and continued by Duncan’s new multiple range test to examine the differences among the mean values. The result showed that pineapple peel fermented by cellulolytic microbes with addition of LAB in all treatment as well as the control had brown colour, and without fungus. The more acidic odor were found in fermented pineapple added with cellulolytic microbes and LAB, due to lactic acid content which increased significantly. Cellulolytic microbes and LAB addition didn’t affect DM and OM content, while the content of CF tended to decrease. The treatments increased NFE as well as CP content, and decreased EE content significantly. Gas production, and the values of a, b, c fractions were not affected by addition of cellulolytic microbes and LAB. It could be concluded that lactic acid bacteria which was added after 12 days of cellulolytic fermentation) gave the best nutritive quality of fermented pineapple peel.

Keywords: Pineapple peel, Cellulolytic microbes, Lactic acid bacteria, Fermentation, In vitro gas production.

INTRODUCTION

In spite of the large amounts of industrial by product and agricultural waste, the problems of inadequate nutrition and prohibitive cost of conventional feedstuff during dry season remained unsolved. It is driving some farmers to find alternative feedstuffs. One of those materials which interested to be considered was pineapple peel. The problems of pineapple peel as animal feed are high water content, and low digestibility due to high fibre content. As a compound of Total Mix Fiber which was produced from agricultural byproduct as an alternative roughage feed, pineapple peel silage contained 23.98% of crude fibre (Maneerat et al., 2013). It was expected the nutritive quality of pineapple silage could be increased by reducing crude fiber content, therefore addition of cellulolytic microbes along with lactic acid bacteria (LAB) should be considered in the pineapple peel fermentation.
MATERIALS AND METHODS

Microbes Preparation

Donor Animal. In this experiment, 2 head of rumen fistulated Ongole crossbred cattle were used as the donor animal to get the rumen fluid for a source of fibrolytic microbes needed for fermentation as well as in vitro gas production technique.

Microbes enrichment. Rumen fluid were collected from the both donor animals early in the morning before feeding time, composited, prepared and kept anaerobically in waterbath at 39°C. A quantity of rumen fluid samples were taken out and subjected into enzymes assays (carboxymethyl cellulase/ CMC-ase) which were done in duplicate (Halliwel et al., 1985). Rumen fluid as much as 10% of medium volume was pipeted into glass fermenter which was already filled with enrichment medium based on Omelianski (1902) cit. Skinner (1971). Fermentation was done anaerobically at 39°C for 7 days.

Rumen cellulolytic microbes cultivation. The inoculum grown in the enrichment media was taken out, and it was added into the glass fermenter filled with growing medium as much as 10% from the total medium which used 4 g cellulose as substrate (Omelianski (1902) cit. by Skinner (1971). The fermenters was kept anaerobically at 39°C for 7 days. The culture was ready to be applied for pineapple fermentation immediately after enzymes assays.

Pineapple fermentation

After growing for 7 days, the cellulolytic culture as much as 5% DM was mixed with 300 g of air-dried pineapple peel, incubated anaerobically at room temperature and followed by addition of lactic acid bacteria (LAB) at the 4th, 8th, 12th and 16th days of fermentation. Fermentation without cellulolytic microbes and LAB addition was carried out as control. Fermentation was done up to 21 days.

Evaluation of fermented pineapple peel quality

At the end of this fermentation period the glass-silos were opened for sampling. The fermented pineapple peel samples were taken out and examined for their physical quality including odor, colour, texture, the presence of fungi and lactic acid content following Baker and Summerson method (Hawk, 1976). Content of dry matter was directly determined in the fresh fermented samples prior to 55°C drying for fermentation end products measurements. The dried sample was then analyzed for dry matter (DM), organic matter (OM), crude fibre (CF), crude protein (CP), extract ether (EE) and nitrogen free extract (NFE) content (AOAC Intl., 2005). The samples were also prepared for evaluation of kinetic fermentation by in vitro gas production technique proposed by Menke and Steingass (1988).

Statistical Analysis

Data obtain were analyzed by analysis of variance using one way design and the means were compared by Duncan’s Multiple Range Test (Rosner, 1990).

RESULT AND DISCUSSION

Specific activity of Carboxy methyl cellulase (CMC-ase) in the rumen fluid was 0.08 U/mg. The specific activity of CMC-ase increased as the inoculums transferred to the enrichment media and also during cultivation in the growing media (0.16 and 1.74 U/mg) respectively. Physical quality of fermented pineapple peel was shown in Table 1.
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Table 1. Physical quality and lactic acid content of pineapple peel fermented by cellulolytic bacteria and different time of lactic acid bacteria addition

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Without addition of inoculum (P0)</th>
<th>The day of lactic acid bacteria addition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4 (P1)</td>
</tr>
<tr>
<td>Odour</td>
<td>Slightly acid</td>
<td>Acid</td>
</tr>
<tr>
<td>Texture</td>
<td>Rough</td>
<td>rough</td>
</tr>
<tr>
<td>Presence of fungi</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lactic acid (%)</td>
<td>0.03c</td>
<td>0.11a</td>
</tr>
</tbody>
</table>

abc: Means within the same row with different superscript letters differ significantly (P<0.01)

The addition of cellulolytic microbes and LAB in the fermentation of pineapple peel significantly increased lactic acid content (P<0.01), therefore the odor became more acid compared with control. There were no fungi found in all treatments and the color of all fermented material remained the same, while the texture of fermented material became smoother as the effect of cellulolytic microbe and LAB addition. The increasing of acidity which was shown by the decreasing of pH and the change of odor to be more acid also reported by Yusiati et al. (2011) when cellulolytic microbes was added into the coffee pulp fermentation. The addition of LAB at the 4th day of fermentation gave the highest lactic acid content of fermented material. It was about 3.67 times lactic acid content of the control. Lactic acid content decreased by the addition time of LAB due to the shortage of LAB resident time in the fermentation media.

Chemical compositions of pineapple peel fermented by cellulolytic microbes and lactic acid bacteria addition were presented in Table 2.

Table 2. Chemical composition of fermented pineapple peel (%DM)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Without addition of inoculum (P0)</th>
<th>The day of lactic acid bacteria addition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4th (P1)</td>
</tr>
<tr>
<td>Dry matterns</td>
<td>47.64</td>
<td>46.66</td>
</tr>
<tr>
<td>Organic matterns</td>
<td>92.16</td>
<td>91.72</td>
</tr>
<tr>
<td>Crude protein</td>
<td>7.16c</td>
<td>7.78sv</td>
</tr>
<tr>
<td>Ether extract</td>
<td>11.10a</td>
<td>11.19a</td>
</tr>
<tr>
<td>Crude fiberns</td>
<td>17.19</td>
<td>17.06</td>
</tr>
<tr>
<td>Nitrogen free extract</td>
<td>56.70b</td>
<td>55.76b</td>
</tr>
</tbody>
</table>

abc: Means within the same row with different superscript letters differ significantly (P<0.01)
sv: Means within the same row with different superscript letters differ significantly (P<0.05)
ns: Not significant

Lactic acid bacteria addition into cellulolytic fermentation of pineapple peel did not give significant effect on dry matter and organic matter content. Nitrogen free extract (NFE) increased significantly when LAB was added after 12 days of cellulolytic fermentation. The increasing of NFE might be as an effect of the crude fiber content which have a tendency (P<0.07) to decrease. The increasing of cellulolytic fermentation time prior to LAB addition gave extended time to the
cellulolytic microbes to degrade the fiber content of pineapple peel and converted it to glucose which is component of NFE.

**In vitro degradation of fermented pineapple waste**

Data on gas production are given in Table 3. It indicated, there was no significant effect of cellulolytic and LAB addition on total gas production, gas produced from a and b fraction as well as the rate of gas production (c values). Hanim *et al.* (2010) reported the same finding that addition of cellulolytic inoculums did not give any effect on a, b and c values of fermented cocoa pod, although its CF content decreased significantly.

**Table 3.** Total gas production, fraction a, b and, c value of fermented pineapple peel

<table>
<thead>
<tr>
<th>Parameter (ml/300 mg DM)</th>
<th>Parameter (ml/300 mg DM)</th>
<th>Parameter (ml/300 mg DM)</th>
<th>Parameter (ml/300 mg DM)</th>
<th>Parameter (ml/300 mg DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>without addition of inoculum (P0)</td>
<td>The day of Lactic Acid Bacteria addition</td>
<td>without addition of inoculum (P0)</td>
<td>The day of Lactic Acid Bacteria addition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4th (P1)</td>
<td>8th (P2)</td>
<td>12th (P3)</td>
<td>16th (P3)</td>
</tr>
<tr>
<td>Gas Volume ns</td>
<td>80.529</td>
<td>84.384</td>
<td>82.961</td>
<td>83.080</td>
</tr>
<tr>
<td>a fraction ns</td>
<td>-0.425</td>
<td>-1.501</td>
<td>-0.693</td>
<td>-1.829</td>
</tr>
<tr>
<td>b fraction ns</td>
<td>83.077</td>
<td>89.649</td>
<td>87.776</td>
<td>87.669</td>
</tr>
<tr>
<td>c value (ml/h) ns</td>
<td>0.055</td>
<td>0.052</td>
<td>0.051</td>
<td>0.054</td>
</tr>
</tbody>
</table>

ns: non significant

Total gas volume and gas produced from insoluble fraction in this present study were higher compared with the gas produced by cellulolytic fermented cacao pod. It seem to be an effect of lower CF content of fermented pineapple peel compared with CF content of fermented cacao pod (16.35-17.19% vs. 22.28%). The increasing of NFE in fermented pineapple with addition of LAB at 12th days of fermentation, followed by the increasing of a fraction value.

Yusiati *et al.* (2010) reported that fermentation using 5% fibrolytic inoculums originally from rumen fluid with CMC-ase activity 4.71 U/mg and xylanase 0.028 U/mg, increased OM and DM in vitro digestibility of palm kernel cake, although CF content was not decrease. It seem that increasing of fermented pineapple peel digestibility could be expected by increasing the level of inoculums as well as by applying mix inoculums such as cellulolytic and xylanolytic.

**CONCLUSION**

The addition of cellulolytic microbes originally from the rumen fluid as much as 5% and lactic acid bacteria 2.5% after 12 days cellulolytic fermentation is the best way to increase the nutritive quality of fermented pineapple peel.

**REFERENCES**


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The Supplementation of ZnSO₄ and Zn-Cu Isoleusinate in the Local Feed Based at Last Gestation Period on Dry Matter Consumption and Digestibility and Calf Birth Weight of Bali Cattle

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Jl. Adisucipto, Penfui, Kupang. 8500, (0380) 881 084
Email: kupangph@yahoo.com

ABSTRACT: An experiment has been conducted to investigate the effect of supplemented ZnSO₄ and Zn-Cu Isoleusinate in the local feed based locally at last gestation period on the dry matter consumption and digestibility and calf birth weight of Bali Cattle. Twenty seven of Bali cows with aged of gestation of 7-9 months were use in this experiment. The feed was fed local feedstuffs substituted with organic minerals of ZnSO₄ and Zn-Cu Isoleusinate mixed with concentrate. Randomized Block Design with three treatments and nine replicates was use in the experiment. The three treatments were: R0 = freed cows in the pasture; R1 = R0 + legume; and R2 = R0 + concentrate contained 150 mg ZnSO₄/kg dry matter and 200 mg Zn-Cu Isoleusinate/kg dry matter concentrate. Parameters measured were dry matter consumption, dry matter digestibility, and calf birth weight of Bali Cattle. The results of this experiment showed that the treatments significantly affected (P <0.05) on the dry matter consumption, dry matter digestibility, and calf birth weight of Bali Cattle. The treatment R2 produce an optimal response on the three treatments. It could be concluded that supplemented ZnSO₄ and Zn-Cu Isoleusinate added in the concentrate increased dry matter consumption and the dry matter digestibility so they were able to increase of calf birth weight of Bali cattle.

Keywords: Supplementation, Dry Matter Consumption, Dry Matter Digestibility, Calf Birth Weight, and Bali Cattle.

INTRODUCTION

Background
A feed shortage in the dry season is a crucial issue in the maintenance of Bali cattle in East Nusa Tenggara. Wirdahayati (1994) stated that the main factors causing low productivity of Bali cattle grazing in this province is due to lack of feed, evidenced from the decrease in gestation rate from 75% to 52.2 to 61%, birth rate from 80% to 64%, calf mortality from 30% to 35%.

Feed, beside is required to meet the basic necessities of life and productivity of Bali cattle, but also to meet the nutritional needs of the female during pregnant. Hafez (1993) stated that at the end of gestation period occur rapid growths of fetus and reached a peak at the end of two months. Therefore, the provision of good quality rations at the end of gestation period can affect the increase in birth weight, and can reduce the mortality rate.

Ranjhan (1980) stated that in order to improve the condition of the parent body weight before and during gestation, the cattle need to get additional feed. A feed additive such as zinc (Zn) is an essential element for animals. The addition of Zn in the rations served to accelerate the synthesis of protein by microbes through activation of enzymes as well as microbial and enzyme activator especially DNA polymerase enzyme, and as a component metaloenzyme needed for...
protein digestion and absorbtion in the intestine. Besides Zn, micro mineral copper (Cu) is also needed to increase the activity of bacteria in digesting crude fiber (Talib et al., 2000). Subsequently also reported that the addition of Zn and Cu can increase the production of VFA.

To optimize the growth and activity of microorganisms in the rumen at the end of gestation period has done research entitle “the supplementation of ZnSO$_4$ and Zn-Cu Isoleusinate in the local feed based at last gestation period on dry matter consumption and digestibility and calf birth weight of Bali cattle”.

**MATERIALS AND METHODS**

Twenty seven of female Bali cattle at the age of gestation 7 to 9 months that are still productive and have been partum one or two times that are kept in semi-intensive system were used in this research. The composition of concentrate and treatment rations are presented in Table 1 and Table 2.

**Table 1. Dry matter composition of concentrate**

<table>
<thead>
<tr>
<th>Types of Feed materials</th>
<th>Composition (Kg/DM)</th>
<th>CP (%)</th>
<th>TDN (%)</th>
<th>Concentrate (%)</th>
<th>TDN Concentrate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow Corn</td>
<td>46.25</td>
<td>10.00</td>
<td>91.00</td>
<td>4.63</td>
<td>42.09</td>
</tr>
<tr>
<td>Rice bran</td>
<td>20.50</td>
<td>10.89</td>
<td>66.00</td>
<td>2.23</td>
<td>13.53</td>
</tr>
<tr>
<td>Coconut oil cake</td>
<td>23.00</td>
<td>23.10</td>
<td>74.00</td>
<td>5.31</td>
<td>17.02</td>
</tr>
<tr>
<td>Fish meal</td>
<td>8.00</td>
<td>61.20</td>
<td>69.00</td>
<td>4.90</td>
<td>5.52</td>
</tr>
<tr>
<td>Coconut oil</td>
<td>1.50</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Salt</td>
<td>0.25</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Premix</td>
<td>0.50</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>17.07</td>
<td>78.16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: (Hartati et al., 2009)

**Table 2. Composition of feed ingredients and treatment rations type tested**

<table>
<thead>
<tr>
<th>Composition of nutrient</th>
<th>Type of Feed</th>
<th>Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter (%)</td>
<td>Grass field</td>
<td>R0</td>
</tr>
<tr>
<td>Organic materials (%)</td>
<td>Gamal Leaf</td>
<td>65.72</td>
</tr>
<tr>
<td>Crude protein (%)</td>
<td>Concentrate</td>
<td>86.67</td>
</tr>
<tr>
<td>Crude fat (%)</td>
<td>Concentrate</td>
<td>90.96</td>
</tr>
<tr>
<td>Coarse fiber (%)</td>
<td>Concentrate</td>
<td>8.4</td>
</tr>
<tr>
<td>BETN (%)</td>
<td>Concentrate</td>
<td>1.90</td>
</tr>
<tr>
<td>GE (kcal / kg)</td>
<td>R0</td>
<td>3410.87</td>
</tr>
<tr>
<td>Zinc (mg / kg)</td>
<td>R1</td>
<td>4137</td>
</tr>
<tr>
<td>Copper (mg / kg)</td>
<td>R2</td>
<td>4137</td>
</tr>
</tbody>
</table>

**Description:** Chemical and Feed Laboratory Animal Husbandry Undana (2013)
Research Methods

This study uses a randomized complete block design (RCBD) with 3 treatments and 9 replications. The treatments tested were:
R0 = Cow released in paddocks during the day and housed in the night without supplemental feeding.
R1 = R0 + 2 to 4 kg legume leaves tree
R2 = R0 + concentrate containing 150 mg ZnSO$_4$ / kg and 200 mg Zn-Cu Isoleusinate/kg DM.

The variables measured

The variables were observed in this study are:

a. Dry matter in feces                      = (amount of Cr$_2$O$_3$ consumption per day)/(amount of Cr2O3 per gram feces)
b. Dry matter consumption             = dry matter given – dry matter remind
c. Dry matter digestibility of feed   = 100 – (100 (% indikator in ration)/(%indikator in feces) x (% dry matter in feses)/(% dry matter in ration ))
d. Birth weight                                = the weight of a newborn calf before 24 hours

Data Analysis

The data obtained in this study were analyzed using analysis of variance and followed by Duncan’s multiple range test to determine differences between treatments using Release 19 program SPSS.

RESULTS AND DISCUSSION

Dry Matter Consumption

Results of statistical analysis showed significantly affected (P<0.05) on dry matter consumption and dry matter digestibility and birth weight of calves Bali cattle as shown at Table 3.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R0</td>
</tr>
<tr>
<td>Dry matter consumption (kg)</td>
<td>4.22 ± 0.48$^a$</td>
</tr>
<tr>
<td>Dry matter digestibility (%)</td>
<td>60.17 ± 2.05$^a$</td>
</tr>
<tr>
<td>Calf birth weight (kg)</td>
<td>11.12 ± 1.17$^a$</td>
</tr>
</tbody>
</table>

Description: different superscripts in the same row indicate significant differences (P <0.05)

These results indicate that supplementation of 150 mg ZnSO$_4$ / kg DM and 200 mg Zn-Cu Isoleusinate/kg DM based on local feed ration can improve dry matter intake (R2) compare to R1 and R0 treatments.

Talib et al., (2000) stated that the addition of Zn in the ration aimed to accelerate the protein synthesis by microbes through activation microbial enzymes as well as enzyme activator especially DNA polymerase enzyme, and as a component metaloenzim needed for protein digestion and absorption in the intestine. The addition of copper (Cu) which can increase the activity of bacteria
in digesting crude fiber and the addition of Zn and Cu also can increase the production of VFA. Theoretically, the level of dry matter intake was strongly influenced by the energy needs for livestock and rumen capacity while also determined by the content of nutrients from feed given (Sentana, 2005).

**Dry Matter Digestibility**

The data in Table 3 shows that the effect of the treatment on dry matter digestibility are significant differences (P <0.05) and the treatment R2 is the highest. This phenomenon indicates that the presence of organic micro-mineral ZnSO₄ and Zn-Cu Isoleusinate in R2 treatment have been able to activate digestive enzymes and accelerate the synthesis of microbial protein. This is consistent with that proposed by Underwood (1977) in Hartati *et al.*, (2009) that Zn was play a role in accelerating the microbial protein synthesis through activation of microbial enzymes.

Besides Zn, ruminants also requires Cu because being involved in a number of functions such enzymes for the synthesis of normal hemoglobin. Hartati *et al.*, (2010) stated that supplementation of 150 mg ZnSO₄/kg DM and 200 mg Zn-Cu Isoleusinate/kg DM ration can improve the consumption and digestibility of dry matter Bali cattle heifer males.

**Calves Birth weight**

Table 3 shows that the treatment have significant effect on calf birth weight, where R2 was the highest while R0 was the lowest. A real impact on consumption and digestibility of dry matter can give significant difference (P <0.05) for calves birth weight. Statistical analysis showed that R2 treatment was significantly differences than R1 and R0 treatments and R1 treatment showed significant different than R0 treatment. This finding indicated that additional of ZnSO₄ and Zn-Cu Isoleusinate in ration have significant effect to increase calves birth weight.

Results of this study prove that the cattle are given additional feed supplementation in the form of concentrate containing 150 mg ZnSO₄/kg DM and 200 mg Zn-Cu Isoleusinate/ kg DM of concentrate (R2) will be able to increase the consumption and digestibility of dry matter, which in turn helped increase body weight fetus. This finding also prove that cows that are pregnant that administrated to R2 treatment was quite enough fed because Tillman *et al.*, (1989) stated that cows that are pregnant will prioritize the utilization of nutrients in the body for the fetus and will undertake demolition of existing nutrients in the body fetus to the mother’s body needs when deprived of nutrients.

**CONCLUSIONS**

Based on the results of this research and discussion of the observed variables can be concluded that the administration of concentrates and supplementation of 150 mg ZnSO₄ / kg DM and 200 mg Zn-Cu Isoleusinate/kg DM of concentrate in the diet based on local feed can increase dry matter consumption and dry matter digestibility and birth weight of calves Bali cattle.

**REFERENCES**


Local Micro Organisms (LMO) as an Activator to Enhance the Quality of Various Plant Waste as Feed

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ABSTRACT: The assessment has been conducted at Gowa Station Research, Assessment Institute for Agricultural Technology (AIAT) South Sulawesi. The aim of this study is to investigate the type of Local Micro Organisms (LMO) as the best activator to improve the quality of agricultural waste as feed. The research activity consists of two stages: first, is the manufacture of the material LMO of six types: fruit of Calabash Tree (Crescentia cujete), fruits that have been wasted, chicken rumen contents, tricoderma, excrescence banana and vegetable wastes. The six types of materials made LMO, selected three types are considered to be the best that Crescentia cujete (LMO I), chicken rumen contents (LMO II) and vegetables wastes (LMO III). The selection of the three types of LMO is primarily based on the percentage content of N - total, the content of N is expected to increase the protein content of the waste material that is fermented. Although the content of elements of C - organic slightly lower than other LMO materials. Second activity, is the use of three types of LMO were selected in the first activities to be used in the fermentation activator 3 types of agricultural waste namely, rice straw, corn straw and sugarcane shoots. The results of laboratory analysis showed an increase in the nutritional quality of the before and after fermentation of the three types of sewage plants, so that from the third LMO was selected as the best activator is Calabash Tree (Crescentia cujete).

Keywords: agricultural waste, microorganisms local, feed, Calabash Tree, fermentation

INTRODUCTION

The determine factors the quality of a solution of LMO include fermentation media, the levels of raw materials or substrates, the shape and nature of microorganisms active in the fermentation process, pH, temperature, length of fermentation, and the ratio of C / N solution of LMO (Hidayat, 2006). The main ingredient in the manufacture of LMO consists of three components, among others: (1) carbohydrate; (2) glucose (3) the source of microorganisms. Source of carbohydrate can be derived from rice washing water, stale rice, cassava, potatoes, wheat, bamboo shoot, grass, and leaves of Gliricidia. For sources of glucose can be derived from brown sugar, liquid sugar, and coconut water, while as a source of microorganisms can come from snails, fruit peel, urine, and shrimp paste. Coconut water is a good medium for the growth of microorganisms during the fermentation process because coconut water contains 7.27% carbohydrates; 0.29% protein; some minerals, among others, 312 mg L-1 potassium; 30 mg L-1 of magnesium; 0.1 mg L-1 iron; 37 mg L-1 for SFOR; 24 mg L-1 of sulfur; and 183 mg L-1 chlorine (Budiyanto, 2002). Cow urine is used as a source of microorganisms in the manufacture of LMO, because livestock manure containing cellulolytic microorganisms that help the digestive process. Bacteria and fungi lignocellulolytic has an important role in the reform process fodder in the form of cellulose in the rumen (Wanapat, 2001) Population cellulolytic microorganisms thrive in ruminants fed forage with the main fiber. Liquid cow manure contains nutrients that are higher than solid cow manure.
MATERIALS AND METHODS

These assessment activities carried out at the experimental Gowa, BPTP South Sulawesi, Gowa. There are two phases of activities that have been implemented as follows: The first stage is making starter by utilizing local micro-organism (LMO) with raw materials consisting of 6 kinds of different types of materials, namely, fruit of Calabash Tree (*Crescentia cujete*), fruit that have been wasted, chicken rumen contents, excrescence bananas and vegetables that have been wasted, collected and subsequently becoming LMO except tricoderma been processed. The second phase is three types of LMO were selected in the first activities for fermentation of agricultural waste to improve the quality and durability of these materials as animal feed. Three types of LMO have been screened is, the fruit of Calabash Tree (*Crescentia cujete*) (LMO I), chicken rumen contents (LMO II) and vegetables that have been wasted (LMO III). The three types of LMO have been screened using for fermentation 3 types of agricultural waste, there were is, rice straw, corn straw and sugarcane buds. Parameters measured were fermented waste appearance, smell, texture and quality, and compositions of nutritional content. The results of laboratory analysis, the six types of materials made LMO shown in Table 1.

<table>
<thead>
<tr>
<th>Material</th>
<th>Chemical Composition (%)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N-total (%)</td>
<td>P₂O₅ (%)</td>
<td>K₂O (%)</td>
</tr>
<tr>
<td>Calabash Tree</td>
<td>0.16</td>
<td>0.03</td>
<td>0.69</td>
</tr>
<tr>
<td>Fruits</td>
<td>0.09</td>
<td>0.03</td>
<td>0.71</td>
</tr>
<tr>
<td>Rumen contents of chickens</td>
<td>0.15</td>
<td>0.02</td>
<td>0.48</td>
</tr>
<tr>
<td>Tricoderma</td>
<td>0.14</td>
<td>0.005</td>
<td>0.004</td>
</tr>
<tr>
<td>Bananas excrescence</td>
<td>0.13</td>
<td>0.02</td>
<td>0.62</td>
</tr>
<tr>
<td>Vegetables</td>
<td>0.13</td>
<td>0.03</td>
<td>0.47</td>
</tr>
</tbody>
</table>

Results of laboratory analysis, the six types of materials made LMO shown in Table 1.

RESULTS AND DISCUSSION

Local micro-organisms (LMO) is a collection of microorganisms can be propagated, which serves as a starter in the manufacture of compost or as an activator in the fermentation of agricultural waste for animal feed. Utilization of agricultural waste such as fruit, vegetables and other unfit for consumption is processed into LMO could increase the added value of waste, and reduce environmental pollution. The six types of LMO which have analysis is best taken three types, namely Calabash Tree (LMO I), rumen contents of chickens (LMO II) and vegetables (LMO III), was then applied as an activator for the fermentation of agricultural waste are 3 types of rice straw, hay corn and sugar cane shoots. The selection of the three types of LMO is based primarily on the percentage content of N-total. From the content of N is expected to increase the protein content of the waste material that is fermented. Although the content of the element of C-organic there were slightly lower than other LMO material. In general, almost all the agricultural wastes containing high crude fiber, but with a touch of simple technology waste can be converted into nutritious feed and energy source for livestock. According to (Saswono and Arianto, 2006) that almost all waste food crops can be used for cattle feed ingredients. To further enhance the quality of the waste it is necessary to fermentation by using LMO (Purwasasmita, 2009) which can be easily obtained around our environment. Material that will be used LMO should have three components, namely,
(1) Source of carbohydrate (2) Source of glucose and (3) Source of microorganism. These three components are very large role in the fermentation process. The results of laboratory analysis showed that the nutritional composition of the three types of waste that has been fermented, shown in Table 2.

Table 2. Nutrients composition of fermented plant waste

<table>
<thead>
<tr>
<th>Material</th>
<th>LMO Type</th>
<th>Nutritional Composition (%)</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DM</td>
<td>FiC</td>
<td>PC</td>
<td>FC</td>
<td>TDN</td>
</tr>
<tr>
<td>Rice straw</td>
<td>I</td>
<td>32.87</td>
<td>21.78</td>
<td>9.46</td>
<td>2.17</td>
<td>66.49</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>35.62</td>
<td>20.42</td>
<td>8.62</td>
<td>2.02</td>
<td>63.42</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>32.73</td>
<td>24.36</td>
<td>8.31</td>
<td>1.86</td>
<td>60.78</td>
</tr>
<tr>
<td>Corn straw</td>
<td>I</td>
<td>25.23</td>
<td>21.30</td>
<td>10.04</td>
<td>2.59</td>
<td>60.98</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>25.42</td>
<td>22.70</td>
<td>9.90</td>
<td>2.67</td>
<td>61.56</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>26.55</td>
<td>23.64</td>
<td>9.67</td>
<td>2.55</td>
<td>60.67</td>
</tr>
<tr>
<td>Cane shoots</td>
<td>I</td>
<td>25.93</td>
<td>25.04</td>
<td>8.21</td>
<td>2.67</td>
<td>66.59</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>26.53</td>
<td>25.22</td>
<td>7.45</td>
<td>2.78</td>
<td>65.34</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>26.96</td>
<td>24.86</td>
<td>7.12</td>
<td>2.90</td>
<td>66.12</td>
</tr>
</tbody>
</table>

Description: LMO I: Calabash Tree, LMO II: The contents of the rumen chicken, LMO III: Waste vegetable

Some research has shown that the application of processing technology can improve the availability of nutrient byproduct of food crops at the same time simplify the storage, transportation (Muktiani et al., 2007; Sitorus et al., 2007). From the results of laboratory analysis (Table 3) shows the nutritional composition of the three types of agricultural waste are tested. Seen an increase in the quality of the waste after fermentation. These results are consistent with some previous results that basically agricultural wastes can be enhanced as animal feed with the fermentation process.

Table 3. Nutrients comparison of plant waste before and after fermentation

<table>
<thead>
<tr>
<th>Material</th>
<th>Composition of Nutrition</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before Fermentation</td>
<td>DM</td>
<td>PC</td>
<td>FC</td>
<td>FiC</td>
<td>TDN</td>
<td>After fermentation</td>
<td>DM</td>
<td>PC</td>
<td>FC</td>
</tr>
<tr>
<td>Rice straw</td>
<td></td>
<td>31.87</td>
<td>5.21</td>
<td>1.17</td>
<td>26.78</td>
<td>51.49</td>
<td>33.74</td>
<td>8.79</td>
<td>2.02</td>
<td>22.19</td>
</tr>
<tr>
<td>Corn straw</td>
<td></td>
<td>21.69</td>
<td>7.66</td>
<td>2.21</td>
<td>26.30</td>
<td>58.24</td>
<td>25.73</td>
<td>9.87</td>
<td>2.60</td>
<td>22.54</td>
</tr>
<tr>
<td>Cane shoots</td>
<td></td>
<td>21.42</td>
<td>5.57</td>
<td>2.42</td>
<td>29.04</td>
<td>55.29</td>
<td>26.47</td>
<td>7.56</td>
<td>2.78</td>
<td>25.04</td>
</tr>
</tbody>
</table>

Description: Dry matter (DM), Protein Content (PC), Fat Content (FC), Fiber Content (FiC) and Total Digestible Nutrients (TDN).

At Table 3. that through the process of fermentation of the three types of waste such plants turns giving compositional changes highest nutrient is rice straw, is evident from the increase in crude protein content from 5.21% to 8.79%, the increase is almost 40%, more higher than those reported Mahendri et al (2005). Besides protein also Totan Digeble Nutriet (TDN) increased from 51.49% to 63.56% and a decrease in crude fiber content of 26.78% to 22.19%. The same thing as reported by Mahendri et al. (2005) that the crude protein content in the fermented rice straw increased while lowering the levels of ADF and NDF. Jamit Pasaribu et al. (1998) also reported
that the fermentation process of the oil sludge using the A. niger can increase the levels of crude protein and pure protein and lower fiber content of oil sludge. Both elements, namely protein and crude fiber in addition to other elements very important role in the process of growing cattle, with high protein content in the feed will greatly affect the enlargement process and the growth of livestock, while the low crude fiber content will increase feed consumption and accelerate the process of digestion of feed that, as reported Marthong et al. (2014) that the sugarcane bagasse that has been fermented by as much as 6% Sodium hydroxide can improve the nutritional content of sugarcane as much as 42% and significantly affect digestibility of DM, NDF and ADF in dairy cattle. In general that agricultural waste contains high fiber, while the coarse fibers are lignin component difficult to digest specially in rice straw. Lignin on rice straw is poly aromatic polymer with high molecular weight and including lignin phenolic groups (Arroyo, 2000) which are resistant to enzymatic hydrolysis including fermentation by rumen microbes and alkaline (Hatakka, 2000). Thus, limiting the digestibility of cellulose and hemicellulose (a polysaccharide) as an energy source ruminant feed.

CONCLUSION

The six types of materials to make LMO, the best is made from fruit of Calabash Tree (Crescentia cujete) selected as the activator for the fermentation of rice straw, corn straw and sugar cane shoots.

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Organic Acid and Inhibition of Complete Silage Ration on the Growth of 
Salmonella enteritidis

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ABSTRACT: Giving feed by silage technology is expected to replace the benefits of antibiotics in poultry feed. The purpose of this study was to determine organic acids content and the ability of silage ration complete in Salmonella enteritidis inhibiting in vitro. Silage complete ration composed of some feedstuffs with the crude protein content of 21% and an additional 1 ml inoculum per 1 liter of water was added until 45% water content. Inoculum contained a total BAL 5 x 10⁸ cfu/ml. An aerobic fermentation process was done by 1 kg of complete feed compacted into plastic and put into silos, stored according to treatment. Organic acids content were: lactic acid, propionic acid, butyric acid analyzed using HPLC with a wavelength of 215 nm. Completely randomized design was applied in this experiment with 4 treatments stored (7, 14, 21, and 28 days) each repeated four times, the data was tested using SPSS, differences between treatments were tested by Duncant. The average results showed that lactic acid very significantly higher (P <0.01) on each day of observation: 7 days = 305.64 ppm; 14 days = 876.52 ppm; 21 days = 1666.79 ppm; 28 days = 4038.70 ppm. Propionic acid content on 7 and 14 days were not significantly differently: 164.1 ppm and 158.9 ppm, while on 21 days and 28 days storaged very significantly higher (P <0.01): 244.2 ppm and 325.9 ppm. However, butyric acid content below the detection limits. Inhibition activity analyzed using agar well diffusion method. Silage ration complete with 100% concentration was capable for forming a clear zone with the average area 7.61 mm against 10⁶ cfu/ml of Salmonella enteritidis. In conclusion silage ration complete with 21% protein had a number of organic acids that could inhibit pathogenic bacteria so that poultry feed was safe and free from antibiotics.

Keywords: Organic acid, Inhibition, Silage, Salmonella enteritidis

INTRODUCTION

Healthy feed produce healthy livestock. Nowadays healthy poultry feed comes with antibiotics. Eventhough beside the positive impact gained there are the negative effects of antibiotics are also obtained in the form of residues in animal products. Several studies of alternative antibiotics have been written by Sanchez et al. (2015) describe another things that is safe and does not leave a residue, which phytobiotic derived from plants, spices and herbs. Research on ‘organic acids and inhibition of complete silage ration to the growth of Salmonella enteritidis ‘ in addition aimed at improving the performance of the livestock also as healthy fodder and able to act as an antibiotic.

Silage is made because of abundant feed ingredients, on the other hand of making silage is also intended to maintain nutritional feed ingredients. Silage also contains lactic acid bacteria are able to produce antimicrobial substances. Silage is also able to improve performance such as that provided by the probiotic effect (McDonald et al, 1991). Complete ration silage has a pH that is acidic and increase the content of total acid (Allaily et al., 2011).
MATERIALS AND METHODS

Materials
Feed ingredients were used for the preparation of complete silage ration as: yellow corn, rice bran, coconut meal, soybean meal, fish meal, coconut oil, CaCO3, DCP, premix, water and liquid inoculum containing a total BAL $5 \times 10^8$ cfu/ml. Equipment were used plastic, silo, petri dish, biuret, laminar, scales, isolative, cool box and a pH meter.

Method
All feed ingredients were mixed according to the formula of laying ducks with 21% crude protein and 45% moisture content. Making 45% water content was refers to Allaily et al. (2011). Water was already containing a total BAL $5 \times 10^8$ cfu/ml. After all ingredients mixed with water, and then compacted for 1 Kg in each plastic. Then covered and stored in a silo in an aerobic fermented during 7, 14, 21, and 28 days (for treatment). Organic acids such as lactic acid, propionic acid, butyric acid were calculated by using HPLC (High Performance Liquid Chromatography). Clear zone formed from 100% concentration challenged of $10^6$ cfu/ml S. enteritidis concentration.

Sample Preparation
The sample was 2 g, then was put in a 125 mL Erlenmeyer. Added water 25 ml and stirred until dissolved. Then pH was set 1-2 with HCl 3 N. Extracted with diethyleter 25 mL for 2 minutes and 2 times. Results extract basified to pH 8 with 2 N NaOH, and then evaporated down to the water phase. A layer of water left behind was dilute to 2 mL with mobile phase, filtered with millex 0.45 pM and 20 mL injected into the HPLC. Challenge test was using the well diffusion method with MHA (Muller Hilton Agar), using a standard fluid Max Farlan $10^6$ cfu/ml. Complete silage ration for 100% fluids was dripped into the well contents of S. enteritidis $10^6$ cfu/ml, then was put into an incubator and 24 hours later formed clear zone can be observed.

Standard
Standard stock of 10,000 ppm lactic acid, Standard series, respectively: Lactic acid: 312.5; 625; 1250 and 2500 ppm, propionic acid: 62.5; 125; 250 and 500 ppm, butyric acid: 62.5; 125; 250 and 500 ppm. 10 mL injected into the HPLC.

HPLC conditions
Column: Meta Carb H Plus coloum 300 x 7.8 mm, Phase Motion: H$_2$SO$_4$ 125 mL in 500 mL of water, Flow: 0.6 mL / min, Gel Length: 215 nm, temperature: 800 C.

Analysis Procedures
Day observation 7,14, 21, and 28 days was the treatment, and each treatment was repeated 4 times. The design used was completely randomized design with 4 treatments and 4 replications. Results were analyzed using SPSS and tested duncan to see a noticeable difference.

RESULTS AND DISCUSSION

Complete silage ration with fermentation time of 7, 14, 21, and 28 days showed an increase significantly, lactic acid content as well as propionic acid in the treatment of 14, 21, and 28 days was increased significantly, but 7 and 14 days showed no different result. While the content of butyric acid in 7 and 14 days was below the limit of detection, treatment of 21 and 28 days were not significantly different. Pictures HPLC analysis results can be seen as follows:
Picture: a. Standard, b. 7 days, c. 14 days, d. 21 days, e. 28 days of fermentation time.
Table 1. Organic acid content in silage treated with fermentation time

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Fermentation Time (Day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Lactic acid (ppm)</td>
<td>305.64±5.44a</td>
</tr>
<tr>
<td>Propionic acid (ppm)</td>
<td>164.05±2.92a</td>
</tr>
<tr>
<td>Butyric acid (ppm)</td>
<td>&lt;0.62</td>
</tr>
</tbody>
</table>


Organic acids have an antimicrobial effect (Tharmaraj and Shah 2009), which examines the acetic acid, lactic, formic, propionic, butyric, benzoic, and phenillaktat able to inhibit pathogens such as E. coli, B.cereus, S. Aureus. Nurjama’yah et al. (2014) succeed to see the antimicrobial activity of lactic acid bacteria against E. coli, S. Thypmurium and L.monocytogenes. Negara et al. (2008) wrote that the organic acid salts of a complete ration of corn silage fluids had inhibitory ability against S.typhimurium and E. coli. Fermentation products was not only produced organic acids as antimicrobials, but was able of being a factor to improve animal performance (Fasina and Thanissery, 2011; Milbradt et al., 2014).

Complete silage ration at 100% concentration was able to inhibit pathogenic bacteria S. enteritidis with a concentration of 106 cfu ml. Clear zone produced with the average area of 7.61 mm. Formed clear zone can be seen in the picture below.

Picture of clear zone formed by 100% concentration of complete silage ration

Miyamoto et al. (2000) reported about the ability of lactic acid bacteria form a clear zone covering an area of 0.7 cm - 1.2 cm. Clear zone area formed by complete silage ration measuring 7.61 mm is almost the same as the ability of lactic acid bacteria derived from the cloaca and vagina chicken inhibited Salmonella enteritidis. But the clear zone formed on the Oyarzabal and Conner (1985) researched was wider at 13 -30 mm, it was probably due to Salmonella sp challenged with bacteria that have been isolated and selected.

CONCLUSIONS

Complete Silage ration with 21% protein had a number of organic acids that was able to inhibit Salmonella enteritidis so that a poultry feed was safe and can replace antibiotics function.
ACKNOWLEDGEMENTS

Thanks to the Research Directorate Community Service, the Directorate General of Higher Education, Ministry of Education and Culture of Indonesia that has funded this research.

REFERENCES

The Utilization of Some Feed Supplements by Using or Without Molasses on Local Male Sheep on Fermentation Results in Rumen Liquid, Daily Live Weight Gain, Production, C/N Ratio and Water Content of Feces.

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ABSTRACT: The objective of this experiment was to know how much pH, ammonia (NH₃) and volatile fatty acid total (TVFA) concentration in rumen liquid, daily live weight gain (DLWG) and feed consumption increase, production and water content in feces due to local male sheep given feed supplement of UMMB, MFS and MFS No molasses. Experimental design used Double Latin square design 4x4, and then if the feed treatments are significantly different, it would be tested by Duncan’s Multiple Range test. Parameters measurement were consist of pH, NH₃, TVFA, DLWG, feed consumption, production and water content of feces. The results indicated that pH, NH₃, TVFA, feed consumption and production of feces were not significantly different on P>0.05. Whereas, DLWG/head/day was significantly different due to the feed treatments, the values of T₁, T₂, T₃ and T₄ were 49.41, 67.26, 111.94 and 88.10 g/head/day respectively. In addition, the water content in feces of male sheep also had a significant difference on P<0.05, the values were 7.42, 7.72, 8.84 and 7.81%.

Keyword : feed supplement, fermentation, production, water, feces

INTRODUCTION

Feed supplement of UMMB, MFS and MFS no molasses had been used for feeding dairy goat of Etawah generation. The result indicated that thus feed supplements were capable of increasing dry matter, organic matter, and crude protein intake, and tending dry and organic digestibility of feed. A part from thus, the feed supplements also influenced milk total solid of early lactation dairy goat of ettawa generation (Asih, et al., 2014 and Suharyono, et al., 2014). Feed supplement could be mentioned as a potential feed for ruminant animal, when it has been treated not only in dairy goat but also in dairy cows, and beef cattle. Dairy cow and bee cattle had been given thus supplements, the results shown milk production, daily live weight gain, and dry matter and organic matter digestibility increased sharply (Kurniawan, 2011; Suharyono, et al, 2014; Waluyo, 2014). Sheep is one of ruminants animal that has not been treated by thus supplements is, therefore, it will be tested on local male sheep. The impact of thus supplements were not only investigated on rumen fermentation results, nutrient digestibility and daily live weight gain but also to be measured excretion, water content and C/N ratio of feces ram. The expectations of this experiment are feed supplement to have potential role for increasing production of ruminant animals.

MATERIAL AND METHODS

The experiment had been conducted at Nutrition group laboratory, Agriculture division, Centre for Application Isotope and Radiation, National Nuclear Energy Agency, Jakarta.
Experimental animals used four local male sheep, which their ages 1 year old and the average of early body weight were 20 kg. Feed treatments were local grass + concentrate (T₁), T₁ + 0.1% UMMB (T₂), T₁ + 0.1% MFS (T₃) and T₄ was T₁ + 0.1% MFS No Molasses. pH, NH₃, TVFA, DLWG, feed consumption, production and water content feces will be measured. Double Latin square design 4x4 will be used for statistical analysis. Nutrient content of feed treatments are presented in Table 1.

**Table 1.** Nutrient content in experimental ration

<table>
<thead>
<tr>
<th>Nutrient content (%)</th>
<th>Feed treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T₁</td>
</tr>
<tr>
<td>Dry matter</td>
<td>49.82</td>
</tr>
<tr>
<td>Crude protein</td>
<td>11.35</td>
</tr>
<tr>
<td>Crude fat</td>
<td>5.83</td>
</tr>
<tr>
<td>Crude fiber</td>
<td>22.19</td>
</tr>
<tr>
<td>Total digestible nutrient</td>
<td>72.21</td>
</tr>
</tbody>
</table>

Suharyono *et al.*, 2010

**RESULT AND DISCUSSION**

The results of the experiment are shown in Table 2. Fermentation results such as pH, NH₃ and TVFA were not significantly different. Their values were in conditional normal microbial growth; these were in between 6.46-6.64; 206.9-236.3 mg/L; and 94.5-97.5 mg/L respectively. Arora (1995) reported that pH normal in rumen liquid is 6-7. Normal content of NH₃ concentration in rumen liquid for growing microbes is 50-250 mg/L (Preston and Leng, 1987). Whereas TVFA is mentioned normal condition in rumen liquid for microbial growth to be 80-160 mg/L (Jalaludin, 1994).

**Table 2.** The average of fermentation results, DLWG, feed consumption, production and water content of feces on local male sheep.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Feed Treatments</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T₁</td>
<td>T₂</td>
</tr>
<tr>
<td>pH</td>
<td>6.46</td>
<td>6.64</td>
</tr>
<tr>
<td>NH₃ (mg/L)</td>
<td>228.2</td>
<td>233.7</td>
</tr>
<tr>
<td>TVFA (mg/L)</td>
<td>94.5</td>
<td>97.5</td>
</tr>
<tr>
<td>DLWG (g/head/day)</td>
<td>49.41</td>
<td>67.26(ab)</td>
</tr>
<tr>
<td>Feed consumption (g/head/day)</td>
<td>1083</td>
<td>1104</td>
</tr>
<tr>
<td>Efficiency of feed utilization (%)</td>
<td>4.59</td>
<td>6.08(ab)</td>
</tr>
<tr>
<td>Dry matter (DM) digestibility (%)</td>
<td>61.84</td>
<td>63.85</td>
</tr>
<tr>
<td>Production of feces ((Kg/head/day)</td>
<td>0.67</td>
<td>0.68</td>
</tr>
<tr>
<td>Water content of feces (%)</td>
<td>7.42</td>
<td>7.72(ab)</td>
</tr>
<tr>
<td>Ratio C/N feces on male sheep</td>
<td>26</td>
<td>25</td>
</tr>
</tbody>
</table>
The daily live weight gain (DLWG) were influenced by supplementation of UMMB, MFS and MFS non molasses on P<0.05, when compared with T1 (Local grass + concentrate commercial). The values were 67.26, 111.94, 88.1 and 49.41 g/head/day respectively. By increasing of DLWG due to addition of feed supplement, the efficiency of feed utilization was also significant different P<0.05. Feed supplement of MFS treatment tended to higher than UMMB and MFS no molasses. When T3 was compared to T1, the values were 9.78% and 4.59% respectively. Maynard and Loosly (1979) reported that the animals are more fast growing of daily weight, it mean that the utilization of feed ration is more efficient. Composition of UMMB, MFS and MFS no molasses consist of protein, energy, minerals essential, non protein nitrogen, by pass protein and fermentable carbohydrate sources. It mean that the nutrient content of thus supplement has potential role for fast growing of microbe to digest of feed in rumen of sheep (Suharyono et al., 2010). It was supported by dry matter digestibility result. The value of DM digestibility tended to be higher in T3 than T4, T2 and T1. These values were 70.66, 67.77, 63.85 and 61.84%, although was not significant different on P>0.05.

Most of nutrient content in feed treatments was almost the same (Table 1), except on TDN content in T1 tended to be lower than T2, T3 and T4, the values were 72.21%, 73.22, 73.84 and 73.46% respectively. C/N ratio and excretion of feces were not significant different on P>0.05, however, water concentration in feces was significant different P<0.05, T3 tended to be higher than T1, T2 and T4, these were 8.84 vs 7.42, 7.72 and 7.81% respectively. Regarding of feed supplement’s composition in T2 and T3 contained molasses, whereas T1 and T4 were not molasses’s include. These supported by content of water in MFS’s feed supplement (T3) was higher than commercial concentrate (T1), UMMB (T2) and MFS non molasses (T4), the values were 17.11, 12.16, 14.5 and 13.41%.

CONCLUSION

Feed supplements of UMMB, MFS and MFS no molasses are able to increase daily live gain of male sheep and efficiency of feed utilization. MFS tended to be better respond than UMMB and MFS no molasses that was supported by value of dry matter digestibility also tended to be higher, it was 70.66% vs 63.85 and 67.77%

REFERENCES


Evaluation of Albazia chinensis as Tannins Source for In Vitro Methane Production Inhibitor Agents Sheep Rumen Liquor

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ABSTRACT: The objective of this study was to investigate the effect of Albazia chinensis as a source of tannin on in vitro methane production and rumen parameters. Two sheeps were used as donor of rumen microbes. Four experimental diets (grass:concentrat, 60:40) with addition of Albazia chinensis leaves equal to tannin level of 0%, 2%, 4% and 6% based on dry matter (DM) were used as substrate for in vitro fermentation by Menke and Steingass gas production method for 48 hours of incubation. Methane production, DM and organic matter (OM) digestibility, and parameters of rumen fermentation were measured at the end of incubation. Data obtained were analyzed by one way analysis of variance (ANOVA) continued by DMRT. The addition of Albazia chinensis leaves decreased (P<0.01) DM and OM digestibility with increasing of tannin level. Moreover, the treatment also decreased methane production. The significant decreasing occurred at tannin level of 6%. The addition of tannin did not affect (P>0.05) number of protozoa, microbial proteins, ammonia, VFA and pH. It could be concluded that the addition of Albazia chinensis equal to tannin level of 6% is the optimal level to reduce methane production without any negative effects on rumen fermentation parameters.

Keywords: Methane, Tannin, Albazia chinensis, Sheep, In vitro

INTRODUCTION

Methane (CH$_4$) is gases which big potensi to cause of global warming (Reay et al., 2010). Methane emissions from the agriculture sector represents 40% of total anthropogenic methane production (Key and Tallard, 2012), with the largest (25%) contribution comes from ruminants enteric fermentation (Thorpe, 2009). Small ruminants (sheep and goats) produce CH$_4$ emissions by 475 million tonnes of CO$_2$eq. Estimates of global CH$_4$ emissions by ruminants ranged between 65 to 85 million tonnes per year, while the total CH$_4$ emissions globally from 400 to 600 million tonnes per year (FAO, 2013). Methane emissions not only related to environmental issues, but also represents a loss of gross energy of feeds which can not be used for the production process. Approximately 2 to 12% of feed gross energy consumed by ruminant lost as CH$_4$ (Patra, 2012).

Several research using in vitro and in vivo method to mitigation of CH$_4$ production and improvement of ruminant performance have been done by supplementation of concentrate (Lovett et al., 2005), fumarate (Ungerfeld et al., 2007), sinamaldehid (Macheboeuf et al., 2008), antraquinone (Yusiati et al., 2010), and essential oils (ME) (Calsamiglia et al., 2007). Tannins or polyphenols is plant natural compound which could be use to reduce CH$_4$ emissions from rumen fermentation. Reduction methane supplementation of several legumes as tannin sources reduce CH$_4$ production from in vitro rumen fermentation are reported by Puchala et al., (2005)
The mechanisms of tannins inhibition on CH$_4$ production are directly by inhibits the growth and activity of methanogens. (Tavendale et al., 2005) and indirectly by form complex tannins protein binding which limiting methanogens acces to protein (McSweeney et al., 2001). And also reducing fiber digestion that reduces the production of hydrogen (H$_2$) a precursor of CH$_4$ synthesis. Albazia chinensis is legume which has high polyphenol compound. Tannins content in Albazia chinensis is 7.21% DM based on Laboratory analysis. This study was conducted to determine the effect of Albazia chinensis as a source of tannins on CH$_4$ production of sheep in vitro.

**MATERIALS AND METHODS**

**Albazia chinensis Preparation**

Albazia chinensis was gain from Wonogiri, Central Java, Indonesia dried in an oven at temperature of 55°C for 3 days, then grounded using a Wiley mile and seave in size of 1 mm. Chemical composition of samples were analyzed using proximate analysis method (AOAC, 2005) and tannins content analyzed according Makkar (2003).

**Inoculum preparation**

Rumen fluid was obtained from two head of slaughtered sheeps before morning feeding. The sheeps had been adapted to diet consist of forages and concentrates in ratio 60:40 DM basic which offered in equal proportions twice a day.

**In vitro gas production**

In vitro gas production were used in this research according Menke and Steinngas, (1988). Substrate for fermentation consist of Pennisetum purpureum Schum (60%) and concentrates (40%) DM based. Albazia chinensis leaf were added to the fermentation diet equal to tannin content of 0, 2, 4, and 6% DM feed Fermentation was conducted for 48 h. At the end of incubation gas samples were collected for methane determination using gas chromatography. Residual feed were collected to calculate DM and OM digestibility, wherease pH, microbial protein synthesis, ammonia, and VFA were measured from the liquid media. Protein of microbe were determined using Lowry methode (Plummer, 1987), protozoa according to methode of Diaz et al., (1993), ammonia followed Chaney and Marbach, (1962), and VFA acording to Filipek and Dvorak, (2009).

**Statistic Analysis**

Data obtained were analyzed by one way analysis of variance (ANOVA) continued by Duncan’s new multiple range test (DMRT).

**RESULTS AND DISCUSSION**

Addition of Albazia chinensis at tannin levels of 0, 2, 4, and 6% DM feed have no effect on pH, protozoa, microbial protein, and NH$_3$. pH media range from 6.92 to 6.97. Normal pH for microbial activity range betwen 5.5 to 7.6 and optimal at 6.7 to 7.0 (Owens and Zinn, 1988) This result is in accordance to Chaudhary et al., (2011).that reported giving tannins from Ficus infectoria leaves in ruminant did not influence significantly on the pH value. For protozoa number, Aghamohamadi et al., (2014) reported that tannin from Quercus persica have no effect on protozoa population in rumen fermentation of sheep. Microbial protein were reported did not affected by tannin extract (Wischer et al., 2012). Utilization of Quercus libani Oliv. in the diet equal to tannin content 16.57 to 22.43 mg/100 ml did not showed the influence on the NH$_3$ content (Abarghuei, 2011). The concentration of NH$_3$ in the rumen depends on feed protein content. The higher the protein content of the feed the higher the concentration of NH$_3$ (McDonald, 2002).
Table 1. In vitro rumen fermentation parameter and microbial activities with different level of tannin from Albazia chinensis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Tannin concentration (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>pH</td>
<td>6.95</td>
</tr>
<tr>
<td>Protozoa (x103)</td>
<td>31.09</td>
</tr>
<tr>
<td>Microbial protein (mg/ml)</td>
<td>0.60</td>
</tr>
<tr>
<td>NH₃ (mg/100ml)</td>
<td>64.85</td>
</tr>
<tr>
<td>DM digestibility (%)</td>
<td>67.73⁹</td>
</tr>
<tr>
<td>OM digestibility (%)</td>
<td>75.67⁷</td>
</tr>
<tr>
<td>VFA (mol/100mol)</td>
<td>68.89</td>
</tr>
<tr>
<td>C2</td>
<td>50.47</td>
</tr>
<tr>
<td>C3</td>
<td>11.72</td>
</tr>
<tr>
<td>C4</td>
<td>6.70</td>
</tr>
<tr>
<td>CH₄ (ml)</td>
<td>4.37</td>
</tr>
<tr>
<td>CH₄/DM</td>
<td>34.09⁷</td>
</tr>
<tr>
<td>CH₄/OM</td>
<td>34.47⁶</td>
</tr>
</tbody>
</table>

a,b,c different superscripts at the row showed significant differences

Albazia chinensis as a source of tannin decreased (P <0.01) digestibility of DM and OM. Digestibility of DM and OM with the addition of 2% tannin level significantly lower than the level 4 and 6%. Tannins from various sources able to reduce DM and OM on feed fermentation in the rumen (Attia et al., 2013). Digestibility of DM and OM associated with protein digestibility and other organic materials such as carbohydrates and fats (Kurniawati et al., 2013). Tannin in moderate level could be used to protec feed protein from microbial rumen degradability.

The results showed that the addition Albazia chinensis as a source of tannin did not affect significantly (P> 0.05) the production of total VFA and VFA components (acetate, propionate, and butyrate). Same result was reported by Dentinho et al., (2014) that feeding containing tannins, both in high and low levels did not affect the VFA production or component. Different tannin source contain different nutrients, particularly carbohydrates content such as cellulose and hemicellulose which will affect the total production of VFA. The proportion of VFA in rumen fluid varies depending on the kind of feed consumed (McDonald et al., 2002).

Albazia chinensis as tannin source at level 0, 2, 4 and 6% did not affect significantly on total volume CH₄ production. But CH₄ production based on DM and OM digestibility were reduced significantly by addition of Albazia chinensis at tannin level of 6%. CH₄ production decreased as much as 12.11%/DM digestibility and 16.24%/OM digestibility compared to control. Declining of CH₄ production in ruminants by tannins also reported by Aghamohamadi et al., (2014). Tannins affinities to bind to protein and other nutrient are varies depend on tannins sources. Sasongko, (2010) stated that the tannins have optimal holding capacity to bovine serum albumin at a certain concentration. Utilization of jackfruit leaves as a source of tannins with varying concentrations have different affinity on binding to protein. At certain tannin concentrations the binding affinity will decreased due to saturation point.
CONCLUSIONS

In conclusion addition of Albazia chinensis leaves at tannin level of 6%, reduce CH₄ production with no negative effect on rumen fermentation. The decreasing of DM and OM digestibility due to reduction of protein digestibility.

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Integrated Approach in Developing Sustainable Tropical Animal Production
October 20-22, 2015, Yogyakarta, Indonesia

Growth and Productivity of *Sorghum Bicolor* (L.) Moench in Merapi Eruption Soil with Organic Fertilizer Addition

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**ABSTRACT:** The aimed of this study was to determine the growth and the productivity of sorghum planted in Merapi eruption soil which was affected by addition with various levels of organic fertilizer. The treatments given was an organic fertilizer 5 and 10 ton/ha. Analysis was conducted on the production, chemical composition, and *In vitro* digestibility. Data was analyzed using anova analysis on Completely Randomized Design (CRD) and the difference between means was continued with Least Significant Difference (LSD) test. The result showed that plant height, dry matter production, *In vitro* digestibility dry matter affected (P<0.05) by addiction of organic fertilizer in Merapi eruption soil. Plant height increase for 87.55 cm to 118.12 - 126.00 cm, dry matter production for 2.82 ton/ha to 5.20 - 5.68 ton/ha, and *In vitro* digestibility dry matter for 65.39% to 66.37 - 69.20%. Based on the result of study, addition an organic fertilizers 5 and 10 ton/ha on Merapi eruption soil increased the growth and the productivity of sorghum.

**Keywords:** Merapi Eruption Soil, Organic Fertilizer, *Sorghum Bicolor* (L.) Moench, Proximate Analyzed, *In vitro* Digestibility

**INTRODUCTION**

Continuous availability and quality of forage will become major variable to support the success in increasing the productivity of ruminants. However, the availability of land which can be used to grow forage increasingly limited. Therefore, necessary to develop marginal land such as sandy soil to improve the availability of feed ingredients, especially forage (Suwignyo *et al.*, 2010). Merapi eruption land is wide-spreading, potential as a pasture land for ruminants. However, the soil of former Merapi eruption containing volcanic ash, sand and rocks that have physical properties that are less good, especially the carrying capacity of the soil moisture availability to plants. Volcanic ash soil were given additional organic fertilizer or animal manure condition will get better (Yunaidi, 1997). Buckman and Brandy (1982) stated that organic fertilizers boosted soil water holding capacity and enhance the amount of water available for plant life. Suwignyo *et al.* (2010), stated that farmers in the sandy soil add some organic fertilizer to increase the quality of the soil before planting. One of the plants that can be utilized in the land of the former Merapi eruption is sorghum. Wahida *et al.* (2013) stated that sorghum has a feature that is easily cultivated to yield high enough, little need of water, the risk of failure is small, adaptability spacious well planted in monoculture or multiple cropping, can experience re-growth, and hold drought with low productivity.

**MATERIAL AND METHODS**

**Materials and tools**

The materials were used in the study is the soil of former Merapi eruption, topsoil from the area Jambusari, Kepuharjo, Sleman, Yogyakarta. Land regosol of farm forage fodder Faculty of Animal Science (Karangmalang), organic fertilizer (compost manure) comes from control study Lusuba (2013), grain sorghum varieties Numbu, SP36 (36% P2O5), and urea (46% N), chemicals for proximate analysis and measurement of digestibility *In vitro* method Tilley and Terry 2 stages, as well as rumen fluid from cows PO fistula.

The tools were used is equipment for polybag, oven 55 °C and 105 °C, ruler size 30 cm, digital scales brand Idealife capacity of 5 kg sensitivity 1 g, equipment for proximate analysis and
measurement of digestibility In vitro method Tilley and Terry, autoclave, brand Sartorius analytical balance 0.0001 g sensitivity. Wiley mill with a diameter of 1 mm sieve to grind samples.

**Preparation of planting medium**

There were 4 kinds of soil from the planting medium are Karangmalang as external control, soil eruption of Merapi without addition of organic fertilizer as an internal control, Merapi eruption soil with the addition of organic fertilizers 5 ton / ha and 10 ton / ha. Soil included approximately ¼ polybag capacity (size 0.08 x 30 / 15x 30 cm) and replication 6 polybags as a growing medium without sifting process. SP36 with a dose of 150 kg / ha (2.25 g / polybag) given as basal fertilizer with organic fertilizer, blended at the top (topsoil), then allowed to stand for 7 days.

**Planting and fertilizing**

Seeds planted by making a hole in the middle polybag depth of approximately 5 cm, 1 grain sorghum each hole and then covered with soil. Urea 100 kg / ha (3 g) given at the time the plant ages 4 and 7 weeks. Watering is done every other day in the morning about 500 mL. Tilling the soil is done every week along with observations of plant height and number of leaves. To prevent stinky pests by spraying insecticide Dacron® (0.5 ml / liter of water).

**Harvesting and preparation of samples**

Plants were harvested at milk stage. Plants were cut 10 cm from the soil surface. Plants in each polybag counted and weighed and then put in the paper bag that had been dried oven 55°C and already weighed. Paper bag containing dried plant samples in an oven temperature of 55°C approximately 2 days. The dried samples were weighed, then ground using a Wiley mill with a 1 mm sieve screen, later in the proximate analysis (AOAC, 2005).

**Variables observed**

The variables measured were growth (germination, leaf number, plant height and flowering time); productivity (dry matter production; production of organic matter; the chemical composition; digestibility of dry matter and organic matter digestibility In vitro sorghum. In vitro digestibility test carried out according to the method of Tilley and Terry (1963) 2 stages with modifications according Utomo (2010) the reduction of the substrate (sample) and rumen fluid, artificial saliva (fluid McDougall) to half (50%), namely 0.25 grams of sample material feed, using 25 mL of rumen fluid mixture with artificial saliva (1: 4), 3 ml of HCl 20% (v / v), and 1 mL of pepsin 5% (w / v), incubated using a 50 ml test tube volume.

**Data analysis**

Data were analyzed by a completely randomized design using SPSS 16.0 unidirectional pattern continued test of Least Significant Different (LSD) (Gomez and Gomez, 1984)

**RESULTS AND DISCUSSION**

**Fertilizers and Soil Quality**

The quality of organic fertilizer and soil were used in this study can be seen in Table 1.

<table>
<thead>
<tr>
<th>Kind</th>
<th>C (%)</th>
<th>BO (%)</th>
<th>N (%)</th>
<th>P (%)</th>
<th>K (%)</th>
<th>C / N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic fertilizer***)</td>
<td>38.17</td>
<td>65.81</td>
<td>1.35</td>
<td>0.44</td>
<td>1.48</td>
<td>34.01</td>
</tr>
<tr>
<td>Karangmalang soil *)</td>
<td>3.45</td>
<td>5.95</td>
<td>0.26</td>
<td>18.75</td>
<td>1.26</td>
<td>13.27</td>
</tr>
<tr>
<td>Merapi eruption soil *)</td>
<td>0.31</td>
<td>0.54</td>
<td>0.03</td>
<td>3.24</td>
<td>0.03</td>
<td>10.33</td>
</tr>
</tbody>
</table>

*) Analysis of the samples in the Laboratory of Soil Science, Faculty of Agriculture
***) (Lusuba, 2013)

**Plant Growth**

Data growth of sorghum as germination, plant height, leaf number and flowering time are presented in Table 2.
Table 2. Data observation, growth of sorghum

<table>
<thead>
<tr>
<th>Variabel</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>External control</td>
</tr>
<tr>
<td>Germination (days)</td>
<td>1.17±0.41p</td>
</tr>
<tr>
<td>Plant height (cm)</td>
<td>155.98±21.14p</td>
</tr>
<tr>
<td>Number of leaves (pieces)</td>
<td>9.83±1.94</td>
</tr>
<tr>
<td>Flowering time (days)</td>
<td>71.50±4.18p</td>
</tr>
</tbody>
</table>

p, q, r different superscripts in the same column indicate significant differences (P <0.05)

Germination. Addition of organic fertilizers 10 tons / ha was able to compensate for the speed of germination of external controls (1.17 days). Factors affecting the speed of germination according to Rao (2010) that is the decomposition of organic matter due to the addition of organic fertilizers.

Plant height. The height of plants was produced in this study was lower than the literature of Cereal Crops Research Institute (2013), which was higher sorghum varieties Numbu ± 187 cm. The growth of plants according to Samanhoedi (2010), influenced by the soil moisture content. That’s because high accretion process plant begins with the formation of buds is a process of cell division and enlargement. Both of these processes are affected by cell turgor. The process of cell division and enlargement will happen when the cells undergo turgiditas whose main element is the availability of water.

Crop Production

The average production of sorghum plants grown in soil eruption of Merapi with the addition of organic fertilizers can be seen in Table 3.

Table 3. Production of dry and organic matter (tonnes / ha) sorghum (% DM)

<table>
<thead>
<tr>
<th>Production (ton / ha)</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>External control</td>
</tr>
<tr>
<td>Dry matter</td>
<td>3.39 ± 0.26q</td>
</tr>
<tr>
<td>Organic matter</td>
<td>3.09 ± 0.24q</td>
</tr>
</tbody>
</table>

pq: different superscripts in the same row indicate significant differences (P <0.05)

Dry matter production. Production of sorghum dry matter in this study was lower than the result Wijayanti (2009) 3.19 tonnes / ha. Dry matter production of the plant can be increased by fertilizing the plant gets bigger as additional nutrients essential for growth, development, and production.

Production of organic materials. Production of organic material in this study is lower when compared with the research Wijayanti (2009) which is 2,76 t / ha. The big difference in the production of organic materials was affected by the ash content of plants. The ash content of plants varies depending on the plant species and the intensity of the light that hits.

Chemical composition

The average yield analysis of the chemical composition can be seen in Table 4 below:

Table 4. The chemical composition of sorghum plant (% in DM)

<table>
<thead>
<tr>
<th>Variables measured</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
</tr>
<tr>
<td>Dry matter (%)</td>
<td>24.50 ± 1.08p</td>
</tr>
<tr>
<td>Organic matter (%)</td>
<td>91.15 ± 0.22</td>
</tr>
</tbody>
</table>

268
Crude protein (%) 
- 10.09 ± 0.22 p 
- 15.59 ± 2.19 q 
- 12.28 ± 0.14 p 
- 11.27 ± 0.66 p

Crude fiber (%) 
- 22.35 ± 0.67 p 
- 24.09 ± 0.53 p 
- 31.98 ± 2.06 q 
- 33.05 ± 2.08 q

Ether extract (%) 
- 2.43 ± 0.11 ns 
- 2.75 ± 0.46 
- 2.30 ± 0.02 
- 2.36 ± 0.43

EMWN (%) 
- 55.52 ± 1.15 q 
- 49.43 ± 4.93 pq 
- 46.02 ± 2.16 p 
- 44.53 ± 3.91 p

Calculate TDN (%) 
- 70.85 ± 0.93 q 
- 69.26 ± 2.05 q 
- 58.87 ± 2.35 p 
- 56.15 ± 2.20 p

ns indicates non-significant
pq different superscripts in the same row indicate significant differences (P <0.05)

**Dry matter content.** The percentage of dry matter content of sorghum plants grown seedless according Praptiwi *et al.* (2013) 30.42%. Susetyo *et al.* (1969), states that if the water content of the plant increases, there will be a decrease in dry matter content.

**Crude protein levels.** The percentage of crude protein of sorghum crops planted on the ground clay geluhan and urea (100 kg / ha) by Koten (2013), namely (4.45%). When compared with the percentage of the study, the percentage of research is above such literature. This can be caused by differences in soil and fertilizing.

**Crude fiber content.** The percentage of crude fiber sorghum crops planted on the ground clay geluhan and urea (100 kg / ha) by Koten (2013), ie 33.14%. Thus treatment with the addition of organic fertilizers 5 and 10 ton / ha in the range of literature.

**Extract materials without nitrogen.** Value of EMWN according Hartadi *et al.* (2005), the sorghum plants grown without seeds (41.1%) and seeds (69.2%) the levels EMWN research results are among the percentage of literature. According to Tillman *et al.* (1998), the levels of plant EMWN is determined by the magnitude of the levels of the other factions are not different then EMWN levels are no different, and vice versa.

**In vitro Digestibility**

In vitro digestibility of dry matter and organic matter sorghum can be seen in Table 6.

**Table 6.** *In vitro* digestibility of dry matter and organic matter of sorghum plant

<table>
<thead>
<tr>
<th>Digestibility</th>
<th>Treatment</th>
<th>External control</th>
<th>0 tonnes/ha</th>
<th>5 ton/ha</th>
<th>10 tonnes/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter (%)</td>
<td></td>
<td>71.03±0.48</td>
<td>65.39b±1.53</td>
<td>66.37b±1.75</td>
<td>69.20±1.04</td>
</tr>
<tr>
<td>Organic matter (%)</td>
<td></td>
<td>71.07±1.25</td>
<td>64.64b±0.85</td>
<td>66.23b±2.04</td>
<td>69.70±1.67</td>
</tr>
</tbody>
</table>

pq different superscripts in the same row indicate significant differences (P <0.05)

**Conclusion**

The addition of 5 and 10 ton / ha organic fertilizer for sorghum plant planted in the soil of the Merapi eruption could increase the growth and production of sorghum, although not the same as the land of Karangmalang.

**Suggestion**

The addition of organic fertilizers 10 tons / ha in the soil Merapi eruption could increase the growth and productivity of sorghum. Furthermore, variety of forage and crops, variations in the type of organic fertilizer, further analysis of neutral detergent fiber (NDF) and acid detergent fiber...
REFERENCES


Quality and Storability of Pelleted Cassava (Manihot utilisima) Leaves var. Bitter

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ABSTRACT: This study was done to determine the effect of pelleting cassava (Manihot utilisima) leaves var. bitter on its quality and storability. Based on 2 × 4 factorial experimental design, 2 forms of cassava leaves (powder and pellet) and 4 storage periods (4, 6, 8, and 12 weeks) were applied on the samples. Dried cassava leaves were ground to powder form and then half of it was pelleted using 15% DM cassava starch as binder. Those 2 forms of cassava leaves were stored for 4, 6, 8, or 12 weeks in unvacuumed and vacuumed plastic bags. Evaluation on quality was done in each period; however samples stored in the vacuumed plastic bags only were evaluated in the end of week 12. Pelleted cassava leaves showed lower crude protein (22.04 vs. 24.68%) and lower total carotene (60.72 vs. 84.19 mg/100 g DM) contents (P<0.01). After 12 weeks in storage, no effect were showed on crude protein concentration but lower total carotene content was detected (P<0.01) on week 12. In addition, storing cassava leaves in vacuumed plastic bags could maintain total carotene content compared to those without vacuumed plastic bags. It can be concluded that pelleting cassava leaves with 15% DM cassava starch decreased crude protein and total carotene content; packing cassava leaves in vacuumed plastic bags could maintain total carotene content up to 12 weeks.

Keywords: Cassava leaves, Manihot utilisima, Pellet, Crude protein, Total carotene.

INTRODUCTION

Cassava (Manihot esculenta) or Manihot utilisima was first introduced to the Indonesian archipelago by the Portuguese in the 16th century and was grown commercially in Indonesia since 1810 (Anonymous, ---- cit. Utomo, 2012). Beside of the tuber used as energy source both for food or feed, cassava leaves are also can be used for feed. The content of crude protein (CP) in cassava leaves is relatively high (30.59%) thus it can be used as protein source, especially for ruminants.

One of the problems in using cassava leaves for ruminant feed is the cyanide acid (HCN) content, which is varying among varieties. There are two varieties of cassava: bitter and sweet cassava, which would lead to different levels of HCN contents. Cyanide acid content in bitter cassava is greater than the sweet varieties. The cyanide acid content in bitter cassava varies from 0.02 to 0.25% (Bo Gohl, 1981; Utomo et al., 2014), while sweet varieties contain less than 0.01% HCN (Bo Gohl, 1981). In addition, the chemical compositions (% DM) of bitter cassava leaves are: 26.35% dry matter (DM), 24.17% crude fiber (CF), 33.80% non-nitrogen extract (NNE), 4.87% ether extract (EE), and 0.24% cyanide acid (HCN) (Utomo et al., 2014).

In order to conserve its high quality nutrient, cassava leaves can be preserved by various methods. One of preservation methods of cassava leaves that commonly practiced by farmers in Indonesia is by drying them under direct sunlight. Dried cassava leaves not only can be used as energy source for ruminant when fresh forages are abundant, but also may provide protein and minerals (Utomo, 2015). Another preservation method is by pelleting the cassava leaves. Pelleting reduces segregation of the different ingredients within the finished feed ensuring a balanced fraction is consumed; feed in pelleted form reduces natural losses, such as wind loss and spillage loss (Fairfield, 1994).
Nutrient loss may occur in hay during storage due to improper storing method as well as by the length of storage. Packaging or bagging can protect feed materials or final products to be more durable during storage. The increasing durability of packed or bagged feedstuffs during storage is due to that feedstuffs are more protected from environment influences, such as temperature, humidity, and oxygen, as well as insect invasion. This study was done to determine the best preservation methods and duration of storage of bitter cassava leaves.

**MATERIALS AND METHODS**

This research was conducted at the Laboratory of Feed Technology, Department of Nutrition and Feed Science, Faculty of Animal Science, Universitas Gadjah Mada, Yogyakarta. Fresh bitter cassava (Manihot utilisima) leaves were collected from Gunungkidul area, Yogyakarta, dried under direct sunlight, and then ground using hammer mill with 1 mm screen. The cassava leaves powder was divided into two: one part was kept in the powder form, and another part was made into pellet by adding 15% cassava starch (DM) as binder.

Both powder and pellet of bitter cassava leaves were packed using polyethylene bags. All samples were stored in room temperature for 4, 6, 8, and 12 weeks. Especially for 12 weeks storage, sample bags were vacuumed. Each treatment was done in 5 replications. Thus, this research experimental design was based on 2 × 4 factorial experimental design, with 2 forms of cassava leaves (powder and pellet) and 4 storage periods (4, 6, 8, and 12 weeks).

Data collected in this research included CP and total carotene contents of fresh and post-storage ceara rubber leaves, in accordance with a predetermined times. Determination of chemical composition of ceara rubber leaves was done using Weende method (Soejono, 1991; Nahm, 1992), while total carotene content was determined using method described by Harris (1970).

Obtained data were analyzed using the General Linier Model Multivariate procedure of SPSS ver. 22 (IBM, USA). Comparisons of means for feed forms and storage periods were done by contrast test with Duncan’s new multiple range test (Gomez and Gomez, 1984) when the effects of feed forms and storage periods (P≤0.05) were detected.

**RESULTS AND DISCUSSION**

**Chemical composition**

The Wendee analysis of fresh bitter cassava leaves showed that bitter cassava leaves contained 44.28% dry matter (DM), 93.46% organic matter (OM), 26.14% crude protein (CP), 8.67% ether extract (EE), 13.14% crude fiber (CF), 45.51% non-nitrogenous extract (NNE), and 108.27 mg/100 g total carotene contents. With its high CP and low CF contents (>20 and <18%, respectively), ceara rubber leaves can be classified as protein source feedstuffs (Utomo, 2012). However, its N as a crude protein constituent is also present in the cell wall. Thus, ceara rubber leaves is classified as protein source roughages in respect to its high CP and low CF contents.

After dried under direct sunlight, bitter cassava leaves showed a decrease in their CP and total carotene contents. Dried bitter cassava leaves contained 97.58% DM, 23.76% CP, and 97.05 mg/100 g total carotene contents, which showed a decline in CP and total carotene contents (9.10 and 10.36%, respectively) compared with the fresh one. The decrease in CP and total carotene contents is due to the direct heating under the sun.

**Post-storage crude protein content**

Data in Table 1 showed that although pelleting process lowered CP content (P<0.01), CP content of bitter cassava leaves in both forms were above 20% (24.68 and 22.04%, respectively), which indicated that the pellet is still can be classified as high protein feed. The decreasing in CP content of pelleted bitter cassava leaves was related to the 15% cassava starch addition during pelleting process. Since starch is low in CP content, thus by adding it in bitter cassava leaves
diluted the CP content of pellets bitter cassava leaves. The high temperature of steam applied
during pelleting process also affected CP content. This low CP content of pelleted bitter cassava
leaves is related to the denaturation of protein due to its high temperature during the steaming
process.

**Table 1.** Crude protein content (%DM) of powder and pelleted bitter cassava leaves after being stored for 4, 6, 8, and 12 weeks

<table>
<thead>
<tr>
<th>Storage period (weeks)</th>
<th>Storage form</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Powder</td>
<td>Pellet</td>
</tr>
<tr>
<td>4</td>
<td>24.99 ± 0.60</td>
<td>22.00 ± 0.48</td>
</tr>
<tr>
<td>6</td>
<td>24.37 ± 0.21</td>
<td>21.56 ± 0.31</td>
</tr>
<tr>
<td>8</td>
<td>25.50 ± 0.74</td>
<td>21.52 ± 0.91</td>
</tr>
<tr>
<td>12</td>
<td>25.11 ± 0.41</td>
<td>21.72 ± 0.41</td>
</tr>
<tr>
<td>12 (vacuumed)</td>
<td>23.42 ± 0.82</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>24.68 ± 0.90</td>
<td>a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22.04 ± 0.89</td>
</tr>
</tbody>
</table>

Means in the same row with different superscripts differ at P<0.01

Crude protein content of bitter cassava leaves was not affected by the length of storage
period, which was above 20% (Table 1). This means that dried bitter cassava leaves stored for 12
weeks in both powder or pellet form can still be used as protein source forage. Likewise, storing
bitter cassava leaves in vacuumed plastic bags did not show any differences compared to those
stored in unvacuumed plastic bags.

**Post-storage total carotene**

The results showed that the pelleting cassava leaves reduced total carotene content (P<0.01; Table 2). Similar to the reduction of CP content, this decreasing total carotene content was caused by the cassava starch addition as much as 15% during the pelleting process. Cassava starch contains very low total carotene content, thus adding cassava starch resulted in lower total carotene content of bitter cassava leaves pellet. The decrease of total carotene content in pellet also might be due heat created from steaming step during pelleting process. Heat might partially destruct carotene contained in bitter cassava leaves when steaming were performed during pelleting process. Steaming is needed in pelleting process since heat converts starch into glue shaft that serves as an adhesive (bounding) for pellet.

**Table 2.** Total carotene content (mg/100 g DM) of powder and pelleted bitter cassava leaves after being stored for 4, 6, 8, and 12 weeks

<table>
<thead>
<tr>
<th>Storage period (weeks)</th>
<th>Storage form</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Powder</td>
<td>Pellet</td>
</tr>
<tr>
<td>4</td>
<td>84.03 ± 2.38</td>
<td>66.26 ± 1.44</td>
</tr>
<tr>
<td>6</td>
<td>83.07 ± 3.13</td>
<td>66.23 ± 3.35</td>
</tr>
<tr>
<td>8</td>
<td>86.57 ± 2.23</td>
<td>61.07 ± 2.87</td>
</tr>
<tr>
<td>12</td>
<td>82.62 ± 4.67</td>
<td>52.28 ± 8.89</td>
</tr>
<tr>
<td>12 (vacuumed)</td>
<td>84.65 ± 2.20</td>
<td>57.74 ± 4.30</td>
</tr>
<tr>
<td>Mean</td>
<td>84.19 a ± 3.37</td>
<td>60.72 b ± 7.02</td>
</tr>
</tbody>
</table>

Means in the same row with different superscripts differ at P<0.01
Means in the same column with different superscripts differ at P<0.01
A noticeable decrease (P<0.01) of total carotene of bitter cassava leaves occurred when they were stored for 12 weeks. However, total carotene of bitter cassava leaves that stored in vacuumed plastic bags did not change. Storing bitter cassava leaves in vacuumed container might maintain total carotene content due to less oxygen in the container and denser feed materials in the pack, thus the oxidation process of feed materials is reduced.

CONCLUSIONS

Several conclusions can be drawn from this research:
1. Bitter cassava leaves contains 26.14% CP and 108.27 mg/100 g total carotene.
2. Direct drying under sun light decrease CP and total carotene contents by 9.10 and 10.36%, respectively.
3. Pelleting process decreased CP and total carotene contents.
4. Storing up to 12 weeks either in vacuumed or did not affect CP content, but only bitter cassava leaves stored in vacuumed packages could maintain total carotene content up to 12 weeks of storage.

REFERENCES

Biomass Production of *Pueraria javanica* Using Rhizobium Inoculant and Urine Bali Cattle in East Borneo

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**ABSTRACT:** This research activity aims to know the productivity of legume cover crop *Pueraria javanica* inoculated Rhizobium and cattle urine. *P. javanica* legume was planted on 24 plots using size of 3x2 m and planting space of 30 cm in palm oil plantations East Kutai. There were four treatments, with inoculated Rhizobium (R+), without inoculated Rhizobium (R-), urine cattle (U+) and without urine (U-) of the six replications (plots). Rhizobium bacteria inoculated on *P. javanica* seeds before planting, urine was given after a 2 week old plants. The research design used completely randomized factorial design (2x2) with 6 replication, data were analyzed using ANOVA and continued with Duncan test if the treatment effect on the parameters observed. Data collected were: germination percentage, dry weight yields, leaves and steam weight, leaves and steam ratio, number and weight of root nodule, nutrient content (e.g. organic matter, crude protein, ash, crude fiber, neutral detergent fiber, acid detergent fiber), tannin and fenol. The results showed that percentage germination below 50% and not significantly, interaction Rhizobium and urine were significantly (P<0.05) on dry weight production and steam production. There was no effect on other parameters. It was concluded that Rhizobium and urine treatment given better results in crop production.

**Keyword:** *Pueraria javanica*, Rhizobium, Bali Cattle Urine, Production, Nutrient Content

**INTRODUCTION**

The development of palm oil plantation area in Borneo is currently rapid and estimated be suitable for cattle farm because they have sufficient feed resources such as oil palm fronds, palm kernel cake as well as the potential sources of feed that are rarely used, legume cover crop. Legumes available were such callopo (*Collopogonium mucunoides*), centro (*Centroccema pubescent*), peuro (*Pueraria phaseoloides var. Javanica*) and mucuna (*Mucuna bracteata*). Legumes are compulsory plants in order to maintain soil moisture, eliminate weeds, increase palm soil fertility (Anonymous, 2009). The production of peuro was 12-20 tons DM/ha/year, callopo and centro reached 6 tons, while mukuna was 22 tons with a crude protein content of 16% after flowering and above 20% before flowering (Legel, 1990).

Peuro productivity in palm oil plantations should be maintained in order to be used as feed crops, by providing inoculant rhizobium and cow urine. The purpose of inoculation was for the gas nitrogen (N₂) from the air can be tethered by rhizobium the root nodule bacteria and converted to ammonia by the complex nitrogenized enzyme and nitrogen absorbed by legumes in the form of NO₃ (nitrate) and NH₄ (ammonium) (Samekto, 2008). Urine produced by the cows as a result of metabolism had a value which is very beneficial. In addition, it contained N and K in which also a plant growth hormone, such as auxin-a, auxin-b and other auxin which was the IAA (Indol Acetic Acid). Auxinis derived from a variety of substances contained in the forage protein from the feed, because itdid not decompose in the body then issued as a filtrate along with urine which secretes specific substances to encourage rooting (Yunita, 2011).
MATERIALS AND METHODS

This study was conducted in one of the palm tree plantations in the Bengalon District, East Kutai Regency in East Borneo for 4 months, November 2014 - March 2015, with monthly rainfall of 142-430 mm and the number of monthly rain days ranged from 14-19 days. Air temperature ranged 22.60 °C - 35.20 °C and air relative humidity of 72% - 88% (Station of Climatology Tanjung Redep, 2014).

Materials

The research land for cultivating legume *Pueraria javanica* (peuro) was covering an area of 15 x 15 m, with a number of 24 plots in 3 x 2 m per plot. Soil samples were taken as deep as 20 cm in some places and analyzed at the Laboratory of Soil Faculty of Agriculture UGM (2014), as in Table 1.

Table 1. Analysis of Soil Chemistry, Organic Fertilizer and Bali Cow Urine

<table>
<thead>
<tr>
<th>No</th>
<th>Parameter</th>
<th>Soil</th>
<th>Fertilizer</th>
<th>Bali Cow Urine</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>pH (1:2.5) (H2O)</td>
<td>4.40</td>
<td>7.47</td>
<td>7.32</td>
</tr>
<tr>
<td>2</td>
<td>C organic (%)</td>
<td>9.36</td>
<td>17.61</td>
<td>0.70</td>
</tr>
<tr>
<td>3</td>
<td>Organic ingredient (%)</td>
<td>16.14</td>
<td>30.66</td>
<td>0.70</td>
</tr>
<tr>
<td>4</td>
<td>Total N (%)</td>
<td>0.46</td>
<td>1.51</td>
<td>0.03</td>
</tr>
<tr>
<td>5</td>
<td>P Available (ppm)</td>
<td>2.16</td>
<td>0.47</td>
<td>0.02</td>
</tr>
<tr>
<td>6</td>
<td>K Available (me/100 g)</td>
<td>0.25</td>
<td>1.04</td>
<td>0.3</td>
</tr>
<tr>
<td>7</td>
<td>C/N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Texture class</td>
<td>Red soil</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Seeds of legumes *Pueraria javanica* (PJ) was 150 g (10 kg/ha), organic fertilizers (raw materials: feces, empty fruit bunches of palm tree, ash boiler, 600 kg (4,350 kg/ha) fiber and starter) (Anonymous, 2009), 270 l of Bali cattle urine (5000 l/ha) (Kamara, 2011), 21.6 kg (200 kg / ha) rock phosphate fertilizer (Anonymous, 2009), 3.75 g (25 g / 1 kg of seeds peuro) Rhizobium Legin LCC (*leguminose inoculant cover crop*) (Anonymous, 2014).

Methodology

There are four combinations of treatments in this research: 1. Treatment with Rhizobium (R+), 2. Treatment without Rhizobium (R-), 3. Treatment with Cow Urine (U+), 4. Treatment Without Bali cow Urine (U-), with each replication of 6 plots.

Peuro legume seeds 150 g wassmoaked in a mixture of hot water and cold water (1: 2) for one hour to soften the outer shell of hard seed (Anonymous, 2014). The number of seeds was divided by two. For R+, 50% seed was mixed with 3.75 g rhizobium, and for R-, 50% was without rhizobium. Both were allowed to stands for 6 hours. Planting the seeds of R+ and R- was conducted on the afternoon in polybag with a depth of 2 cm, 5 seeds peuro per polybag. After 21 days, legume peuro were transferred to plots of land by leaving one plant per hole. Simultaneously, in each planting hole were given fertilizers, phosphate rock, with a spacing of 30 x 30 cm (Anonymous, 2009). Fertilization used was only organic fertilizer of 0.5 kg/plant (0.15 kg seven days before planting, 0.15 when it is 10 days old, and 0.2 kg when it is 30 days old) and the treatment of cow urine (U+). Urine was given to the plant life of 15 days old and 30 days by way
of sprayed around the plant, diluted with water (1:10). Harvesting can be conducted in 3 month old by cutting the plants 10 cm from the ground.

Parameters measured were (1) the production aspects: nodule (number, weight), the length of legumes, the ratio of leaves : steam, weight leaves and steam, dry weight yeild (DM), organic matter (OM), (2) aspects of the nutrient : proximate analysis, analysis of fiber (NDF, ADF), (3) the aspect of anti-nutrients: tannins and phenols. Legume production data of biomass and nutrients were analyzed with Complete Random Design factorial 2 x 2. If there is a difference, it will be followed by Duncant test.

RESULTS AND DISCUSSION

Biomass production of *Pueraria javanica*

Production of dry matter and organic matter of *Peuraria javanica* legumes shown in Table 2.

**Table 2.** Production of *Pueraria javanica* Biomass with Rhizobium and cow urine inoculant treatment

<table>
<thead>
<tr>
<th>Rhizobium</th>
<th>U-</th>
<th>U+</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter production per plant (g)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-</td>
<td>93.22±8.6aA</td>
<td>104.13±12.59aB</td>
<td>98.67±14.65</td>
</tr>
<tr>
<td>R+</td>
<td>109.10±10.92bA</td>
<td>147.16±12.96bB</td>
<td>128.13±29.39</td>
</tr>
<tr>
<td>Average</td>
<td>101.16±17.73</td>
<td>125.64±30.16</td>
<td></td>
</tr>
<tr>
<td>Dry matter production per m² (g)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-</td>
<td>838.98±67.49aA</td>
<td>937.17±167aB</td>
<td>888.07±131.82</td>
</tr>
<tr>
<td>R+</td>
<td>981.88±198.02bA</td>
<td>1,324.43±210.44bB</td>
<td>1,153.16±264.49</td>
</tr>
<tr>
<td>Average</td>
<td>910.43±159.57</td>
<td>1,130.8±271.49</td>
<td></td>
</tr>
<tr>
<td>Organic matter production per plant (g)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-</td>
<td>87.18±2.39</td>
<td>86.59±2.24</td>
<td>86.88±2.21</td>
</tr>
<tr>
<td>R+</td>
<td>88.36±1.56</td>
<td>86.30±3.77</td>
<td>87.33±2.93</td>
</tr>
<tr>
<td>Average</td>
<td>87.77±2</td>
<td>86.44±2.93</td>
<td></td>
</tr>
<tr>
<td>Leaf Production (g)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-</td>
<td>38.07±1.35</td>
<td>40.49±8.57</td>
<td>39.28±5.98</td>
</tr>
<tr>
<td>R+</td>
<td>45.07±12.87</td>
<td>49.78±13.86</td>
<td>47.43±12.99</td>
</tr>
<tr>
<td>Average</td>
<td>41.57±9.46</td>
<td>45.14±12.01</td>
<td></td>
</tr>
<tr>
<td>Steam production (g)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-</td>
<td>55.15±8.61</td>
<td>63.64±12.59</td>
<td>59.4±11.19c</td>
</tr>
<tr>
<td>R+</td>
<td>64.03±10.92</td>
<td>97.38±12.96</td>
<td>80.7±20.83d</td>
</tr>
<tr>
<td>Average</td>
<td>59.59±10.45a</td>
<td>80.81±21.41b</td>
<td></td>
</tr>
<tr>
<td>Ratio steam and leaves</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-</td>
<td>0.73±0.13</td>
<td>0.69±0.13</td>
<td>0.71±0.13</td>
</tr>
<tr>
<td>R+</td>
<td>0.73±0.16</td>
<td>0.54±0.13</td>
<td>0.63±0.17</td>
</tr>
<tr>
<td>Average</td>
<td>0.73±0.13a</td>
<td>0.61±0.15b</td>
<td></td>
</tr>
</tbody>
</table>

Explanation: Different Superscript in the same column and row showed significantly different.
Dry matter production per plant and per m² was affected by Rhizobium inoculant and cow urine (P <0.05). The highest dry matter production per plant and per m² was in treatment R+U+ and the lowest was in R-U-. It shows that Rhizobium inoculants as one of a group of bacteria that was enabled as a provider of nutrients for plants. PJ legumes can take N from the air if it hadsymbiosis with Rhizobium bacteria. Before being able to take the N from the air legume, PJ needed N as a starter of early growth, and cow urine can be used because it contains nitrogen (Table 1). Dry Plant weight was a measure of the determination of the quality of plant growth and yield of a crop that was the result of the process of photosynthesis, assimilate and translocation to the decline in plant organs (Yunita, 2011). The influence of the urine was significantly because cow urine contained the hormone indole acetic acid, which is known as the main auxin in plants. Auxin is expected to promote the occurrence of the bend in the hair root, which is a prerequisite Rhizobium infection (Gardner et al, 1991, Kamara, 2011).

Production of organic materials (BO) no difference among all treatments. The highest BO was R+U and the lowest was R+U+, BO is affected by the ash ingredients in each treatment plant (Table 4).

Leaf production had no differences between treatments. The weight of the stems showed different results (P <0.05), there is an interaction between rhizobium and the urine with the ultimate weight on R+U+ and the lowest of R-U-. It caused by Rhizobium inoculant and cow urine were expected to provide sufficient nutrients for the growth of PJ legumes. The amount of auxin contained by cow urine was in the right amount which then interacts with growth regulator that was existed in cow urine (Yunita, 2011). Germination parameter, plant length, number and weight of nodules were presented in Table 3.

Table 3. Germination, Plant Length, Number and Weight of Nodules of *Pueraria javanica* with Rhizobium treatment and Cow Urine

<table>
<thead>
<tr>
<th></th>
<th>Cow Urine</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U-</td>
<td>U+</td>
</tr>
<tr>
<td>Germination (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-</td>
<td>41.83±11.70</td>
<td>42.50±7.21</td>
</tr>
<tr>
<td>R+</td>
<td>39.17±4.24</td>
<td>43.00±11.12</td>
</tr>
<tr>
<td>Average</td>
<td>40.5±8.63</td>
<td>42.75±8.99</td>
</tr>
<tr>
<td>Plant Length (cm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-</td>
<td>297.01±42.76</td>
<td>278.77±53.03</td>
</tr>
<tr>
<td>R+</td>
<td>290.22±44.72</td>
<td>323.41±31.92</td>
</tr>
<tr>
<td>Average</td>
<td>293.62±41.85</td>
<td>301.09±43.91</td>
</tr>
<tr>
<td>Number of Nodules</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-</td>
<td>38±20.22</td>
<td>39±24.92</td>
</tr>
<tr>
<td>R+</td>
<td>29±12.29</td>
<td>25±12.42</td>
</tr>
<tr>
<td>Average</td>
<td>33±16.7</td>
<td>28±19.62</td>
</tr>
<tr>
<td>Nodule weight (g)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-</td>
<td>2.73±0.99</td>
<td>2.80±0.97</td>
</tr>
<tr>
<td>R+</td>
<td>3.00±2.22</td>
<td>3.17±1.51</td>
</tr>
<tr>
<td>Average</td>
<td>2.87±1.65</td>
<td>2.98±1.22</td>
</tr>
</tbody>
</table>
Legumes’ ability to grow with Rhizobium treatment did not make a difference because of the effects of Rhizobium appeared at days 28 (Rao, 2006) and had not received the addition of cow urine. PJ legume length had no difference in the treatments. The longest grow was in the R+U+ with an average gain of 3.6 cm length per day, the shortest on the R-U+ with a gain of 3.1 cm per day. The number and weight of nodules had no difference with rhizobium treatment and urine. The most nodules was R-U+ and the least was on R+U+. This is due to the possibility of nodules in R+U+ had already ripped first.

**Nutrient Value of *Pueraria javanica* Legume**

The value of nutrients and anti-nutrients such as legumes PJ was listed in Table 4.

**Table 4. *Pueraria javanica* nutrient with Rhizobium inoculant and cow urine treatments (% Dry matter)**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>R-U-</th>
<th>R-U+</th>
<th>R+U-</th>
<th>R+U+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter</td>
<td>26.95</td>
<td>24.82</td>
<td>26.25</td>
<td>26.58</td>
</tr>
<tr>
<td>Crude protein</td>
<td>22.65</td>
<td>22.93</td>
<td>23.48</td>
<td>23.59</td>
</tr>
<tr>
<td>Crude fiber</td>
<td>17.88</td>
<td>24.23</td>
<td>22.19</td>
<td>20.99</td>
</tr>
<tr>
<td>Fat</td>
<td>2.70</td>
<td>2.58</td>
<td>1.93</td>
<td>1.99</td>
</tr>
<tr>
<td>Ash</td>
<td>11.72</td>
<td>12.26</td>
<td>10.58</td>
<td>12.49</td>
</tr>
<tr>
<td>NFE</td>
<td>38.56</td>
<td>38.75</td>
<td>41.95</td>
<td>40.94</td>
</tr>
<tr>
<td>TDN</td>
<td>65.90</td>
<td>65.62</td>
<td>68.47</td>
<td>66.67</td>
</tr>
<tr>
<td>NDF</td>
<td>45.70</td>
<td>43.54</td>
<td>43.72</td>
<td>40.91</td>
</tr>
<tr>
<td>ADF</td>
<td>29.45</td>
<td>29.11</td>
<td>27.31</td>
<td>26.57</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Anti-Nutrient</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tannin</td>
<td>36.74</td>
<td>38.74</td>
<td>41.23</td>
<td>41.17</td>
</tr>
<tr>
<td>Fenol</td>
<td>15.01</td>
<td>15.75</td>
<td>16.70</td>
<td>16.67</td>
</tr>
</tbody>
</table>

Rhizobium inoculant treatment and the distribution of cow urine did not make a difference to the nutrition value of legume, almost the same dry matter content of about 26%, the highest crude protein in the R+U+, for the lowest in R-U-. The highest TDN in R+U- amounted and at the lowest of R-U-. The highest NDF and ADF was in R-U- and the lowest was R+U+. The highest tannin anti-nutrient was in R+U- and the lowest was in R-U-. The highest phenol was at R+U- and the lowest was at R-U-.

According to Legel (1990), the crude protein content of *Pueraria javanica* before flowering was about 22%, TDN treatment almost equal approximately 65% - 68%. This indicates that the feed plant contains sufficient energy for the needs of cattle feed, while the TDN of PJ legumes of palm plantations in Borneo was around 57%. The fiber content (NDF) 40-45% indicates that PJ legumes do not contain a lot of fiber, compared NDF *Mucuna bracteata* legume by 71% (Sirait, 2009).
CONCLUSION

Leguminose *Pueraria javanica* showed good growth with the production and relatively high nutrient value with Rhizobium inoculant treatment and the contribution of cow urine, even though nutrient values did not give a significant difference. The highest production of dry matter per m² was in Rhizobium inoculant and urine of 1.324 g or 1.3 kg DM/m² and the lowest was 0.83 kg DM/m² on treatment without rhizobium and without urine.

REFERENCE


The Effect of Using Different Sources of Carbohydrates to Feed Efficiency on Indigenous Thin Tailed Male Lamb

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ABSTRACT: Differences in structure and bonding material feed sources of carbohydrates causes the difference fermentability and digestibility in the rumen and post-rumen. Thus, the utilization rate and feed efficiency were also different. The objective of this experiment was to study the feed efficiency of various sources of dietary carbohydrates on indigenous thin tailed male lamb. The experiment design was randomized block design 4x4. Sixteen thin tailed male lamb with average body weight 15±2.07 kg maintained for 12 week. The 4 treatment applies in ration (CP 13%, TDN 68%) namely, P1= complete feed containing rice bran 25% DM, P2= complete feed containing corn 25% DM, P3= complete feed containing cassava waste meal 25% DM, P4= complete feed containing sorghum 25% DM. The result showed that the fed containing different sources of carbohydrates significantly effect on dry matter intake, average daily gain (ADG) and feed efficiency (P<0.01). Feed efficiency generated in this study were 15.75 (P1); 17.96 (P2); 15.55 (P3) dan 19.09% (P4). Based the result on this study, it could be concluded that the feed containing carbohydrates from grain (corn and sorghum) are more efficiency than carbohydrates sources from agriculture by product (rice brand and cassava waste meal), but still profitable use as a source of energy in the ration of sheep.

Keywords: Lamb, carbohydrates, daily gain, feed efficiency

INTRODUCTION

Feed efficient will provide great benefits in the farm. The better quality of the feed will generate a high body weight gain and more efficiently of feed (Tadeschi et al., 2006). In addition to protein, the animal requires energy adequacy, because energy shortage led to an overhaul of protein so that the feed is not efficient. Feed ingredients such as maize and sorghum are often used as a source of energy in the ration of fattening (Theurer et al., 1999; Ncube et al., 2014). Although the energy needs can be supplied from ruminant livestock forage, but the provision of grain will be able to reduce the production of methane and improve feed efficiency (Gill, 2012). Unfortunately, the needs of feed ingredients such as grain today compete with humans, i.e. as food or biofuel (McNeil, 2012). Therefore, the use of industrial wastes such as rice bran and cassava waste meal should be increased to replace corn and sorghum. Ku Vera et al (2014) states that the energy efficiency of feed utilization influenced by differences in physical characteristics, digestibility and metabolism of each of the feed materials, as well as other components contained in the feed material, such as tannin (Rooney et al, 2005). Based on it, the different sources of energy in the diet is also likely to produce a different feed efficiency.
MATERIALS AND METHODS

Sixteen indigenous thin tailed male lamb 6-8 months old with an average body weight 15+2.07 kg maintained for 12 weeks. The experimental design used was completely randomized block design with 4 treatments and 4 block as replicates. Four treatment diets prepared with 4 different carbohydrate sources, namely:
P1 = complete feed containing rice bran 25 % dry matter
P2 = complete feed containing corn 25 % dry matter
P3 = complete feed containing cassava waste meal 25 % dry matter
P4 = complete feed containing sorghum 25 % dry matter
Several feed ingredients used to make the treatment ration were rice straw fermented, coffee hull, coconut meal, palm kernel meal, urea and lime. The composition of ingredients and nutrient of the ration are shown in Table 1.

Tabel 1. Composition of ingredient and nutrient of the ration

<table>
<thead>
<tr>
<th>Feed ingredients</th>
<th>Treatment</th>
<th>Feed Prices IDR*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rice bran 25% DM</td>
<td>Corn 25% DM</td>
</tr>
<tr>
<td>Fermented rice straw</td>
<td>17.0</td>
<td>20.5</td>
</tr>
<tr>
<td>Coffee hull</td>
<td>16.0</td>
<td>20.3</td>
</tr>
<tr>
<td>Rice bran</td>
<td>25.0</td>
<td>-</td>
</tr>
<tr>
<td>Corn</td>
<td>-</td>
<td>25.0</td>
</tr>
<tr>
<td>Cassava waste</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sorghum</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Palm kernel meal</td>
<td>20.6</td>
<td>16.0</td>
</tr>
<tr>
<td>Coconut meal</td>
<td>20.0</td>
<td>16.0</td>
</tr>
<tr>
<td>Urea</td>
<td>0.4</td>
<td>0.86</td>
</tr>
<tr>
<td>CaCO₃</td>
<td>1.0</td>
<td>1.34</td>
</tr>
<tr>
<td>Total digestible nutrients (%)</td>
<td>68.36</td>
<td>70.25</td>
</tr>
<tr>
<td>Crude protein (%)</td>
<td>13.57</td>
<td>13.38</td>
</tr>
<tr>
<td>Extract ether (%)</td>
<td>6.39</td>
<td>4.96</td>
</tr>
<tr>
<td>Crude fiber (%)</td>
<td>33.92</td>
<td>31.02</td>
</tr>
<tr>
<td>Nitrogen free extract (%)</td>
<td>21.89</td>
<td>29.58</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>12.71</td>
<td>9.37</td>
</tr>
</tbody>
</table>

Note : *feed prices in 2015

The parameters measured in this experiment were dry matter intake (DMI), average daily gain (ADG), feed efficiency and income over feed cost (IOFC). Feed offered and refused was measured and recorded daily during to calculate feed intake. Orts (10% daily refused) composite than were dried at 55°C and ground. Dried samples of feed and orts were analyzed for DM (AOAC, 2000). The lambs were weighed at 2 week intervals before feeding. Data were analyzed using Analyzed of Variance (ANOVA) with F test to determine the treatment effect and continued with Duncan New Multiple Range Test (DMRT) (Steel and Torie, 1984).
RESULTS AND DISCUSSION

Dry Matter Intake and Feed Efficiency

The average of dry matter intake, daily weight gain and feed efficiency calculation to the lambs experiment is presented in Table 2. Dry matter intake (DMI), average daily gain (ADG) and feed efficiency overall was affected by the treatment (P <0.05). Dry matter intake of corn and rice bran ration were higher than cassava and sorghum ration, because rice bran and corn have higher digestibility than cassava and sorghum, so will experience rate of passage in the rumen faster. As a result, the stomach will quickly empty and encourage the lamb to eat more. A bulky physical forms of cassava and tannin content in sorghum is also thought to be because a low digestibility and palatability (Ncube et al., 2014). Based on the percent of live weight (LW), DMI of the treatment lamb 3.28 to 3.63%, included low. According Ranjhan (1981), fattened lamb should consume between 4.5 to 5% LW. The low consumption is due to the physical form of the dry and dusty feed (mash). Although consumption of sorghum ration DM was lower than the rice bran ration, but able to generate average daily gain (ADG) is higher. Brouk (2010) state in generating energy sorghum can be compared with corn. The content of tannins in sorghum also does not cause negative effects. White sorghum used in this study only contains tannin of 17.2 g/kg DM, according to Waghorn (1990) contains tannins below 40 g/kg DM has no effect on animal performance.

Table 2. Dry matter intake, daily gain and feed efficiency in treatment lambs

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Rice bran 25% DM</th>
<th>Corn 25% DM</th>
<th>Cassava waste 25% DM</th>
<th>Sorgum 25% DM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter intake (g/day)</td>
<td>680.54a</td>
<td>673.08a</td>
<td>592.70b</td>
<td>560.05b</td>
</tr>
<tr>
<td>Dry matter intake (% LW)</td>
<td>3.63a</td>
<td>3.48b</td>
<td>3.28c</td>
<td>3.28c</td>
</tr>
<tr>
<td>Daily weight gain (g/day)</td>
<td>106.75ab</td>
<td>120.24a</td>
<td>91.37b</td>
<td>105.11b</td>
</tr>
<tr>
<td>Feed conversion</td>
<td>6.38a</td>
<td>5.60b</td>
<td>6.49a</td>
<td>5.33c</td>
</tr>
<tr>
<td>Feed efficiency (%)</td>
<td>15.75abe</td>
<td>17.96ab</td>
<td>15.55c</td>
<td>19.09a</td>
</tr>
</tbody>
</table>

Note: Same row with different superscript a, b or c are significant (P<0.05)

Feed conversion and feed efficiency in this study is quite good that each ranging from 5.33 to 6.49 and 15.55 to 19.09%. According to Gatenby (1986) sheep feed conversion in the tropics ranges from 7 to 15, but Purbowati et al. (2009) to get sheep feed conversion were given a complete form of pellets ranging from 5.47 to 6.51, it was equal to the results of research of N cube (2014) namely 4.64 to 6.29. The research of Mayulu (2012) resulted feed efficiency of sheep were given complete feed palm kernel meal in the range 19.10 to 20.14%, means the complete feed made from rice straw treatments have almost the same quality. Conversion and efficiency of feed grains (sorghum and maize) is better than industrial waste (bran and cassava waste), this is due to high crude fiber content so it is more difficult to digest. Even so its use could be considered by looking at the economic aspect because they were cheaper.
Economic efficiency
Calculation of feed costs and income over feed cost is presented in Table 3. The result of calculation shows that the feed cost of rations made from cassava waste meal occupies the lowest feed cost is IDR 1287 per head per day, but the highest IOFC owned by feed made from corn that was IDR 5855 per head per day. Four source of carbohydrate was profitable to use as a source of energy in the ration of sheep. Figures IOFC can be used to predict the rate of profit and the amount of minimum lamb that must be maintained. From these results it appears that the maintenance of 10 lambs will produce IOFC 44.23 to 58.55 thousand, so it is not efficient when it must issue labor costs of approximately 50 thousand per day.

Table 3. Income over feed cost

<table>
<thead>
<tr>
<th>Feed ingredient</th>
<th>Treatment</th>
<th>Rice bran 25% DM</th>
<th>Corn 25% DM</th>
<th>Cassava waste 25% DM</th>
<th>Sorgum 25% DM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed prices (IDR/kg Asfed)</td>
<td>2307.64</td>
<td>2195.28</td>
<td>1932.87</td>
<td>2415.73</td>
<td></td>
</tr>
<tr>
<td>Intake asfed (g/day)</td>
<td>764.65</td>
<td>756.27</td>
<td>665.96</td>
<td>629.27</td>
<td></td>
</tr>
<tr>
<td>Feed Cost (IDR/head/day)</td>
<td>1765</td>
<td>1660</td>
<td>1287</td>
<td>1520</td>
<td></td>
</tr>
<tr>
<td>Daily weight gain (g/day)</td>
<td>106.75</td>
<td>120.24</td>
<td>91.37</td>
<td>105.11</td>
<td></td>
</tr>
<tr>
<td>Income (IDR/head/day)</td>
<td>6672</td>
<td>7515</td>
<td>5711</td>
<td>6569</td>
<td></td>
</tr>
<tr>
<td>IOFC (IDR/head/day)</td>
<td>4907</td>
<td>5855</td>
<td>4423</td>
<td>5049</td>
<td></td>
</tr>
</tbody>
</table>

Note: IOFC= Income Over Feed Cost;
*feed prices in 2015; the price of live weight: IDR 62500 per kg

CONCLUSIONS
The conclusion of this study was the feed containing carbohydrates from grain (corn and sorghum) are more efficiency than carbohydrates sources from agriculture by-product (brand rice and cassava waste). However, according to the economic aspect, rice brand and cassava waste is still profitable to use as a source of energy in the ration of sheep.

REFERENCES
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Substitution of Concentrate by Protein Source Forage for Growing Heifer of Friesian Holstein (FH)

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ABSTRACT: The best weight of Friesian Holstein (FH) heifer used for replacement stock at first matting is above 300 kg at 15 months old. To achieve that weight, the animals must at least grow for 600-700 g/day after weaning period (11 months of age). High quality diet is required to maintain the high growth rate. Leguminous leaves, *Gliricidia sepium* is high protein source feed contains amino acids that can support high growth rate as well as development of female reproductive organs. A study was undertaken to investigate the effect of concentrate substitution by *Gliricidia* leaves on performance of young FH heifer. Three Rations with similar metabolize energy level of 11 MJ/kg, were investigated by using Complete Block Design. Ration A: King grass (RR)+concentrate (Con); Ration B: RR+Con+Gliricidia (L1=16%) and Ration C: RR+Con+Gliricidia (L2=31%). The study measured feed intake, body weight gain for 5 months, blood metabolite concentration, and progesterone concentration profile. Results indicated that growth rate of animals in three groups were below the body weight gain targeted in the beginning of experiment. At 15 months old, the weight of heifers fed Ration A was 272 kg; Ration B was 270 kg and Ration C was 255 kg. Plasma urea and glucose concentration in animals fed Ration A were lower (9.8 mg/dl and 70.4 mg/dl) than those of animals fed Ration B (10.98 mg/dl and 71.1 mg/dl) and Ration C (11.13 mg/dl and 72.4 mg/dl) (P>0.05). The concentration of progesterone at a peak was 11.6 ng/ml; 12.71 ng/ml and 11.71 ng/ml for animals in group Rations A, B and C, respectively (P>0.05). It is concluded that substitution of concentrate by *Gliricidia* leaves up to 31% has no negative effect on intake, urea and glucose concentration and progesterone concentration profile, but affected the live weight gain of young heifer FH.

Keywords: Heifer, Gliricidia, body weight, blood metabolite.

INTRODUCTION

The purpose of a rearing program in dairy cattle industry is to get healthy heifers that can grow well to achieve ideal live weight at first mating time. Heifers that can attain an ideal body weight will have good fertility and milk production. For heifer FH, the ideal weight at the first mating is between 300-350 kg at the age of 15-16 months (Morran, 2005). To achieve that ideal weight, young heifer with 200 kg at 10 months of age must have average daily gain of 600-700 g/day during the 5-6 months of period. In order to achieve a targeted weight gain of 600-700 g/day, the animal needs to consume 48-51 MJ ME/day with the ration protein content of about 17% (NRC, 1989). Therefore the minimum ME contained in the ration is about 11 ME/kg DM. However, young heifer with that weight, could not achieve an ideal growth if only consume grass as single diet due to a small of rumen capacity as well as low quality of grass (7-8% ME/kg). Therefore, improving the quality of grass is required to increase the ration quality. One strategy is supplementation using high quality feed, such as concentrate. The ME and crude protein content of concentrate must above 13% and 19%. The price of this type of concentrate is very expensive, thus will has an effect in increasing feed cost. Substitution of concentrate by high protein forage
(containing 22-24% protein) is expected to reduce feed costs as well as can fulfill the need of nutrient for the animals. Therefore, the purpose of study presented in this paper was to investigate the effect of concentrate substitution by high protein forage (Gliricidia) on growth of young heifer of FH.

**MATERIALS AND METHODS**

The study used 18 heads of young heifer (10-11 months of age) with average live weight 196.8 ± 5.40 kg. The animals were divided into three groups based on live weight by using complete block design based on live weight to test three type of rations. Each ration containing similar ME but have different material composition.

1. Ration A with ME 11 MJ/kg DM. The composition of ration in DM base was 47% King grass : 53% concentrate.
2. Ration B with ME 11 MJ/kg DM. The composition of ration in DM base was 48% King grass : 36% concentrate:16% Gliricidia.
3. Ration C with ME 11 MJ/kg DM. The composition of ration in DM base was 50% King grass : 19% concentrate:31% Gliricidia.

The ration offered to each animal was 3% of live weight in dry matter base. Daily ration was divided into two part, one was offered at 08.00 am and another part offered at 15.00 pm. Measurements were undertaken on feed consumption, live weight gain, progesterone concentration profile and plasma urea and glucose concentration. Feed consumption was determined by deducted feed offered with feed residue after 24 hours of feeding time. The animals were weighed every two weeks to determine the live weight changing of the animals during the experimental period. Blood sample from each animal was collected every 3 days in a period of 30 days to determine progesterone concentration profile. Blood for urea and glucose concentration analysis were taken from each animal at the end of experimental period. Concentrations of progesterone in blood plasma were analysed using a commercial Kit Progesterone and determined by radioimmunoassay technique. All data collected was analyzed using IBM SPSS statistics ver. 20 following the complete block design (Steel and Torrie, 1980)

**RESULTS AND DISCUSSION**

Data on feed consumption during the 5 months of experimental period is presented in Table 1. The feed consumption of animals in three groups was increased as live weight increased. Substitution of concentrate by Gliricidia leaves up to 31% did not significantly affect the feed consumption. Althought statistically the feed consumption (DM, CP and ME) similar for all the groups, the pattern indicated that animals fed Ration A consumed more DM, CP and ME during the experimental period. However, all the animals consumed adequate DM, CP and ME as required for young heifer. According to NRC (1989), young heifer required EM consumption about 48-51 MJ/day to achieve live weight gain of 600-700 gram/day. In the experiment presented, the animals could not achieved the live weight gain recommended, eventhought the animals consumed adequate amount of energy metabolism. It might due to the different climate where the experiment undertaken. The experiment was undertaken in the area with the daily temperature of 28-29 °C, while the upper critical temperature (UCT) for FH is between 25-26°C (Berman et al., 1985). Temperature above the UCT causes heat stress resulting in an increase of heat production as a consequence of a rise in body temperature (Yousef, 1985; Kadzere, 2002, Turnpenny, 2000).
Table 1. Consumption of dry matter (DM), crude protein (CP), and metabolizable energy (ME) by animals fed Rations A, B and C during 5 months of experimental period.

<table>
<thead>
<tr>
<th>Ration</th>
<th>experimental period (month)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DM (kg/day)</td>
<td>4.94 + 0.3</td>
<td>4.85 + 0.8</td>
<td>5.4 + 0.40</td>
<td>6.09 + 0.3</td>
<td>6.35 + 0.5</td>
</tr>
<tr>
<td>Ration A</td>
<td>CP (g/day)</td>
<td>648 + 15.3</td>
<td>630 + 14.8</td>
<td>679 + 18.5</td>
<td>740 + 18.6</td>
<td>764 + 19.4</td>
</tr>
<tr>
<td></td>
<td>ME (MJ/day)</td>
<td>55.4 + 4.8</td>
<td>54.5 + 2.7</td>
<td>60.8 + 3.8</td>
<td>68.7 + 4.4</td>
<td>71.7 + 7.1</td>
</tr>
<tr>
<td>Ration B</td>
<td>DM (kg/day)</td>
<td>4.57 + 0.2</td>
<td>5.04 + 0.4</td>
<td>5.17 + 0.3</td>
<td>6.39 + 0.2</td>
<td>6.12 + 0.3</td>
</tr>
<tr>
<td></td>
<td>CP (g/day)</td>
<td>622 + 14.7</td>
<td>728 + 13.8</td>
<td>691 + 12.3</td>
<td>850 + 11.2</td>
<td>764 + 15.1</td>
</tr>
<tr>
<td></td>
<td>ME (MJ/day)</td>
<td>51.9 + 4.2</td>
<td>57.6 + 4.1</td>
<td>59 + 7.7</td>
<td>73.1 + 5.6</td>
<td>69.8 + 10.5</td>
</tr>
<tr>
<td>Ration C</td>
<td>DM (kg/day)</td>
<td>4.33 + 0.2</td>
<td>5.36 + 0.3</td>
<td>5.51 + 0.3</td>
<td>5.27 + 0.4</td>
<td>5.84 + 0.3</td>
</tr>
<tr>
<td></td>
<td>CP (g/day)</td>
<td>624 + 12.6</td>
<td>640 + 11.5</td>
<td>753 + 16.3</td>
<td>734 + 12.3</td>
<td>760 + 11.8</td>
</tr>
<tr>
<td></td>
<td>ME (MJ/day)</td>
<td>50.7 + 3.8</td>
<td>62.3 + 5.3</td>
<td>64.8 + 4.6</td>
<td>78.3 + 6.1</td>
<td>68.8 + 7.2</td>
</tr>
</tbody>
</table>

Data on live weight changing during the 5 months of experimental period is presented in Figure 1.

**Figure 1.** Live weight changing of young heifer fed Rations A, B and C during 5 months of experimental period.

During the 5 months of experimental period, application of three experimental Rations (A, B and C) resulted in significantly higher live weight gain for animal fed by Ration A (37.4 kg) compared to those of animals fed Ration C (29.0 kg) (P<0.05), but similar with those of animals fed Ration B (35.3 kg). These results were parallel with the feed consumption of animals in each group. The average dry matter consumption of animals fed Ration A was the highest (2.37% live weight) compared to those animals fed Ration B (2.44% live weight) and only 2.13% live weight for animals fed Ration C. At the end of experiment, the ideal live weight targeted for young heifer at 15 months of age (300 kg) could not be achieved, although the animals received adequate amount of DM, CP and ME for daily ration. It seems that differences in environment temperature caused un-optimum energy utilization by the animals. The explanation of this reason has been mentioned above. Figure 2 shows the urea (a) and glucose (b) concentration in the blood plasma of animals fed experimental rations.

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Although the plasma urea and glucose concentration were not significantly affected by substitution of concentrate by Gliricidia leaves up to 31%, the data recorded indicated that the plasma urea and glucose concentration of animal fed Ration A was 13.57% and 2.8% higher than that of taken from animals fed Ration A and only 1.37% and 1.8% higher than those of animals fed Ration B. While the plasma urea and glucose concentration of animal fed Ration B was 12.04% and 1% higher than those of animal fed ration A. These results indicated that differences in the sources of protein resulting in differences in urea and glucose concentration in the blood, eventhought the protein and energy metabolism contained in the three Rations were similar. Most of dietary protein in Ration A was supplied from grain contained in concentrate, while dietary protein in Ration B and C partly come from Gliricidia leaves. Protein contained in leguminouse leaves (Gliricidia) reported more degradable than those protein in grain (Widiawati, 2004). Protein degraded in the rumen produces ammonia that converted to urea when absorbed from rumen wall to blood stream. The more protein degraded in the rumen the higher urea concentration in the blood. Legumes leaves also reported rich of amino acids compared to protein of grains. Some amino acids are potentially as precursors for gluconeogenesis to produce glucose (Di Pasquale, 2007). Therefore animals fed Rations B and C that contain 16% and 31% Gliricidia have more glucose in their blood plasma.

Progesterone concentration pattern found on different sampling days were as expected for normal profile of young heifher for all the animals in three groups of treatment. Substitution of concentrate by Gliricidia leaves up to 31% has no negative effect on progesteron concentration profile of young heifer FH. The highest concentration in group Ration A was 11.6 (ng/ml) with the lowest concentration was 0.8 ng/ml. While in animals fed Ration B and C, the highest concentration was 12.71 ng/ml and 11.71 ng/ml, respectively with the lowest concentration for animals in both groups was 1.89 ng/ml and 1.71 ng/ml, respectively. The lowest concentration of progesteron recorded for all animals in three groups was similar with reproted by Hittinger et al., (2004) and Jose Nelio et al., (2011).

CONCLUSION

It is concluded that substitution of concentrate by Gliricidia leaves up to 31% has no negative effect on intake, urea and glucose concentration and progesteron concentration profile, but affected the live weight gain of young heifer FH.
REFERENCE


The Use of *Trichoderma sp.* as a Starter of Fermentation
Dry Teak Leaves (*Tectona grandis*) as Animal Feed

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**ABSTRACT:** There were many starter that has been produced for the fermentation of forages. The aim of this study is to determine the effectiveness of starter *Trichoderma sp.* within fermentation to compare to other starter to increase the physical quality of dry teak leaves as animal feed. This study conducted Completely Randomized Design (CRD) experimental method, consisted of 4 treatments (T0: Control; T1: SOC; T2: EM4 and T3: *Trichoderma sp.*) and 3 replications. This study conducted a the fermentation for 14 days. Observations of the temperature and pH are conducted once in every two days. Bacteria and fungi are calculated on day seven and fourteen using total cell count method. The results showed that *Trichoderma sp.* increase the physical quality of dry teak leaves (color, smell, texture and fungi) significantly (P <0.05). The highest *Trichoderma sp.* obtained T3 (4.5 x 10⁴ cfu/g) while the number of bacteria achieved by T1 and T2. In applying the fermentation for 14 days is recomended. The conclusion of this study indicates that *Trichoderma sp.* is the suitable starter for fermentation of dry teak leaves.

**Keywords:** Fermentation, Physical quality, Teak leaves, and *Trichoderma sp.*

**INTRODUCTION**

Development of local feed-based technology innovation is expected to improve the competitiveness of farm products, because of the contribution of feed and seed production costs of about 70-80% or more (Diwyanto and Priyanti, 2009). By-product of food crops and agro-industry are potential sources of ruminant feed ingredients, one of them is dry teak leaves. Although most of agricultural by-products have limited nutritive value (high fiber, low available nutrient and digestibility), contain various anti-nutritional compounds such as selica, tannins, theobromine, cyanide, and ceratyne which can lead to decrease productivity of livestock, thus they become a limiting factor in utilization in rations, but fermented can improve the nutritive value of the by-product (Tamada *et al.*, 1999 and Mudita *et al.*, 2011).

Dry teak leaves have strategic value is used as feed material for the abundant availability during the dry season or when forage is limited. Dry teak leaves containing 89.07% Dry Materials, Organic Materials 71.83% and 4.9% and Crude Protein; 26.04% Crude fiber and 5.59% Crude Fat (Mintarso, 2008). The use of dry teak leaves in complete feed showed the best in vitro digestibility (KcBK = 61.04% and KcBO = 59.49%) is the composition of 70% concentrate and 30% BK BK forage (20% and 10% field grass dry teak leaves).

Lamid *et al.* (2013) reported that the inoculation of *Actinobacillus sp.* Painokulasi *Actinobacillus sp.*. On the teak leaf fermentation can lower crude fiber content, increase the crude protein content. Dose efficient to use bacterial fermentation teak leaves *Actinobacillus sp.* is 10%. Significant differences (P <0.05) for crude fiber and crude protein P3 and P2 compared to controls. Effective solution microorganisms 4 (EM4) was first discovered by Prof. Dr. Teruo Higa of the University Ryukyus, Japan, is a starter for fermentation of feed that many well known farmers in Indonesia. EM4 containing the microorganism fermentation. Total microorganism fermentation in the EM4 very much, about 80 genera. The selected microorganisms that can work effectively in fermenting organic matter. Of the many microorganisms, there are five principal categories, namely: photosynthetic bacteria, *Lactobacillus sp.*, *Streptomyces sp.*, yeast and *actinomycetes* (Indriyani, 2009).

Fermentation causes changes in the organic elements of feed, so that the components in the feed becomes simpler. The highest value of protein digestibility of feed obtained at concentrations of starter solution of EM-4 15% in the amount of 83.29%. The use of EM-4 at concentrations of starter solution of 20% (P4) is not effective, the value decreased protein digestibility of feed that
Safeguarding microorganisms EM-4 in decomposing the organic elements of feed too much compared with the available substrate, thereby reducing the speed of the growth of microorganisms (Winedar et al. 2006).

SOC (Liquid Organic Supplement) is Organic Bio Nutrients developed by PT Life Bright Prosperous (HCS). SOC among others, can balance the microorganisms in the rumen of animals and increase appetite. During the dry season, the majority of farmers have trouble getting feedstuffs. Cattle ranchers in Gunung kidul Yogyakarta, already widely utilize dry tea leaves and bamboo leaves as feed material fermented with SOC, the composition of the fermentation with 10 kg of dry leaves, 2 kg rice bran, 2.5 cassava flour, 10 grams of salt, 5 spoons of molasses, 6 liters of water and 3 spoons of liquid organic supplements (SOC), a result that maintained PO cattle can grow well (Anonymous, 2013).

Besides EM4 and SOC, Trichoderma sp also widely used as a starter to ferment the feed. Supriyati et al. (2013) suggest the changes of Nutritive values during fermentation of rice straw using Trichoderma viride as the starter was observed. The fermentation did not influence percentage of NDF (P > .05) but influenced the percentages of ADF, CP and ash (P < 0.01) in. Its could be concluded that the highest nutrient percentage of fermented rice straw using Trichoderma viride were Obtained at days of 8th.

This research was conducted to determine the effectiveness of starter Trichoderma sp. within fermentation to compare to other starter to increase the physical quality of dry tea leaves as animal feed.

MATERIALS AND METHODS

An experiment was conducted at Brahmaputra Animal Husbandry Academy, Yogyakarta. Dry tea leaves obtained from Brahmaputra garden, collected and chopped into a length of approximately 1-2 cm. and then put in 12 fermentation plastic cans. Each can contains 2.5 kg of dry tea leaves. From the 12 cans was divided into 4 treatments. Each treatment was replicated 3 times. Treat 1 as a control (T0), cans filled tea leaves and distilled water 1.5 liters. Treatment 2 (T1) filled cans of dry leaves, distilled water 1.5 liters and starter SOC, Treatment 3 (T2) cans filled dried leaves and starter EM4 (2% and 1.5 liters of distilled water). Treatment 4 (T3) charged 1.5 liters of distilled water and a solution of Trichoderma sp inoculum. Inoculum was obtained from the Laboratory of Biotechnology, Faculty of Agriculture Gadjah Mada University.

All of treatment incubated anaerobically for 14 days. Observations of the temperature and pH are conducted once in every two days. Bacteria and fungi are calculated on day seven and fourteen using total cell count method. Data recorded includes physical quality teak leaves fermented leaves (color, smell, texture and fungi) are calculated using the 20 testers.

All data were statistically analysed by one-way analysis of variance (ANOVA) and followed by Duncan’s New Multiple Range Test for significant difference between treatments (Ghozali, 2011).

RESULTS AND DISCUSSIONS

Development of local feed-based technology innovation is expected to improve the competitiveness of farm products from Indonesia, because of the contribution in the cost of feed production reaches 70-80% or more (Diwyanto and Priyanti, 2009). As one example is the use of dry tea leaves fermentation. Potential leaves of teak in Indonesia is very large as the forest on the island of Java alone managed forestry in 1989 was 3,007,222 ha (22.8% of total land area), and teak forests reached 1.0693 million ha (Siregar, 2005). Teak leaves as ruminants feeding have many advantages, but high of crude fiber and tannin and low digestibility, therefore the fermentation is an effort to optimize the use of teak leaves as ruminants feeding. Because fermentation effect on the physical and chemical circumstances that will affect the quality and feed palatability, then the research with various fermentation starter is expected to produce physical and chemical feed in accordance with the needs of livestock.

The study of teak leaf fermentation without starter T (T0), starter SOC (T2), starter EM4 (T3) and Trichoderma (T4) is given in Table 1. The results of statistical analyses showed The color
of teak leaves are fermented without starter is different from that given starter, the more black dark brown, like other decaying leaves. According Sianipar and Simanihuruk (2009), silage without adding inukulum have a darker color, because the fresh material to be fermented has a living tissue that occurs in the early phase of active aerobic respiration produces water, CO2 and heat. The increasing temperature, affecting the dark color of the silage.

Fermented smell assessment scores in this study indicate that smell at T2, T3 and T4 is lower than T0 (P <0.05), indicating that the administration of a fermented starter produce better quality with the smell / aroma fresh. Likewise, the smell and texture as well as the presence of fungal fermentation results show significant differences. Ridla et al, (2007) which cited Zachariah et al, (2015) claimed that a good quality silage has a soft texture, not slimy and no smell. Teak leaf texture fermented at T3 showed the most gently. This can be caused by T3 contains many Trichoderma sp. (Table 3). This fungus is able to produce cellulase enzymes that can decrease crude fiber, by changing selulusa become more simple carbohydrates. Trichoderma sp. prolific producing extracellular proteins and is best known for its ability to produce enzymes that can degrade cellulose and chitin (Harman, et al., 2004).

The existence of Trichoderma in the fermentation process is to inhibit the growth of other fungi, seen in Table 1. That the presence of the fungus in the most low T3. Trichoderma sp. is a fungus that can be antagonistic biocontrol agent due to other fungi, especially those that are pathogenic. Antagonist activity in question may include competition, parasitism, predation, or the formation of toxins such as antibiotics. For the purposes of biotechnology, biocontrol agents of Trichoderma can be isolated and used to address the issue of crop damage due to pathogens. Ability and mechanism of Trichoderma sp. in inhibiting the growth of pathogens in detail varies on each species. The difference is due to the ability of the ecological factors that make the production of metabolites also varies Trichoderma sp. produce metabolites that are volatile and non-volatile. Non-volatile metabolites are more effective than those volatile. Metabolite produced by Trichoderma sp. can diffuse through the dialysis membrane then can inhibit the growth of some pathogens. One example of these metabolites are monooxygenases which appears when the contact between species of Trichoderma sp, and the optimal pH 4. The absence of these metabolites will not change the morphology of Trichoderma but it will only reduce the ability of pathogen inhibition (Hasanuddin, 2003). Meanwhile, according to Prayuwidayati, (2009) mycelium of Trichoderma sp can produce an enzyme that is diverse, including the enzyme cellulase, glucanase and chitinase.

The observation of the pH in the fermentation process showed that T0 is higher than T1, T2 and T3 (P <0.05) (Table 3). This can be caused by the T0 acid-producing bacteria such as lactic acid is less developed, while giving starter / inoculum, support lactic acid bacteria that have the potential to improve the quality of fermentation (Hippen et al., 2010). PH good during the fermentation ranges between 3.8 to 4.2. when PH is higher than 4.8 indicates a failure fermentation (Ranjit and Kung, 2000). In this study, the pH of the fermentation treatment of teak leaves are added starters ranged from 4.33 to 3.93. It showed in this study the fermentation process goes well, but in the TO fermentation imperfectly.

Table 1. Physical quality teak leaves fermented leaves

<table>
<thead>
<tr>
<th>Parameter</th>
<th>T0</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>3.22 ±0.12a</td>
<td>2.72±1.04b</td>
<td>2.88±0.32b</td>
<td>2.72±1.04b</td>
</tr>
<tr>
<td>Smell</td>
<td>3.30±0.05a</td>
<td>2.93±0.24b</td>
<td>3.13±0.15b</td>
<td>2.22±0.33b</td>
</tr>
<tr>
<td>Texture</td>
<td>1.02±0.29a</td>
<td>2.75±0.10b</td>
<td>3.22±0.03c</td>
<td>3.37±0.03d</td>
</tr>
<tr>
<td>Fungi</td>
<td>3.12±0.07a</td>
<td>2.35±0.05b</td>
<td>2.36±0.03b</td>
<td>2.12±0.03c</td>
</tr>
<tr>
<td>pH</td>
<td>5.33±0.57a</td>
<td>4.33±0.57b</td>
<td>4.33±0.57b</td>
<td>3.93±0.12b</td>
</tr>
<tr>
<td>CF</td>
<td>28.40±1.62a</td>
<td>25.23±1.37b</td>
<td>25.95±1.04b</td>
<td>25.14±1.01b</td>
</tr>
</tbody>
</table>

abc Means with different superscript on horizontal row were significantly (P<0.05)

Table 1. It can be seen that the quality of the texture of fermented increased becomes increasingly gently due to lower crude fiber content. Inoculan use EM4 produce cellulase enzymes to digest crude fiber advantageous because the bacteria do not produce crude fiber in the activity, making it more effective in lowering crude fiber (Santosa and Aryani, 2007).

<table>
<thead>
<tr>
<th>Treatments</th>
<th>T0</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>6.1x10^6</td>
<td>4.6x10^6</td>
<td>4.7x10^6</td>
<td>2.2x10^6</td>
</tr>
<tr>
<td>R2</td>
<td>5.0x10^6</td>
<td>1.4x10^6</td>
<td>5.0x10^6</td>
<td>2.2x10^6</td>
</tr>
<tr>
<td>R3</td>
<td>5.1x10^6</td>
<td>6.1x10^6</td>
<td>5.9x10^6</td>
<td>6.4x10^6</td>
</tr>
<tr>
<td>Rata-rata</td>
<td>5.4x10^6ns</td>
<td>4.0x10^6ns</td>
<td>5.2x10^6ns</td>
<td>3.6x10^6ns</td>
</tr>
</tbody>
</table>

ns : Non Significant

Total bacteria at the end of fermentation (day 14) showed no real difference among the treatments. In this study, no added nutrients other than teak leaves and stater so nutrients needed are not available in sufficient quantities. The fall in the growth of the bacteria are seen in the decreasing temperature as shown in chart 1. Decrease in the average - average occurs after the eighth day.

Table 2. Total of bacteria

Table 3. Total of Trichoderma sp (Colony Forming Unit/CFUx10^4/g)

<table>
<thead>
<tr>
<th>Treatments</th>
<th>T0</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>0.55</td>
<td>0.44</td>
<td>0.20</td>
<td>3.500</td>
</tr>
<tr>
<td>R2</td>
<td>0.35</td>
<td>0.45</td>
<td>0.45</td>
<td>6.00</td>
</tr>
<tr>
<td>R3</td>
<td>0.40</td>
<td>0.35</td>
<td>0.45</td>
<td>4.00</td>
</tr>
<tr>
<td>Mean</td>
<td>0.43^a</td>
<td>0.41^a</td>
<td>0.37^a</td>
<td>4.50^b</td>
</tr>
</tbody>
</table>

abc Means with different superscript on horizontal row were significantly (P<0.05)

The presence of fungi during the fermentation process showed significant differences (P <0.05). At T3 produce the highest of Trichoderma sp. The existence of this fungus was found to produce silage with color, smell, and good texture. From the results of this study indicate the use of an inoculum of Trichoderma sp as a fermentation starter teak leaves produce the best physical quality. The use of Trichoderma sp. can reduce other harmful fungi in the fermentation process, making good quality silage fuisik, and produce cellulase enzymes that can degrade selulusa in teak leaves, resulting in lower crude fiber content.

When this study was applied to the development of Indonesian animal husbandry, to achieve self-sufficiency in meat, especially in the utilization of by-products for ruminant feed, then dried teak leaves as animal feed is recommended to be fermented. During the fermentation can be given additional material source of carbohydrates and protein to improve the working of microbial perombak serat Kasar in teak leaves and improve the quality of the fermented feed (silage).

Figure 1. Temperatur graphic during the research
CONCLUSION

The results showed that *Trichoderma sp.* increase of the physical quality of dry teak leaves (color, smell, texture and fungi) Significantly. The highest *Trichoderma sp.* Obtained T3 (4.5 x 10^4 cfu / g) while the number of bacteria Achieved by T1 and T2. In applying the fermentation for 14 days is recommended. The conclusion of this study indicates that *Trichoderma sp.* is the suitable starter for fermentation of dry teak leaves.

ACKNOWLEDGMENT

Acknowledgment to the Directorate General of Higher Education that has funded this research through Foundamental Program 2015.

REFERENCES


**Nutritive Values of Rice Straw Fermentation Used Carbon Sources on Different Level with Various of Inoculant Levels** *Aspergillus niger* and *Lactobacillus plantarum*

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**ABSTRACT:** Utilization of agricultural waste products (rice straw) as the basic feed into the strategic thing to be developed to meet the needs of fibrous feed for cattle. Cellulolytic microbes and lactic acid bacteria are sources of inoculum that can improve the quality of rice straw as feed fibrous base. The study was conducted with the aim to obtain the appropriate carbon source for the growth of *Aspergillus niger* and *Lactobacillus plantarum*. The microbial are grown with solid and semi-solid method. The sources of carbon treatment were given two kinds of substrates, namely molasses and rice bran. The treatment of *Aspergillus niger* with a level of 0.5, 10, and 15%. Administration of *Lactobacillus plantarum* was 10% in each treatment. Fermentation is carried out for 21 days. The variables were observed in this study were pH, lactic acid, DM, OM, CP, CF, NDF, ADF, and TDN. Data were analyzed using analysis of variance completely randomized design (CRD) unidirectional pattern and factorial pattern (2 x 4), if there is a real effect, then it was followed by DMRT (Duncan’s Multiple Range Test). The results showed that the best substrate was molasses and *Aspergillus niger* at best level of 15%. It was based on the value of the lowest crude fiber and lactic acid produced the highest (P<0.05). It was concluded that the use of *Aspergillus niger* and *Lactobacillus plantarum* were best for fermented rice straw; the dry matter of *Aspergillus niger* was 15% and *Lactobacillus plantarum* was 10%.

**Keywords:** Rice straw, fermentation, digestibility

**INTRODUCTION**

Forage production in the rainy season is abundant, whereas in the dry season forage production, especially those from low grass even if the long drought reduced production. As for how to overcome the shortage of forage grasses can be done for example by way of utilizing the results of agricultural plant waste, such as rice straw. In line with the increasing intensification of food crop cultivation efforts, the results of agricultural crop residues, especially rice straw will increase. As for how to overcome the shortage of forage grasses, among others, by way of utilizing the results of agricultural crop residues, one of which is rice straw.

Low levels of digestibility of rice straw, because the bonding that occurs in rice straw (cellulose and hemicellulose) is difficult to be broken down by rumen microbes. Consumed rice straw is also difficult to digest and many are not utilized by the ruminant digestion. Indeed, the improvement of nutritional value can be done through the processing of agricultural waste through physical, chemical, and microbiology. One of them, to improve the quality of rice straw with innovative technology in the form of rice straw fermentation using cellulolytic microbes and lactic acid bacteria (LAB).
Rice straw fermentation using cellulolytic microbial inoculum and LAB, with secrete enzymes cellulose and xylanase by the cellulolytic microbes, cellulose and hemicelluloses is hydrolyzed into simple sugars that subsequently by LAB is converted to lactic acid so that the pH drops and the process defaunation. Thus there will be an increase in the digestibility of dry matter and total digestible nutrients (TDN). This indicates that the cellulolytic microbes can produce cellulose and xylanase enzymes capable of breaking down lignocelluloses bonds so as to hold the penetration to break down and degrade the cell walls to further convert into simple carbohydrate compound which is used as a substrate by *Lactobacillus plantarum* to produce lactic acid to lower the pH. Cellulolytic microbial isolates and *Lactobacillus plantarum* can be used as treatment fermented rice straw which gives results in improving the quality of the feed substances by lowering the coarse fiber content and improve digestibility of feed, so that the rice straw can be improved nutritional value by using multiple levels of *Aspergillus niger* and *Lactobacillus plantarum*.

**MATERIALS AND METHODS**

Microbial source used was *Aspergillus niger*, collection of the University Centre for Biotechnology Universitas of Gadjah Mada and *Lactobacillus plantarum*, collection of Nutritional Biochemistry Laboratory of the Faculty of Animal Science, Universitas Gadjah Mada. The fermented material is rice straw and bran IR64 obtained from farmers in the district of Magelang, and molasses. It also used reagents for microbial growth, CMC-ase activity determination, determination of lactic acid levels by Baker and Summerson method, and determination of the chemical composition of fermented rice straw with proximate method.

*Aspergillus niger* was grown in the sterile Potato Dextrose Broth (PDB) medium, then incubated at room temperature for 4 days. *Aspergillus niger* was then tested to determine its cellulolytic ability and CMC-ase activity, *Lactobacillus plantarum* was grown in sterile liquid Man Rogosa Sharpe (MRS) medium then incubated for 24 hours. This study aims to increase microbial isolates of *Aspergillus niger* and LAB (*Lactobacillus plantarum*) and studying it. The study begins from enrichment (enrichment culture) isolates and optimizes isolates with different temperature and time. *Aspergillus niger* was grown in liquid PDB medium sterile, then reproduced in the semi-solid fermentation. Semi-solid medium is a medium GDP plus 10% rice straw substrate. Fermentation is done for 4 days. At the end of fermentation is determined CMC-ase activity of his. Rice straw Fermentation were using two kinds of treatment, the levels of *Aspergillus niger* (0, 5, 10, and 15%) and the kinds of carbon sources (molasses and rice bran) that in studies using analysis of variance completely randomized factorial 2x4 pattern. Implementation begins with the fermentation of rice straw chopping fresh rice straw with a size of 3 to 5 cm. Furthermore, rice straw is weighed as much as 100 g was mixed with a carbon source is molasses or rice bran each 2% of the total as feed then coupled with *Aspergillus niger* with a level of 0, 5, 10, and 15% of the total as feed and 10% *Lactobacillus plantarum* in all levels. Once thoroughly mixed and then put into a glass fermenter, then pressed so dense that the air out and become anaerobic atmosphere tube to be incubated for 3 weeks at room temperature. After incubation for 3 weeks, fermentation is terminated and the weighing is done to determine the loss of dry matter (DM). After the sample was taken to determine the level of acidity of the fermentation is done by using a pH meter pH measurement and analysis of lactic acid in spektrofotometris using Baker and Summerson (Hawk et al., 1976). In addition to sample preparation was carried out to determine the chemical composition of rice straw fermentation using proximate analysis.

Data weight loss, pH, lactic acid and chemical composition of fermented rice straw were analyzed using analysis of variance completely randomized design (CRD) 2x4 factorial design. Further tests followed by Duncan’s Multiple Range Test (DMRT) to find out the difference between the mean (Steel and Torrie, 1991).
RESULTS AND DISCUSSION

Cellulolytic activity *Aspergillus niger*

The test results CMC-ase activity of *Aspergillus niger* showed enrichment in semisolid condition produces CMC-ase activity which is better than the enrichment in liquid form. Medium in the form of a liquid medium consisting of the GDP, while the semisolid medium is a medium comprising a substrate, namely GDP and rice straw. Many rice straw contain cellulose that is capable hydrolysed by *Aspergillus niger*. Cellulose can be hydrolyzed by the enzyme is acid-swollen cellulose, carboxymethyl cellulose (CMC), cellulose azure, and trinitrophenyl Cm-cellulose hydrolyzed by endoglucanases (Coral et al., 2002). The addition of rice straw in semisolid medium causes the activity of *Aspergillus niger* is better than that without given (liquid medium) because substrat sources used will be complete. CMC-ase activity on *Aspergillus niger* using PDA medium with cellulose substrate is added 0.542 U/ml (Narasimha et al., 2005). Medium according to research results Kasmiran and Tarmizi (2012) that the enzyme activity of *Aspergillus niger* on sustrat coconut pulp with long incubation four (4) days showed large hasilse 2.39 U/ml. By looking at the increase in enzyme activity when used in semisolid medium showed fermentation method can be used to multiply the inoculum in the fermentation process (Table 1).

Table 1. Summary enzyme CMC-ase and the fungus *Aspergillus niger*

<table>
<thead>
<tr>
<th>Enrichment</th>
<th>CMC-ase (U/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid</td>
<td>4.644</td>
</tr>
<tr>
<td>Semisolid</td>
<td>5.492</td>
</tr>
</tbody>
</table>

Nutritional Value of Rice Straw Fermentation

Level *Aspergillus niger* and the kinds of carbon sources do not provide significant effect on dry matter (DM) rice straw fermentation. This is consistent with the results of research Dradjat et al. (2013) who did the fermentation of rice straw to feed cattle Bali basis. *Aspergillus niger* inoculum levels give real effect to the content of organic matter rice straw fermentation (P<0.05). Provision of 5% led to significantly increase the levels of organic matter, however, the increase in *Aspergillus niger* from 5 to 10% does not lead to an increase in organic matter. This is consistent with the results Kasmiran (2011) using local microorganisms to ferment rice straw. Provision of *Aspergillus niger* inoculum with different levels of influence on the levels of crude protein (P<0.05). Provision of *Aspergillus niger* as much as 5 and 15% led to significantly increase levels of crude protein with the highest levels resulting from *Aspergillus niger* inoculum level was 5%. Giving molasses as the carbon source resulted in CP levels were higher than rice bran (P<0.05). Provision of *Aspergillus niger* inoculum levels give real effect to changes in crude fat (CF) (P<0.05). The higher the level of inoculum administration increases levels of crude fat. The highest crude fat produced from *Aspergillus niger* inoculum levels are respectively 15, 10, 5 and the lowest This is consistent with the results of research Irawan (2012) with 10% giving buffalo rumen contents for the fermentation of rice straw.

Provision of *Aspergillus niger* inoculum levels give real effect to changes in crude fiber (CF) (P<0.05). Provision of *Aspergillus niger* inoculum will hydrolyze crude fiber thereby increasing the digestibility. Lowest crude fiber produced from *Aspergillus niger* inoculum levels are respectively 15, 5, 10, and the highest 0%. Giving inoculum of 5 and 10% did not make a difference, but the granting of 0 and 15% make a difference. Provision of *Aspergillus niger*
inoculum level does not give real effect to changes hay NDF fermentation. Provision of *Aspergillus niger* inoculum levels seem to significantly affect change in the ADF (P<0.05). The highest ADF produced from *Aspergillus niger* inoculum level row was 0, 15, 5, and the lowest 10%. Giving inoculum of 0, 5, and 15% did not make a difference, but it makes a difference to the level of the provision of 10%. Generally *Aspergillus niger* are capable of producing cellulolytic enzymes and amylolytic enzymes such as amylase and gluco-amylase. Cellulose is a component commonly found in plants. *Aspergillus niger* is able to break down cellulose into simple sugars. Crude fiber is able to be hydrolyzed by *Aspergillus niger* using the synergy of three types of enzymes, namely cellobiohydrolase, endoglucanase and β-glucosidase (Bath, 2000 cit. Narasimha et al., 2005). This ability causes the crude fiber content decreased. This is consistent with the results of research Lamid (2006) fermentation of rice straw by adding rumen bacteria xylanolytic origin. Decline in crude fiber in fermented rice straw by giving some cedar *Aspergillus niger* lower levels of crude fiber according to the results of research Kusumaningrum et al. (2012).

Provision of *Aspergillus niger* inoculum levels give real effect to the change NFE (P<0.05). The highest NFE produced from *Aspergillus niger* inoculum levels are respectively 5, 0, 10, and the lowest 15% of 42.53 ± 0.80. Giving inoculum of 0 and 5% did not make a difference, but it makes a difference in the level of provision of inoculant 15%. This is consistent with the results of research Kusumaningrum et al. (2012), with the provision of some cedar *Aspergillus niger* on rice straw fermentation extract material without increasing the levels of nitrogen.

### Table 2. The nutrient content of rice straw fermentation using *Aspergillus niger* various levels and kinds of different carbon sources

<table>
<thead>
<tr>
<th>Additive Type</th>
<th>Level inoculum</th>
<th>Mean Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td>DM Molasses</td>
<td>40.99±2.37</td>
<td>42.83±2.13</td>
</tr>
<tr>
<td>Rice Bran</td>
<td>44.51±0.37</td>
<td>45.31±1.75</td>
</tr>
<tr>
<td>Averagea</td>
<td>42.75±2.45</td>
<td>44.07±2.21</td>
</tr>
<tr>
<td>DM Molasses</td>
<td>85.70±0.56</td>
<td>86.40±0.33</td>
</tr>
<tr>
<td>Rice Bran</td>
<td>86.42±0.28</td>
<td>88.22±1.09</td>
</tr>
<tr>
<td>Averagea</td>
<td>86.06±0.56a</td>
<td>87.31±1.23b</td>
</tr>
<tr>
<td>DM Molasses</td>
<td>5.34±0.17</td>
<td>6.46±0.49</td>
</tr>
<tr>
<td>Rice Bran</td>
<td>5.05±0.36</td>
<td>6.23±0.20</td>
</tr>
<tr>
<td>Average</td>
<td>5.20±0.30a</td>
<td>6.34±0.36b</td>
</tr>
<tr>
<td>DM Molasses</td>
<td>1.82±1.20</td>
<td>1.91±0.75</td>
</tr>
<tr>
<td>Rice Bran</td>
<td>1.50±0.27</td>
<td>1.97±0.64</td>
</tr>
<tr>
<td>Average</td>
<td>1.66±0.80a</td>
<td>1.94±0.62a</td>
</tr>
<tr>
<td>DM Molasses</td>
<td>34.84±0.48</td>
<td>34.02±0.73</td>
</tr>
<tr>
<td>Rice Bran</td>
<td>34.66±0.35</td>
<td>34.82±1.58</td>
</tr>
<tr>
<td>Average</td>
<td>34.75±0.38b</td>
<td>34.41±1.18b</td>
</tr>
<tr>
<td>DM Molasses</td>
<td>43.71±1.65</td>
<td>44.02±0.43</td>
</tr>
<tr>
<td>Rice Bran</td>
<td>45.21±0.48</td>
<td>45.20±0.79</td>
</tr>
<tr>
<td>Average</td>
<td>44.46±1.37b</td>
<td>44.61±0.86b</td>
</tr>
</tbody>
</table>
The use of *Aspergillus niger* and *Lactobacillus plantarum* for the best fermented rice straw *Aspergillus niger* was 15 and 10% *Lactobacillus plantarum* of dry matter. The use of molasses substrate better when compared to rice bran, it is seen from the results of the analysis of crude proteins, crude fiber, crude fat, ADF, and the results of physical testing rice straw fermentation.

### REFERENCES


The Fat Protective Effect of Fish Oil, Sunflower Seed Oil and Corn Oil on Fluid Rumen Fermentation Parameters

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ABSTRACT: This study was aimed to obtain oil and the exact saponification optimization to protect unsaturated fats, which does not interfere with the fermentation of rumen fluid. The studied the protective effects of unsaturated fat as sheep feed supplement on fermentation parameters of sheep rumen fluid in vitro. Three oil comparising lemuru fish oil (LFO), sunflower seed oil (SSO) and corn oil (CO) each made with a combination of saponification soap and capsulation. Manufacturing unsaturated fatty acids soap was protected by heating and stirring each oil and 20% NaOH solution (caustic soda), added with 10% starch solution to form soft and elastic paste (gel). Ratio of oil volume ratio, 20% NaOH solution and starch was 1:2:1. Pasta was allowed to solidify within one night (12 hours), then sliced into thin slats with knife and soaked in saturated CaCl₂ solution to harden the gel slats which was then crushed by squeezing to form small grains (crystals). Then dried (moisture content of 10 to 20%). Soap samples were taken for in vitro analysis to determine the parameters of the rumen fermentation conditions by observing parameters rumen fluid pH, VFA, NH₃, and rumen microbial protein. The results showed that the three oils were not significantly affecting (P>0.05) pH, microbial proteins, VFA, and NH3, except for significantly low digestibility of dry matter (DM) and organic matter (OM) (P<0.01) compared with no soap. Conclusively, protection of unsaturated fats did not interfere with rumen microbial fermentation and was safe from degradation in the rumen (shown with a normal pH and in vitro DM digestibility and very low OM).

Keywords: protected fat, fermentation parameters, fish oil, sunflower seed oil, corn oil

INTRODUCTION

Lamb meat has a complete nutritional content of human needs despite the high saturated fatty acids compared to other livestock. Efforts to increase mutton production and to decrease levels of saturated fatty acids and cholesterol by increasing the unsaturated fatty acids have become challenge and demand. The main factors to consider in order to increase the levels of unsaturated fatty acids in sheep meat are the biohydrogenation process from unsaturated into saturated fatty acids in the rumen which causes the fat entering the small intestine mostly in the form of saturated fatty acids. Other property of unsaturated fatty acids is anti-microbial cellulolytic. Supplementation in ruminant diets will coat the fibers then inhibit the action of cellulase enzymes, and inhibits the activity of cellulolytic microbes to degrade the fiber. Efforts to prevent biohydrogenation of unsaturated fatty acids in the rumen consisted of saponification and capsulation to protect the fatty acids.

Fish oil and vegetable oil are expected to be the source of unsaturated fatty acids. Lemuru fish oil (LFO), sunflower seed oil (SSO) and corn oil (CO) were utilized in this research. The third oil contains relatively high unsaturated fatty acids. Lemuru oil is particularly produced in
abundance for fish cannery industry, and is therefore a potential animal feed due to the cheap price and is noncompetitive with food demand.

Different content of unsaturated fatty acids in lemuru oil, sunflower seed oil and corn oil causes possibility of providing different protection outcomes. Protection by saponification and capsulation of unsaturated fats is not expected to interfere with the process of fermentation in the rumen because it will be stable at neutral pH (e.g pH in the rumen), and protection will be released in the abomasum at acidic pH, which eventually will be absorbed in the small intestine. Differences in fatty acids of different raw materials can affect the production, quality chemical and physical quality of the meat. Therefore, it is essential to examine the protective effect of unsaturated fatty acids with different raw materials of vegetable origin and fish oils against biohydrogenation process, fermentation, digestibility in the rumen and celluolytic microbial activity in the rumen.

Problems expected to be solved in this research was to what extent the protected unsaturated fat affect of unsaturated fatty acids with the raw material origin fish oil and vegetable oil to the process of fermentation, digestibility and microbial activity in the rumen celluolytic. The sequential study on the protective effects of unsaturated fatty acids was comprehensively tested as seen from the results of rumen fermentation and celluolytic microbial activity in the rumen. This series of research studies was requisitesince the results were expected to identify and examine the resilience of unsaturated fatty acids in the protected rumen, and not to have negative effect on the result of fermentation in the rumen.

METHOD AND MATERIALS

The material used for fatty acid soap was lemuru oil, sunflower seed oil, and corn oil, while saponification was made of distilled water, caustic soda (NaOH technical), technical CaCl₂, and starch served as encapsulation. Material for in vitro test was rumen fluid obtained from one donor sheep’s rumen, 40-day old pangola grass, fatty acid soaps are produced from fish oil, sunflower seed oil and corn oil. Other ingredients included CO₂, 5% pepsin, Mc Dougall solution (artificial saliva) and 20% HCl. Tools for manufacturing fatty soap were used, comprising in vitro tools, pH meter, and VFA test kit.

Manufacturing unsaturated fatty acids soap was preceded by heating and stirring each oil and technical 20% NaOH solution (caustic soda), added with10% starch solution to form soft and elastic paste (gel). Ratio of oil volume ratio, 20% NaOH solution and starch was 1: 2: 1. Pasta was allowed to solidify within one night (12 hours), then sliced into thin slats with knife and soaked in saturated CaCl₂ solution to harden the gel slats which was then crushed (still soaked in CaCl₂ solution) by squeezing to form small grains (crystals). The grains were remained in CaCl₂ solution to solid for approximately 1 hour, then sieved and dried (moisture content of 10 to 20%). Soap samples were taken for in vitro analysis (Tilley and Terry, 1963) to determine the parameters of the rumen fermentation conditions by observing parameters rumen fluid pH, VFA, NH₃, and rumen microbial protein.

The data obtained were statistically tested using ANOVA with SPSS version 17 with a One Way completely randomized design. Differences between treatments were tested further by Duncan test (Steel and Torrie, 1991).
RESULT AND DISCUSSIONS

Effect of unsaturated fatty protection as a sheep feed supplement on fermentation parameters of in vitro rumen fluid

The observed parameters of in vitro rumen fluid fermentation were: pH, N-NH\textsubscript{3}, microbial protein, VFA, dry matter digestibility, and organic matter digestibility. Saponification process combined with the oil capsulation in lemuru fish oil physically produced better and more viable soap than sunflower oil and corn oil. Protection result of lemuru fish oil, corn oil and sunflower seed oil was not significantly different in moisture content, dry matter, crude protein, crude fat, crude fiber, ash and NFE.

Different treatment of fatty acid soap resulted in not significantly different rumen liquid pH. The average rumen liquid pH in lemuru fish oil-based soap, corn oil soap, and sunflower seed oil soap was 7.44, 7.42 and 7.97, respectively. Komar (1984) stated that the neutral pH was ideal for ruminal microbe development. Chuzhaemi (1994) reported that acid pH or pH under neutral would slower the degradation rate of cellulose cell wall. Research result demonstrated that the activity of cellulolytic microbe was not interfered because ruminal liquid pH was within optimal range. It showed that the fatty acid oil of the three materials (lemuru fish oil, corn oil and sunflower seed oil) was stable in rumen, or not degradable as proven from the optimal pH.

Ammonia (N\textsubscript{H\textsubscript{3}}) in rumen liquid was derived from degradation of feed protein, non-protein feed compound (NPN), N urea and saliva (Egan, 1980). The average N\textsubscript{H\textsubscript{3}} level in rumen liquid obtaining soap from lemuru fish oil, corn oil, and sunflower seed oil was 2.99 mg/100ml; 3.96 mg/100ml dan 1.99mg/100ml, respectively. According to Rajhan (1981), N\textsubscript{H\textsubscript{3}} was the main soluble nitrogen amount in rumen liquid needed by ruminal bacteria for protein synthesis as long as carbon frame was available. It was further explained that 20-5-mg/l N\textsubscript{H\textsubscript{3}} was sufficient for bacteria growth (the value was conversible into the same unit with Egan (1980) or 2-5 mg/100ml).

Rumen N\textsubscript{H\textsubscript{3}} level was the reflection of degrading activity of feed protein and endogen protein by ruminal microbe through N balance mechanism of cattle body (Kamra, 2005). Treatments of unsaturated fatty acid source types did not cause different N\textsubscript{H\textsubscript{3}} concentration in rumen. It showed that the activity of proteolytic bacteria as protein degrader to produce nitrogen (N) in rumen was not affected by the supplementation of protected unsaturated fat, therefore the growth of ruminal microbe was not interfered. N\textsubscript{H\textsubscript{3}} level in rumen in this research demonstrated that fatty acid soap of lemuru fish oil and corn oil did not interfere N\textsubscript{H\textsubscript{3}} condition in rumen which remained optimal. While supplementing sunflower seed oil-based soap tended to produce a slightly lower N\textsubscript{H\textsubscript{3}}. It was parallel with the level of microbial protein in sunflower seed oil-based soap that was in fact the lowest compared to lemuru fish oil and corn oil. Protein ration level was equally given to treatments in this research but resulted in varied N\textsubscript{H\textsubscript{3}} rumen liquid. According to Ginting (2005), N\textsubscript{H\textsubscript{3}} was affected not only by feed protein but also non-protein nitrogen (NPN) degradation, saliva and N of rumen wall. Ranjhan (1981) reported that some amino acids could directly be used by bacteria for protein synthesis, but ammonia was the main soluble protein amount in rumen liquid needed by ruminal bacteria for protein synthesis as long as carbon frame from digestible carbohydrate existed, such as starch or glucose. Widjyobroto et al (1995) stated that ammonia concentration in rumen liquid depended on the solubility and amount of feed. Result by Tanuwiria et al (2011) upon supplementing mineral oil complex (calcium soap) in ration, by comparing corn oil, peanut oil and fish oil, reported that ration protein was less fermentable, as observed from N\textsubscript{H\textsubscript{3}} product which was less than in 3.57 mM in every treatment.
Table 1. Parameter of in vitro rumen liquid fermentation and digestibility fermentasi cairan based on different fatty acid oil material

<table>
<thead>
<tr>
<th>Variable</th>
<th>LFO</th>
<th>SSO</th>
<th>CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.44</td>
<td>7.97</td>
<td>7.42</td>
</tr>
<tr>
<td>Microbial protein (mg/g)</td>
<td>0.008</td>
<td>0.010</td>
<td>0.046</td>
</tr>
<tr>
<td>NH3 (mg/100ml)</td>
<td>2.99</td>
<td>1.99</td>
<td>3.96</td>
</tr>
<tr>
<td>VFA:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acetic acid (ml/Mol)</td>
<td>6.758</td>
<td>6.816</td>
<td>9.588</td>
</tr>
<tr>
<td>Propionic acid (ml/Mol)</td>
<td>0.521</td>
<td>0.887</td>
<td>0.875</td>
</tr>
<tr>
<td>Butyric acid (ml/Mol)</td>
<td>2.054</td>
<td>1.907</td>
<td>3.060</td>
</tr>
<tr>
<td>Dry matter digestibility (%)</td>
<td>22.54</td>
<td>18.98</td>
<td>22.07</td>
</tr>
<tr>
<td>Organic matter digestibility (%)</td>
<td>19.16</td>
<td>10.50</td>
<td>12.83</td>
</tr>
</tbody>
</table>

VFA is the carbon source and main energy for ruminants. VFA digestibility in order was first butyric, followed by propionic and acetic. In feedlot, propionic acid concentration is generally higher than the other acids because propionic is the main energy source for meat cattle through gluconeogenesis. Research result showed no different propionic concentration in supplementation of protected lemuru fish oil, corn oil and sunflower seed oil. More propionic acid was absorbed by cell wall in lemuru fish oil than corn oil and sunflower seed oil, so propionic concentration of lemuru fish oil in rumen was low. Chuzaemi (1994) stated that acetic acid and butyric acid were the energy source for ketogenic oxidation, while propionic acid was used for gluconeogenesis or was glucogenic.

Digestibility test on protected fatty organic material by combining saponification and capsulation was not affected by different types of material. Digestibility test on organic matter of dry matter showed low result, indicating saponification combined with capsulation resulted in quite strong protection thereby less degradable by ruminal bacteria.

Supplementing mineral oil complex (calcium soap) in ration, comparing corn oil, peanut oil and lemuru fish oil concluded that the type of oil in making the complex with calcium did not affect fermentability and ration digestibility; however, it was indicated that fermentability and digestibility of ration containing whole oil was lower (Tanuwiria et al, 2011). It was reported that the dry matter digestibility of ration supplied with whole corn oil was lower (P<0.05) than that with calcium complex oil. It showed that oil saponification process by calcium mineral increased dry matter digestibility.

The results showed that the three oils were not significantly affecting dry matter, crude protein, ether extract, crude fiber, and ash.

Table 2. The results of proximate analysis of soaps

<table>
<thead>
<tr>
<th>Variable</th>
<th>LFO</th>
<th>SSO</th>
<th>CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter (%)</td>
<td>76.65</td>
<td>73.29</td>
<td>74.95</td>
</tr>
<tr>
<td>Crude protein (% of DM)</td>
<td>0.42</td>
<td>0.42</td>
<td>0.42</td>
</tr>
<tr>
<td>Ether extract (% of DM)</td>
<td>1.30</td>
<td>4.62</td>
<td>4.60</td>
</tr>
<tr>
<td>Crude fiber (% of DM)</td>
<td>28.01</td>
<td>22.45</td>
<td>12.78</td>
</tr>
<tr>
<td>Ash (% of DM)</td>
<td>45.73</td>
<td>51.98</td>
<td>40.62</td>
</tr>
</tbody>
</table>
CONCLUSION

Conclusion of the study were as follows:

1. Unsaturated fatty acid soap made from lemuru oil was easier to manufacture and deliver the best production results.
2. Rumen fluid conditions (pH, NH₃, VFA) with the addition of fatty acids in protected lemuru oil, corn oil and sunflower seed oil were relatively the same.
3. Protection method with a combination of saponification and capsulation could protect fatty acids from degradation by rumen microbes. This was shown in rumen fluid conditions (pH, NH₃, and VFA) fermented in the normal range, and the results were very low compared to digestibility without fatty acid soaps.

REFERENCES

The Effect of Supplementation of Gliricidia or Rice Bran on Liveweight Gain, Feed Intake and Digestibility of Kacang Goat Fed Mulato Grass

Marsetyo¹, Damry¹ and Mustaring¹

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ABSTRACT: A low liveweight gain of Kacang goats when given grass as single feed indicated that additional feed is required to increase their growth performance. This study was done to examine the effect of addition of Gliricidia or rice bran on liveweight gain, feed intake, and feed digestibility of Kacang goat given Mulato (Brachiaria mulato) grass. Twenty four male Kacang goat approximately 13.4±0.6 (SE) kg in initial weight and 10 months of age were housed in individual metabolic pen and allocated to one of three dietary treatments. The experimental design was a completely randomized block design, with 3 treatments and 8 replicates (goats). The treatments were Mulato grass ad libitum (M), M plus Gliricidia (1% W/d, dry matter (DM)) (MG), and M plus rice bran (1% W/d, DM) (MRB). The experiment was run for 8 weeks period (2 and 6 weeks for adaptation and measurement period, respectively). Parameters measured were liveweight gain (LWG), dry matter intake (DMI), and dry matter digestibility (DMD). The result showed that dietary treatment significantly affected (P<0.05) LWG, DMI and DMD of Kacang goat. Goat given M had lowest LWG, DMI and DMD with value 58 g/d, 2.77 % weight (W)/day (d) and 57.61%, respectively. Goat received MG and MRB had the highest LWG (73 and 76 g/d, respectively), DMI (3.25 and 3.65 %W/d, respectively) and DMD (62.28 and 63.19%, respectively). However, no significant difference (P>0.05) between goat received MG and MRB. In conclusion, this study demonstrated that protein or energy contents of the diet dictated growth, feed intake and digestibility of Kacang goat.

Keywords: Kacang goat, Mulato grass, Gliricidia, and rice bran

INTRODUCTION

(source of cash in emergency, as insurance for crop harvest failure) and potentially to reduce poverty. At national level the population of goat increased from time to time. For example in 2009, goat population was 15.82 million head increased to 17.91 million head in 2012. This lead to the contribution of meat from goat up to 65.2 thousand tons or approximately 18% of total meat production (LAHS, 2013). The data suggests that contribution of goat meat production can be increased through increasing goat population and productivity.

However, liveweight gain of Kacang goat given native grass as single feed are generally low. In their previous studies, Garantjang (2004), Liwa (1996) and Marsetyo (2014) reported that daily liveweight gain of Kacang goat given native grass was 45, 30 and 43 g/d, respectively. This poor growth performances are mainly due to insufficient supply of protein or other nutrients for animals, particularly during dry season (Panjaitan et al., 2010; Sodiq et al., 2011). Poppil et al. (2009) reported that crude protein (CP) content of native grass in Indonesia is mainly low which ranged at 5-8%. Lower of CP content of forages often resulted in the longer retention time of its digesta in the rumen which is caused a lower feed intake (Panjaitan et al., 2010). This suggests that additional feed are required to increase growth performance of Kacang goats. The use of improved grass such as Mulato (Brachiaria mulato) grass plus supplement feed is one way to improve...
growth performance of Kacang gotas. Many previous studies (Marsetyo, 2004 and Ngongoni et al., 2008) reported that supplementing basal grass diets with legume forage or concentrate has increased feed intake and diet digestibility by ruminant livestock. Feed supplement improves nitrogen (N) retention by the ruminant when grass diets that do not meet ruminant energy and N requirements are fed (Marsetyo, 2004).

There are many types of supplement for the goat that available locally. Gliricidia leaves or rice bran can be used to correct feed deficiency of the goat that potentially to increase their growth. Gliricidia is rich in CP and abundantly available in Palu, while rice bran provide medium carbohydrate that is relatively cheap. This study was therefore directed to examine the effects of addition of gliricidia or rice bran on liveweight gain, feed intake and digestibility of Kacang goats given Mulato grass as a basal diet.

**MATERIALS AND METHODS**

**Site and Time**

The experiment was conducted at the experimental farm, Department of Animal Sciences, Tadulako University, Palu, Central Sulawesi from July to September 2013.

**Treatments and Experimental Procedures**

Twenty four Kacang goats (purchased from local markets) weighing 13 ± 0.6 kg were used for the experiment. These animals were ranked and blocked on the basis of their un-fasted live weights. Within blocks, the animals were then randomly allocated to individual metabolism crates (0.5 x 1.5 m) pens and assigned to one of the dietary treatments tested: Mulato grass *ad libitum* (M), M plus Gliricidia (MG), and M plus rice bran (MRB). The Gliricidia or rice bran was offered at a rate of 1% body weight on dry matter basis. All goats were treated with Ivomec (1 mL per 10 kg of live weight) to eliminate internal and external parasites at the beginning of preliminary period.

Experimental animals were confined in individual pens. The experiment lasted for 8 weeks, consisted of a 2 week of adaptation period to diets and experimental routines and a 6 weeks of measurement. The experiment employed a completely randomized block design with 3 treatments and 8 replicates (animals) per treatment. The supplements were given once daily at 07:00 h and fed separately to basal diet. Initially, the animals receiving the supplemental treatment were accustomed to the supplement by gradually introducing the supplement over the first 7 days of the preliminary period. Mulato grasses were obtained from the farm, cut fresh daily and offered to the corresponding animals twice a day at 08:00 and 13:00 h. The grasses were cut to 5-10 cm in length before feeding. The amounts of basal feed offered to the goat daily were set at 10% more than that basal feed intake of the previous day. Drinking water was provided in bucket placed to each crate for *ad libitum* intake.

**Chemical analyses**

Feed offered, feed refusal and faeces collected during digestibility run were sampled and their representative were ground and analysed to determine their DM, organic matter (OM) and ether extract (EE) content (AOAC, 1990). Samples were dried to a constant weight at 60 oC using oven. Feed offers were also sampled for neutral detergent fibre (NDF) (Goering and Van Soest, 1970) and N analysis to determine its CP content, by using the Kjeldahl laboratory method.

**Statistical analysis**
Data collected (feed intake, digestibility and growth of goat) were analysed as a block randomized design using ANOVA in Genstat Release 11.1 statistical package (GenStat, 2008). The mean differences between treatments were compared by Least significant differences test (Steel and Torrie, 1980).

**RESULTS AND DISCUSSION**

The nutritive value of feed given to goat is presented in Table 1. The main differences between Mulato grass, Gliricidia and rice bran is the CP and DM content. The CP content of Gliricidia is more than double of the CP content of Mulato grass (23.7 vs 11.3% DM). In addition, Gliricidia contained the lowest NDF compared with Mulato grass and rice bran. Rice bran showed the highest DM, and EE contents compared with MG and Gliricidia.

<table>
<thead>
<tr>
<th>Feedstuff</th>
<th>DM (%)</th>
<th>OM (%)</th>
<th>CP (%)</th>
<th>NDF (%)</th>
<th>EE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mulato grass</td>
<td>29.8</td>
<td>92.1</td>
<td>11.3</td>
<td>59.1</td>
<td>1.6</td>
</tr>
<tr>
<td>Gliricidia</td>
<td>31.7</td>
<td>90.8</td>
<td>23.7</td>
<td>38.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Rice bran</td>
<td>87.3</td>
<td>93.4</td>
<td>10.6</td>
<td>45.4</td>
<td>6.7</td>
</tr>
</tbody>
</table>

1Dry matter (DM), organic matter (OM), crude protein (CP), neutral detergent fibre (NDF), ether extract (EE).

Table 2. Feed intake, digestibility and growth of Kacang goat given Mulato grass, Mulato grass plus Gliricidia or rice bran

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mulato grass (M)</th>
<th>M+Gliricidia (MG)</th>
<th>M+rice bran (MRB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forage intake (kg DM/d)</td>
<td>0.42±0.01</td>
<td>0.38±0.01</td>
<td>0.39±0.01</td>
</tr>
<tr>
<td>Forage intake (%W/d)</td>
<td>2.77±0.08</td>
<td>2.52±0.07</td>
<td>2.67±0.09</td>
</tr>
<tr>
<td>Supplement intake (kg DM/d)</td>
<td>0.00</td>
<td>0.12±0.01</td>
<td>0.14±0.01</td>
</tr>
<tr>
<td>Supplement intake (%W/d)</td>
<td>0.00</td>
<td>0.73±0.02</td>
<td>0.98±0.01</td>
</tr>
<tr>
<td>Total intake (kg DM/d)</td>
<td>0.42±0.01</td>
<td>0.50±0.01</td>
<td>0.53±0.01</td>
</tr>
<tr>
<td>Total intake (%W/d)</td>
<td>2.77±0.07</td>
<td>3.25±0.05</td>
<td>3.65±0.08</td>
</tr>
<tr>
<td>Dry matter digestibility (%)</td>
<td>57.61±1.07</td>
<td>62.28±1.09</td>
<td>63.19±1.12</td>
</tr>
<tr>
<td>Daily live weight gain (g/h/d)</td>
<td>58.33±2.80</td>
<td>72.62±2.01</td>
<td>75.79±0.73</td>
</tr>
</tbody>
</table>

Means with different superscripts in same raw are significantly different (P<0.05).

The effect of supplement intake on feed intake is shown in Table 2. Forage DM intake was lowest (P<0.05) for goats receiving MG compared goat receiving M and MRB respectively, but no significant difference (P>0.05) between the last two groups. All goats receiving Gliricidia or rice bran did not consume 100% of their total allowance. Supplement intake expressed as percentage of liveweight was higher for goats received rice bran (98%) than Gliricidia (73%). Although the supplementation increased total DM intake, in fact, supplement resulted in the decline of forage intake that often called as a substitution. In this study, the substitution rates with addition of Gliricidia and rice bran (1%W/d) were 9 and 4%, respectively. This is only small substitution rate. The reason of this substitution is not clear but probably because of limited gut fill and increasing intake of metabolisable energy (ME) due to supplemental feed. Goats received Gliricidia had higher basal feed intake depression compared goats received rice bran. Both Gliricidia and Mulato
grass were bulky materials which could limit capacity in reticulorumen. This is in agreement with Marsetyo (2004) who suggests that physical condition of supplement can potentially result in the decrease in forage intake due to physical limitation.

The effect of supplement intake on DMD, and daily liveweight gain are shown in Table 2. In both parameters, the greatest values were achieved by goat received MG and MRB and no significant differences (P>0.05) between two treatments (Table 2). The values of DMD for MG an MRG treated goats were 4.67 and 5.58% higher respectively than M treated goats. This study demonstrated that addition extra N to goat given MG could stimulate feed intake and digestibility. The stimulation of total intake and digestibility of goats supplemented with Gliricidia or RB could be due to increased N intake and supported by earlier studies (Bowen et al., 1998). Assuming that N is one of the major limiting nutrients (along with minerals, particularly sulphur, and soluble carbohydrate) in forage, a significant increase in intake and digestibility could have been expected when supplementary nitrogen was provided. Carbohydrate supplementation in addition, supplies substrates for microbial activity in the rumen. The reason for the highest responses in total intake, digestibility for calves received rice bran could be due to addition of extra N and carbohydrate from feed component such as rice bran. These results suggest that addition of energy and protein to the basal diet dictated feed intake and digestibility of Kacang goat.

M had the lowest daily liveweight gain. The main constraints leading to these lower goat performances given M only are probably from lower supply of CP or other nutrients for animal, which resulted in the low rate of productivity. Many previous studies (Damry et al., 2008; Panjaitan et al., 2010; Marsetyo et al., 2012) indicated that CP content of feed influence significantly feed intake and digestibility, and retention time of digesta in the rumen. The total feed intake and digestibility of goats received M were significantly lower (P<0.05) than goats received MG and MRB. This finding is supported by Panjaitan et al. (2010) who suggested that the lower of CP content of feed the longer retention time its digesta in the rumen. The current study demonstrated that the addition of simple supplements, such as Gliricidia or rice bran to M can result in higher daily liveweight gain than goats given M only. The current data of liveweight gain of goat offered M as single feed is relatively closed to the finding of Marsetyo (2014). In the previous study this author reported that daily liveweight gain of Kacang goats given M as single feed was 53.50 g/d, which is much higher than goat given native grass (28.11 g/d). Both studies used similar materials with similar chemical contents so it is no surprising for the close growth rate data.

CONCLUSIONS

It is concluded that addition protein from supplement feed can stimulate feed intake, feed digestibility and growth rates of young Kacang goat given Mulato grass.

ACKNOWLEDGMENTS

The authors wish to thank to Directorate of Higher Education (DIKTI) for provide the fund for this study through the Penelitian Unggulan perguruan Tinggi. We are also grateful to Rulisman, SPt, who help in collecting goats. We also thank to the undergraduate students (I Wayan Dharma Yadi and Reza Faizal) at the Department of Animal Science, Tadulako University, who assisted with this research as part of their honours program.
REFERENCES


In Sacco Feeding Value of Multi-Stage Ammoniated Palm Press Fiber

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ABSTRACT: The objective of present study was to evaluate feeding value of multi-stage ammoniated (MA) palm press fiber (PPF) by nylon bag technique. Fistulated-Bali cow with 250 kg body weight was used as an in situ animal for nylon bag technique. Nylon bags were sampled in 0, 6, 12 and 24 hour. The sample was Palm press fiber which has been treated with hydrous ammonia several times by gradually-decreased hydrous ammonia concentration (8%, 4% and 2% respectively) within 12 days. Three treatments (control, ammoniated and multi-stage ammoniated) of PPF were evaluated in sacco for its apparent digestibility. Apparent digestibility of ammoniated and multi-stage ammoniated PPF were 2 times higher than control, moreover rate of disappearance in sacco also 36% higher than control. N-ammonia and Total VFA of multi-stage ammoniated PPF were 11% and 16% higher than control. There were no significant difference of N-ammonia and Total VFA between ammoniated and multi-stage ammoniated PPF.

Keywords: In Sacco, Multi-stage Ammoniated, Nylon Bag, Palm Press Fiber,
Alternative Rations to Maintain High Growth Rate of Bali Bulls Fattened with Leucaena Based Diet in Sumbawa, Eastern Indonesia

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ABSTRACT: Alternative rations to maintain high live weigh gain (LWG) of Bali bulls fed leucaena basal diet over season had been studied under field condition in Sumbawa district of West Nusa Tenggara Province. Twenty four male Bali cattle with an initial age of 17±3 months and initial body weight of 163±36 Kg were used. The animals were randomly allocated into four dietary treatments with six replicates per treatment. The treatments were leucaena solely ad libitum (LS); Leucaena 1.0% BW with native grass ad libitum (LG); Leucaena ad libitum with maize 0.5% BW (LM) and Leucaena 1.0% BW with maize 0.5% and native grass ad libitum (LMG). Native grass consists of grass, weeds and forbs that commonly fed to animal in the area. Live weight gain and feed intake were determined over 20 weeks. Body weight was recorded twice per month. The LWG was not different for bull fed LM (0.62 Kg/d), LS (0.57 Kg/d) and LMG (0.58 Kg/d) however higher than that of bull fed LG (0.48 Kg/d). Bull fed LM had highest total dry matter (DM) intake (28.7 g DM/Kg LW) and no differences in total DM intake between bull fed LS (26.1 g DM/Kg LW) and LMG (25.8 g DM/Kg LW) while the lowest total DM intake had recorded in bull fed LG (21.0 g DM/Kg LW). Addition of maize of 0.5% BW in the diet have no negative effect on leucaena intake resulted in an increased on total intake. Feeding leucaena restricted to 1% BW with maize 0.5% BW and grasses ad libitum resulted on similar total intake to LA diet while without maize and grass ad libitum resulted in lower total intake and thus LWG. The proportion of leucaena (50%) in LG diet may be inadequate to have similar response in intake and LWG to LS diet. Leucaena maize, LMG and LG diet can be used as an alternate ration other than leucaena alone to maintain high live weight gain over season under traditional fattening systems in Sumbawa.

Keywords: rations, fattening, liveweight gain, Bali cattle, leucaena

INTRODUCTION

West Nusa Tenggara province is one of prominent cattle sources in Indonesia. Current cattle population in both Lombok and Sumbawa islands is 1 million head (NTB in Figures, 2014). The island of Sumbawa inhabited by 57% of total cattle population in the province with Bali cattle as a dominant breed. Bali cattle are the best local beef breed in the region considered to the ability to adapt in harsh environment condition (Martojo, 2012). Cattle production in Sumbawa basically bases on extensive systems where mostly cattle graze both native grass in a common land and agricultural residue following harvesting time. Panjaitan (2012) reported that Bali bulls fed tropical grasses and forbs under fully confined traditional fattening system gained weight of 0.26 Kg/d. However, Mastika (2003) recorded when Bali cattle fed high quality feed this local beef breed capable to reach live weight gain (LWG) of 0.85 Kg/d. Leucaena is one of high quality forages that available around the island. Dahlanuddin et. al. (2014) reported that feeding leucaena as a sole component of the diet to weaned male Bali cattle increased LWG of 0.47 kg/d. Rhee subdistrict is an area in Sumbawa region that already practiced an intensive fattening system based on leucaena (Leucaena leucocephala) more than three decades (Panjaitan et. al., 2014). It had been reported that leucaena feeding in this area resulted in average LWG of 0.42 Kg/d with the highest point of 0.62 Kg/d in a good season where leucaena leaf available lush and leucaena fed to nearly 100% (Panjaitan et. al., 2014). However, LWG of 0.23 Kg/d also recorded during peak of dry season due to inadequate feed offered to animal and leucaena fed less than 50% in the diets. This indicated
that leucaena production predominantly drive LWG thus the availability limit cattle production in this system. An exploration of other feed sources to add to leucaena as main component of diet is needed to improve feeding system in the region. The most available feed source in the region is native grass in the wet season and maize grain in late wet season to peak dry season. Maize grain has high non structural carbohydrate that may enhance rumen available energy to improve LWG while grass have a role to reduce unused rumen degraded N. Addition of maize and or grass in the diet is important to lengthen leucaena supply towards dry season and maintaining high LWG in this system. The objective of this study was to evaluate alternative rations to maintain high live weight gain over season in Bali cattle fatten based on leucaena feeding system in dry tropical Sumbawa.

MATERIALS AND METHOD

The experiment was conducted under field condition over 20 weeks between March 2013 and August 2013 at Jatisari (latitude 8°25’8.4”S; longitude 117°15’58.5”E and Altitude 6-42 m) Rhee subdistrict of Sumbawa region, West Nusa Tenggara, Indonesia.

Animals

Twenty four male Bali beef were used in this experiment. The bulls were approximately 17±3 months and initial body weight of 155±36 Kg (mean ± s.d. of the mean) at the commencement of the experiment. All bulls were treated with albendazole to control internal and external parasites before the commencement of the experiment.

Experimental design

The experimental design was a completely randomized design with four treatment and six replicates (animals) per treatment. Animals were randomly allocated into four treatment diets. The four treatments diets were (1) leucaena ad libitum (LS), (2) Leucaena ad libitum with maize at 0.5% of body weight (LM), (3) Leucaena at 1.0% of body weight with maize at 0.5% of body weight and grasses ad libitum (LMG) and (4) Leucaena at 1% of body weight with grasses ad libitum (LG). The amount of feed offered was based on dry matter basis. Drinking water was provided once a day between 11:00 and 13:00 hours in a 10 L bucket.

Feed and feeding procedures

Leucaena and grasses were collected in the evening or in the morning before feeding. Leucaena fed first to cattle in a half of daily allowance at 09:00 hours except for LG and LMG where all daily allowance of leucaena fed at once. Maize grain fed at around 11:00 hours following leucaena feeding in the morning. Drinking water provided at between 12:00 and 13 hours and bull allowed to drink to satiety and the remaining feeds offered at around 14:00 hours. Grasses were mainly native grass and a mixture of various grasses and forbs.

Sampling procedure and measurement

Live weight was recorded twice a month over a 138 day period and average live weight gain (LWG) was determined. Feed intake was measured over seven consecutive days on three consecutive months during experiment. Dry matter content of feeds offered and feed refusals was determined by drying sample to a constant weight at 70 °C in a forced fan oven.

Statistical analysis

The study was conducted under completely randomized design. The statistical significance of treatments effect on LWG and intake was tested by analysis of variance (ANOVAs). The significant differences between treatments were tested using Duncan Multiple Range Test (DMRT) procedure. All data were analysed using the statistical package SPSS version 16.0.
RESULTS AND DISCUSSION

Live weight gain

Substitution of leucaena to other locally available feed sources in bull fed leucaena alone primarily are to lengthen availability of leucaena in order to maintain high liveweight gain of Bali bull over season under traditional fattening systems in Sumbawa. Total LWG and daily LWG of Bali bull fed four different diets based on leucaena are given in Table 1. Bull fed leucaena alone (LS) gained weight of 0.57 Kg/d and addition of maize and grass in the diet has no different results in LWG for both LM (0.62 Kg/d) and LMG (0.58 Kg/d) diets. However, bull fed LG had lower LWG than that of bull fed LS, LM and LMG diets.

Table 1. Total and daily liveweight gain of Bali bull fed leucaena (L), leucaena at 1% BW and grass ad libitum (LG), leucaena ad libitum and maize at 0.5% BW (LM) and leucaena at 1% BW, maize at 0.5% BW and grasses ad libitum (LMG).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>L</th>
<th>LG</th>
<th>LM</th>
<th>LMG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial weight</td>
<td>Kg</td>
<td>151.6±37.6</td>
<td>154.8±32.5</td>
<td>180.5±42.0</td>
</tr>
<tr>
<td>Final weight</td>
<td>Kg</td>
<td>230.8±35.9</td>
<td>221.2±23.4</td>
<td>266.7±48.0</td>
</tr>
<tr>
<td>Total LWG</td>
<td>Kg</td>
<td>79.2±10.4a</td>
<td>66.3±14.8b</td>
<td>86.2±7.1a</td>
</tr>
<tr>
<td>LWG</td>
<td>Kg/d</td>
<td>0.57±0.08a</td>
<td>0.62±0.05a</td>
<td>0.48±0.11b</td>
</tr>
</tbody>
</table>

This study confirmed that feeding Bali bull with high content of leucaena in the diet resulted in high LWG. The results found agree with previous study reported by Dahlanuddin et. al. (2014), Panjaitan et. al. (2013) and Panjaitan et. al. (2014) who has reported a LWG above of 0.40 Kg/d in cattle fed high content of leucaena in diets. However, lower LWG in bull fed LG diet may be associated with proportion of leucaena in the diet. Feeding leucaena at 1% BW with grass ad libitum may not be enough to attain minimum limit of leucaena to have a high LWG as reach by bull fed leucaena solely.

Intake

Intake is the most important factor affecting LWG and the intake of leucaena and total dry matter intake of bull fed various leucaena based diet under traditional fattening system are shown in Table 2. Male Bali beef fed leucaena as the sole diet (LS) consumed leucaena at 26.1 g DM/Kg BW/d or 2.6% of BW and this leucaena intake was no different to bull fed LM diet where the intake of leucaena was 24.2 g DM/Kg BW/d as a result, bull fed LM diet that received maize at 0.5% BW had higher total dry matter intake than that of bull fed LS diet. The intake of leucaena in bull fed LG and LMG as expected lower than that of the intake of leucaena in bulls fed LS and LM as leucaena offered to bull for both diet restricted to 1% BW. Interestingly, grass intake for bull fed both LG and LMG diets was fairly similar to around 1% BW despite bulls fed LMG diet received maize to 0.5% BW. The highest total dry matter intake was in bulls fed LM diet, followed by LS and LMG but with no different to each other while the lowest was in bulls fed LG diet.

Table 2. Intake of leucaena in each diet and total dry matter intake of bull fed leucaena (L), leucaena at 1% BW and grass ad libitum (LG), leucaena ad libitum and maize at 0.5% BW (LM) and leucaena at 1% BW, maize at 0.5% BW and grasses ad libitum (LMG).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>L</th>
<th>LG</th>
<th>LM</th>
<th>LMG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake (g DM/kg LW d-1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leucaena</td>
<td>26.1±1.1a</td>
<td>10.4±0.8b</td>
<td>24.2±3.0a</td>
<td>11.0±1.2b</td>
</tr>
</tbody>
</table>
Leucaena proportion (%)

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100±0.0</td>
<td>49.8±4.7</td>
<td>84.0±1.7</td>
</tr>
</tbody>
</table>

Leucaena intake in bull fed leucaena solely in this study lower than previous study reported by Dahlanuddin et al. (2014) who recorded leucaena intake of 29.3 g DM/Kg BW/d on weaned male Bali calves fed leucaena hay ad libitum. Differences in class of animal may be responded differently to similar diet. Animals in the current study were older thus range of nutrients required for growth may be different. However, when maize added up to 0.5% BW with leucaena ad libitum did not affect leucaena intake thus resulted total dry matter intake of 28.7 g DM/kg BW/d and close to total dry matter intake of weaned male Bali cattle fed leucaena as sole diet reported by Dahlanuddin et al. (2014). Feeding leucaena at 1% BW with or without addition of maize at 0.5% BW in diets was only able to stimulate intake of grass to around 1% BW. Thus resulted total intake of LMG diet relatively similar to LS diet but below LM diet. This indicated that more than 1% BW of leucaena required to compost leucaena grass diet with or without maize at 0.5% BW to have an optimal intake.

Liveweight gain obtained in this study was in accordance pattern with total dry matter intake. Although LWG of bull fed LM was not significantly different to bull fed LS and LMG but showed similar trend to the total dry matter intake. This suggests that feeding LM, LMG and LG diets result relatively similar LWG to LS diet.

CONCLUSION

Leucaena-maize, leucaena-maize-grass or leucaena-grass provided an option rations to leucaena sole diet to maintain high growth rate of Bali bulls fatten based on leucaena thus lengthen leucaena supply over season in order to sustain fattening activities year around.

REFERENCES

Martojo, H. 2012. Indigenous Bali cattle is the best suited cattle breed for sustainable small farm in Indonesia. Reproduction in Domestic Animals 47. 10-14
The Use of Ramie By-Product (Boehmeria nivea) Materials as Complete Feed on the Growth and Hematology of Weaning Ettawa Cross Breed Goat

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ABSTRACT: This study aims to determine the effect of complete feed using ramie with or without ensilage and vegetable or animal sources of protein towards the growth and blood hematology of weaning Ettawa cross breed goat. The study used a 2X2 factorial design and 6 (six) replicates. The complete feed treatment using ramie by-product without ensilage showed that almost all parameters of growth was higher than the ensilaged one (P<0.05) except height. Complete feed treatment using ramie by-product with an additional source of animal protein indicates the final weight and daily weight gain (PBBH) was higher (P<0.01). The interaction of both treatments was proved the final weight, daily weight gain, and chest circumference. The complete feed treatment using ramie without and with ensilage, the addition of a source of protein and the interaction of both treatments had no effect on the blood hematology. The study could be concluded the weaning Ettawa cross breed goat that received complete feed using ramie waste without ensilage showed higher growth while the addition of animal protein sources are higher.

Keywords: Blood hematology, Ensilage, Growth, Protein Source, Ramie.

INTRODUCTION

Ramie (Boehmeria nivea L Goud) is a shrub that produces fibers in the bark. Its fiber production is approximately 3 to 5% of forage production and the rest is forage by product. Ramie leaves can be used as a substitute for forage legume since its rude protein content was 22% (Saroso, 2000). It was reported that it has shortage of amino acids methionine, mineral phosphor (P) and cuprum (Cu) (Duarte et al., 1997). Methionine is an essential amino acid, while mineral P plays a role in energy metabolism and Cu is a micro mineral in the transport of oxygen. The straw from decortications residue which has crude fiber (CF) as high as 37.81% can be used as a source of fiber (energy) for ruminant. Production and nutritional feed quality of ramie by product was maximized as complete feed constituent and being formulated with vegetable or animal sources of protein, a source of energy, vitamins and mineral. Complete feeds with different protein sources experiencing ensilage that those without ensilage. Ensilage in complete feed is the simplest method of improving its quality for long-term storage (Wongnen et al., 2009), and increase the digestibility of dry matter (DM), organic matter (BO), crude fiber (CF) as well as non-structural carbohydrate (Vasupen et al., 2005; 2006) due to the growth of lactic acid bacteria. Complete feed was given to after weaning Ettawa cross breed goat in order to identify its influence as animal feed by measuring growth and blood hematology.

MATERIAL AND METHODS

Complete feed consists of ramie by-product (stalks and leaves), dried cassava, cassava, rice bran, pollard, crushed soybeans, soybean meal, fish meal, molasses, urea, salt, calcium, and mineral mix. Ration composition and nutrient are presented in Table 1. Twenty after weaning Ettawa cross breed goats (age 3 to 4 months) and 24 units of individual housing are equipped with eat and drink container. The chemicals and analysis was equipment BK, BO, CP, NDF, and ADF. Weighing capacity of 200 g and 20 kg. The method used was experimental in vivo, the basic design of completely randomized design (CRD) 2X2 factorial and 6 (six) replicates (Steel and Torrie,
1993) The first factor is a complete feed without ensilage (CF0) or with ensilage (CF1), while the second factor is a source of vegetable protein (N) or animal (H). The four kinds of treatment are: 1) CF0N is complete feed without ensilage and source of vegetable protein, 2) CF0H is complete feed without ensilage and sources of animal protein, 3) CF1N is complete feed with ensilage and source of vegetable protein, 4) CF1H is complete feed with ensilage and diverse sources of animal protein. Difference analysis was following the procedure of general linear models (GLM) in the SAS program version 6.12 (SAS, 1996) and a further test of Honestly Significant Different (Gill, 1978). Growth parameters variables measured were as follows: final body weight, daily weight gain (PBBH), height, body length, chest circumference, and the circumference of the pelvis (Hardjosubroto and Astuti, 1993) and hematological blood (glucose, erythrocytes, leukocytes, hemoglobin, and PCV).

Table 1. Complete feed formulation and nutrient composition

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CF0N</td>
</tr>
<tr>
<td>Ramie leaves</td>
<td>13.5</td>
</tr>
<tr>
<td>Ramie stalk</td>
<td>16.5</td>
</tr>
<tr>
<td>Dried cassava</td>
<td>10</td>
</tr>
<tr>
<td>Cassava</td>
<td>10</td>
</tr>
<tr>
<td>Rice bran</td>
<td>9.4</td>
</tr>
<tr>
<td>Pollard</td>
<td>9</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>10.5</td>
</tr>
<tr>
<td>Crushed soybeans</td>
<td>8.8</td>
</tr>
<tr>
<td>Fish meal</td>
<td>-</td>
</tr>
<tr>
<td>Molasses</td>
<td>10</td>
</tr>
<tr>
<td>Urea</td>
<td>0.3</td>
</tr>
<tr>
<td>Salt</td>
<td>0.5</td>
</tr>
<tr>
<td>Calcium</td>
<td>0.5</td>
</tr>
<tr>
<td>Mineral+Vitamin</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Chemical composition*

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>CF0N</th>
<th>CF1N</th>
<th>CF0H</th>
<th>CF1H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ash (% BK)</td>
<td>10.42</td>
<td>9.50</td>
<td>13.53</td>
<td>11.25</td>
</tr>
<tr>
<td>Extract ether (% BK)</td>
<td>1.93</td>
<td>2.51</td>
<td>3.31</td>
<td>3.42</td>
</tr>
<tr>
<td>Crude fiber (% BK)</td>
<td>19.59</td>
<td>13.46</td>
<td>19.91</td>
<td>15.65</td>
</tr>
<tr>
<td>BETN (% BK)</td>
<td>48.18</td>
<td>52.99</td>
<td>41.12</td>
<td>49.62</td>
</tr>
<tr>
<td>Crude protein (% BK)</td>
<td>19.88</td>
<td>21.54</td>
<td>22.13</td>
<td>20.07</td>
</tr>
<tr>
<td>TDN (% BK)</td>
<td>70.01</td>
<td>70.01</td>
<td>65.74</td>
<td>65.74</td>
</tr>
</tbody>
</table>

*Calculation based on table (Hartadi et al., 2005) and analysis result of Animal Feed Laboratory.

Sequences of Work
1. Prepare 24 after weaning Ettawa cross breed goat and weighing and worm medication and vitamins. Goats are placed in individual cages.

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2. Raising begins with a stage adaptation for 14 days and feeding as much as 3.5% of its weight at 06.30 pm and 15.00 pm and drinking water and labium. Raising is carried out for four months.

3. Complete feed using ramie by-product with ensilage (Table 1) then conduct the ensilage process an-aerobically for 21 days at room temperature. Complete feeds using ramie by-product without ensilage was prepared every day with the composition as in Table 1 with the leaves and stems of ramie was in the form of air-dried.

4. Individual weighing was conducted every two weeks (after the preliminary stage) and measured the size of the body to determine the weight and daily weight gain before feeding in the morning. Blood sampling was conducted for hematology test.

RESULTS AND DISCUSSION

The treatment using a complete feed of ramie by-product with and without ensilage and source of vegetable and animal protein on the growth of after weaning Ettawa cross breed goat is presented in Table 2.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Protein source</th>
<th>CF0</th>
<th>CF1</th>
<th>Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final body weight (kg BB 0.75)</td>
<td>N</td>
<td>9.51±0.68&lt;sup&gt;ac&lt;/sup&gt;</td>
<td>8.66±0.20&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>s</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>10.19±0.23&lt;sup&gt;ad&lt;/sup&gt;</td>
<td>8.72±0.33&lt;sup&gt;bd&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Daily weight gain (g/kg BB0.75)</td>
<td>N</td>
<td>77.97±11.89&lt;sup&gt;ac&lt;/sup&gt;</td>
<td>42.37±3.22&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>s</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>108.66±22.06&lt;sup&gt;ad&lt;/sup&gt;</td>
<td>51.02±4.86&lt;sup&gt;bd&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Height (cm)</td>
<td>N</td>
<td>62.80±1.60</td>
<td>63.00±3.29</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>62.80±2.93</td>
<td>61.00±1.90</td>
<td></td>
</tr>
<tr>
<td>Body length (cm)</td>
<td>N</td>
<td>55.78±1.37&lt;sup&gt;a&lt;/sup&gt;</td>
<td>51.40±3.20&lt;sup&gt;b&lt;/sup&gt;</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>56.00±1.09&lt;sup&gt;a&lt;/sup&gt;</td>
<td>51.83±1.72&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Chest circumference (cm)</td>
<td>N</td>
<td>61.00±1.55&lt;sup&gt;a&lt;/sup&gt;</td>
<td>60.20±2.31&lt;sup&gt;b&lt;/sup&gt;</td>
<td>s</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>63.00±1.67&lt;sup&gt;a&lt;/sup&gt;</td>
<td>58.20±2.99&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Pelvis Circumference (cm)</td>
<td>N</td>
<td>62.00±1.67&lt;sup&gt;a&lt;/sup&gt;</td>
<td>58.60±3.98&lt;sup&gt;b&lt;/sup&gt;</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>66.40±2.15&lt;sup&gt;a&lt;/sup&gt;</td>
<td>59.00±4.43&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

Description: <sup>ab</sup>: different superscript in the same row/column showed significant differences (P<0.05).

<sup>cd</sup>: different superscript in the same row/column showed highly significant differences (P<0.01).

CF0: complete feed ramie by-product e without ensilage; CF1: complete feed using ramie by-product with ensilage N: source of vegetable protein; H: source of animal protein.

Final Weight and Daily Weight Gain (PBBH)

After weaning Ettawa cross breed goat who get complete feed using ramie by-product without ensilage showed final body weight of 9.76±0.55 kg BW0.75 (20.87±0.45 kg; CF0N) and 9.93±1.73 kg BW0.75 (21.50±2.08 kg; CF0H) higher than the complete feed with ensilage of 9.93±1.73 kg BW0.75 (18.30±2.08 kg; CF1N) and 8.76±0.59 kg BW0.75 (18.07±0.49 kg; CF1H) (P<0.05). Final weight of after weaning Ettawa cross breed goat achieved as a result of weight gain daily (PBBH) with a positive average value 77.97 g/kg BB0.75/day (CF0N) dan 108.66 g/kg BW0.75/day (CF0H). 42.37 g/kg BB0.75/day (147.71 g/day) (CF1N) and 51.02 g/kg BW0.75/day (189.23 g/day) (CF1H) (P<0.05). Weight gain was consistent with the consumption of BK, OM and NDF and were higher in animals that received complete feed without ensilage (P<0.01) (Susanti and Suhartati, 2015). It shows the total consumption intake to supports livestock growth and productivity. Final body weight in this study was higher than the study results of Musnandar.
et al. (2011). The goat who received rations of grass substitution with fermented palm bunches of 0%, 50% and 100% produced the final weight of 16.68 kg; 18.07 kg and 18.5 kg. Achievement of the final weight of the treatment showed that complete feed can provide energy and protein for the after weaning Ettawa cross breed goat and indicated real interaction of both treatments. Growth period is the period that require nutrient intake of energy and protein sources in sufficient amounts as provided in the rations, larger than the recommended requirements of Ranjahn et al. (1981) for after weaning Ettawa cross breed goat.

**Height, Body Length, Chest Circumference, and Pelvis Circumference**

After weaning Ettawa cross breed goat who received complete feed using ramie by-product without and with ensilage showed no significant difference of body length of 62.80±1.60 cm on CF0N; 62.80±2.93 cm on CF0H; 63.00±3.29 cm in CF1N, and 61.00±1.90 cm on CF1H. The average size of goat body length who received complete feed using ramie by-product without ensilage was 55.78±1.37 cm (CF0N) and 56.00±1.10 cm (CF0H), longer than those who got complete feed with ensilage of 51.40±3.20 cm (CF1N) and 51.83±1.72 cm (CF1H) (P<0.01). After weaning Ettawa cross breed goats’ body length (less than one year) was 49.4±7.8 cm (Kurnianto et al., 2013). Body weight is a reflection of livestock (Cam et al., 2010). The size of chest circumference of after weaning Ettawa cross breed goat who got complete feed using ramie by-product without ensilage was 61.00±1.55cm (CF0N) and 63.00±1.67 cm (CF0H), greater than those who received complete feed with ensilage of 60.20±2.31 cm (CF1N) and 58.20±2.99 cm (CF1H) (P<0.01). The development of chest circumference size was according to goat consumption that received complete feed of ramie by-product of BK, BO and NDF that were respectively higher than complete feed without ensilage. Treatment of different protein sources showed the same response in body length and chest circumference. The effect of complete feed using ramie by product without ensilage on the size of the pelvis circumference was 62.00±1.67 cm (CF0N) and 66.40±2.15 cm (CF0H), higher than those who received complete feed silage of 58.60±3.98 cm (CF1N) and 59.00±4.43 cm (CF1H) (P<0.01).

**Blood Hematology**

The distribution of complete feed using ramie by-product with and without ensilage and the use of vegetable and animal protein source at weaning goat against hematological blood condition is presented in Table 3.

**Table 3.** Condition blood hematology of after weaning Ettawa cross breed goat who received complete feed of ramie by-product with and without ensilage and different protein sources

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Protein source</th>
<th>CF0</th>
<th>CF1</th>
<th>Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose</td>
<td>N</td>
<td>46.67±8.07</td>
<td>46.17±4.83</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>46.83±10.68</td>
<td>45.67±7.92</td>
<td></td>
</tr>
<tr>
<td>Erythrocytes (X106/uL)</td>
<td>N</td>
<td>2.39±0.34</td>
<td>2.07±0.51</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>2.15±0.34</td>
<td>1.94±0.39</td>
<td></td>
</tr>
<tr>
<td>Leukocytes (X103/uL)</td>
<td>N</td>
<td>19.82±5.39</td>
<td>19.48±3.28</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>21.15±3.65</td>
<td>17.02±3.34</td>
<td></td>
</tr>
<tr>
<td>Hemoglobyn (g/dL)</td>
<td>N</td>
<td>9.77±0.64</td>
<td>9.15±1.29</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>9.38±0.95</td>
<td>8.80±1.34</td>
<td></td>
</tr>
<tr>
<td>PCV (%)</td>
<td>N</td>
<td>26.00±5.19</td>
<td>23.63±6.11</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>23.37±4.55</td>
<td>21.90±6.10</td>
<td></td>
</tr>
</tbody>
</table>

**Description:** CF0: complete feed using ramie by-product without ensilage; CF1: complete feed using ramie by-product with ensilage N: complete feed using ramie by-product with vegetable protein sources; H: complete feed using ramie by product with the source of animal protein.
Complete feeds using ramie by-product with and without ensilage had no effect on blood hematolgy of blood glucose; erythrocytes; leukocytes; hemoglobin and PCV. Barbari goat that got the complete feed block consisted of grass hay: concentrate of 60:40 (T1). While mustard cake in concentrate amounted to 15% (T2) and 30% (T3) that was replaced with leucaena leaves flour showed the blood glucose concentration of 53.59±0.85 mg/dl; 53.67±1.05 mg/dl and 53.80±0.95 mg/dl (P>0.05) (Samanta et al., 2003). Kramer (2000) reported the condition of normal blood hematolgy of goats was: erythrocytes 6 to 19 X106/µL; leukocyte 4 to 13X103/µL; hemoglobin 8 to 12 g/dL; and PCV 22 to 38%. The number of erythrocytes of weaning Ettawa cross breed goats who received complete feed using ramie by-product with both treatments was lower than Kramer guidance (2000). It was suspected that weaning Ettawa cross breed goats showed symptoms of anemia. Leukocyte counted higher than the Kramers’ recommendation (2000). They were showing infection. Nutrition in complete feed using ramie by-product with vegetable or animal protein source is also had no real effect on blood hematolgy. Interaction of the two treatments on after weaning Ettawa cross breed goats hematological blood is not significantly different.

CONCLUSION

The weaning Ettawa cross breed goats that received complete feed using ramie by-product with ensilage shows lower growth, while complete feed using ramie by-product with source of vegetable protein has low nutrition than animal protein source.

REFERENCES


Study on Complete Feed Fermentation of Agricultural By-product on Performance of Etawah Goat

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ABSTRACT: Complete feed is nutritious feed that exclusively given to fulfill basic living need and production. A study was conducted to find high quality complete feed with highly digestible can increase animal production. Latin square randomized design was used in the study with 4 treatments and 4 periods upon Etawah goat. The treatments given were as follow: R0 = fresh Elephant grass + commercial concentrate; R1 = fermented rice straw + fermented pod cacao; R2 = fermented rice straw + fermented rice bran; R3 = fermented rice straw + fermented sago. Daily weight gain, nutrition intake and nutrition digestibility were determined. The study indicated that there was no significant different result among the treatments on daily weight gain, crude protein and fiber intake as well as dry matter, crude protein, fiber and ash digestibility. However, dry matter intake showed highly significant different (P<0.01) among treatments, and ash intake result was significantly different (P<0.05). It was found that fermented rice straw can improve palatability as well as digestibility. It is concluded that fermented rice straw was able to substitute fresh forage as a basic diet. Fermented complete feed based on agricultural by product (pod cacao, rice bran and sago) combined with fermented rice straw has no significant different on digestibility and palatability.

Keywords: complete feed, fermentation, agricultural by product, Etawah goat

INTRODUCTION

The availability of agricultural product strongly depends on season and the area of land. These are the reason of not enough stock available that needed to develop animal husbandry sector. In Aceh, agricultural by-product is not properly exploited, such as rice straw, which is burned in the rice cultivation after harvesting, pod cocoa, which is thrown away that give off an odor to the environment. Sago is directly given to livestock without processing does not give maximal result. Hartadi et al., (1990) said that the complete feed is the feed that contain enough nutrition for a certain animal, which is able to prevent the production without addition of others except water.

Goat has high characteristic selection on type or part of plant as an effort to find the more nutritious feed, which depends on the availability of agricultural stock. Novita et al., (2005) conducted a research on livestock fermentation. The result showed that rice straw fermented by urea and probiotic, which is cut or milled, combined with a concentrate did not give effect on performance of reproduction, production and the quality of Etawah goat. It can replace Elephant grass as the source of crude fiber in feed. Study on fermentation technology on feed showed no reduction in feed quality. Nahrowi et al., (2006) studied on giving 100% fermented feed based on organic waste to cows. Their research showed that no digestion and physiological function disturbance on cows.

Based on the previous researches, study on complete feed fermentation of agricultural byproduct on performance of Etawah goat was done. The objective of this research was to find out the complete feed with good quality, increase the daily weight gain, and increase the feed palatability by using agricultural waste.
MATERIALS AND METHOD

Research Materials

Livestock used was 8 male Etawah goats in the age of 15-18 months. The observation was done for daily weight gain, feed consumed (dried material, crude protein, crude fiber, and ash), and feed digestible (dried material, crude protein, crude fiber, and ash). Goats were placed in metabolic stalls based on feed treatment. There were 4 types of treatment, i.e. Control Feed (R0): fresh Elephant grass + commercial concentrate; Complete Feed I (R1): fermented rice straw + fermented pod cocoa; Complete Feed II (R2): fermented rice straw + fermented rice bran; Complete Feed III (R3): fermented rice straw + fermented sago. Daily weight gain was done once every two week, in the morning before feeding. It was done by using digital scale (Alramana, Australia). Nutrient digestibility was estimated with nutrition consumed minus nutrient in feces, devided by nutrient consumed multiplied by 100 %. Feed consumed was determined by substract the feed given with left overs feed. The daily average dry matter consumed were multiplied with the percentage of proximate analysis of dry matter.

Experimental Design and Statistical Analysis

The experimental design used was Latin Square Design with four Complete feed treatment and kept for four periods. Data collected were statistically analyzed by using Analysis of Variance (ANOVA). The difference among treatments was continue tested by using Duncan’s Multiple Range Test (Steel and Torry, 1991).

RESULTS AND DISCUSSION

Average Daily Gain

The average weight gain of male Etawah goats is shown in Table 1. In this research, fermented rice straw was combined with concentrate of fermented agricultural waste.

Table 1. The Daily Average Weight Gain (g/day)

<table>
<thead>
<tr>
<th>Period</th>
<th>Complete Feed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R0</td>
</tr>
<tr>
<td>I</td>
<td>41.43</td>
</tr>
<tr>
<td>II</td>
<td>71.43</td>
</tr>
<tr>
<td>III</td>
<td>41.43</td>
</tr>
<tr>
<td>IV</td>
<td>71.43</td>
</tr>
<tr>
<td>Average</td>
<td>56.43</td>
</tr>
</tbody>
</table>

The fermented complete feed gave no significant effect on daily average weight gain of male Etawah goat (P>0.05). The research found that there was no weight gain different and digestibility of male goat given fermented rice straw + fermented rice bran, fermented rice straw + fermented sago and fermented rice straw + fermented pod cocoa compared to the male goat given fresh forage + commercial concentrate. It proves that complete feed with the variation of concentrate from agricultural by product can replace commercial feed, and fermented rice straw can replace fresh forage. Budiarsana et al., (2006) reported that there was no weight gain different of male goat given fermented rice straw and fresh forage. This was probably caused by nutrition content in fermented rice straw with urea and probiotic increase compared to unfermented one, as stated by Broudisco et al., (2003) that urea can improve crude protein content from 36.9 to 102.6 g/kg.
dried material. Some researches established that fermentation can increase nutrition content of agricultural wastes, such as fermented pod cocoa can increase its crude protein content from 8.35 to 9.96% (Laconi, 1998), fermented rice bran can increase its crude protein content from 12.65 to 15.18% (Wahyuni, 2003).

Feed Consumption

Amount of feed consumed by livestock illustrates palatability value of the feed, as shown in Table 2.

Table 2. The average of Nutrition Consumed from Complete Feed (g/day)

<table>
<thead>
<tr>
<th>Nutrition Composition</th>
<th>Complete Feed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R0</td>
</tr>
<tr>
<td>Dry matter</td>
<td>748.78&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Crude protein</td>
<td>72.11</td>
</tr>
<tr>
<td>Crude fiber</td>
<td>144.46</td>
</tr>
<tr>
<td>Ash</td>
<td>99.64&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Note: Different superscript on the same row showed the most significant value (P<0.05)

Table 2 showed that control feed (elephant grass + commercial concentrate) has significant value (P<0.01) on consumption of dry matter, compared to the other three complete feed. This was probably caused by palatability of Elephant grass and commercial concentrate better than the other three treatments. But, this result was not followed by daily weight gain and digestible sector. Syamsu (2003) said that weight gain was affected by quality of feed and ability of livestock in treating the feed.

Consumption of dry matter of complete feed R1 (fermented rice straw and fermented pod cocoa) has the lowest value, parallel with complete feed R2 (fermented rice straw and fermented rice bran), but different from complete feed R3 (fermented rice straw and sago). It illustrate that palatability of complete feed R1 lower than the other two complete feed (R2 and R3).

The analysis results showed that there were no different of crude protein and crude fiber among four treatments. This was probably caused by the increasing amount of crude protein in fermented rice straw (using urea and probiotic) and agricultural waste concentrate (using probiotic). Novita (2005) reported that rice straw which was fermented by urea and probiotic increased crude protein content from 4.2 to 6.1%. Laconi (1998) said that fermented pod cocoa increase crude protein content from 8.35 to 9.96% and decrease crude fiber from 55.67 to 45.56%. Wahyuni (2003) also said that rice bran which was fermented by *Aspergillus ficuum* increased crude protein from 8.07 to 8.43% and decreased crude fiber from 18.37 to 11%. The proximate analysis of sago showed that there was the increasing amount of protein from 4.5 to 5.06%, before and after fermentation process. Fermentation was also able to decrease crude fiber content in rice straw through probiotic activity by breaking β-1.4 glycosidic chain in complex carbohydrate into simple one. It is said that there was a decrease of crude fiber content from 31.38 to 28.93% on rice straw which was fermented by using *T. reesei* and *T. plantarum* (Rachmadi, 1995). The proximate analysis of fermented sago showed a decrease of crude fiber content from 6.59 to 4.01%.

The varian analysis showed the significant different of ash consumption among all four treatments. Control treatment (Elephant grass and commercial concentrate) was different from the other three treatments. There were no different among R1, R2, and R3. This was probably caused by the same palatability value among these three treatments.

Digestibility

Digestibility or pseudo-digested coefficient of all nutrient is the standard ability of livestock...
in using given feed to fulfill their basic need, growth and production.

**Table 3. The average of digestibility (g/day)**

<table>
<thead>
<tr>
<th>Nutrient composition</th>
<th>Complete feed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R0</td>
</tr>
<tr>
<td>Dry matter</td>
<td>33.73</td>
</tr>
<tr>
<td>Crude Protein</td>
<td>68.89</td>
</tr>
<tr>
<td>Crude fiber</td>
<td>45.01</td>
</tr>
<tr>
<td>Ash</td>
<td>27.50</td>
</tr>
</tbody>
</table>

Table 3 showed that there were no effect of treatments on digestible of dry matter, crude protein, crude fiber, and ash. This was caused by the increasing of digestible of all three complete feed fermented by urea and probiotic. Urea digested the chain between lignin and cellulose or hemicellulose, so that the carbohydrate become digested, as reported by Prasad *et al.*, (1998), urea increase the digestible of dry matter as big as 2.35%. The enzyme contained in microorganism from probiotic digested the chain between lignin and cellulose or hemicellulose. Biostarter increased digestible of fermented rice straw as big as 12%, compared to unfermented rice straw, as reported by Aryogi and Umisyah (2002). Haryanto *et al.*, (2002) also reported that the addition of 1.0 and 0.5% probiotic in feed concentrate of sheep increased the digestible of dry matter of 50.7 and 49.9%, the digestible of crude protein of 62.9 and 61.9%, respectively, while there was only 61.0% in feed without the addition of probiotic. Suwadyastuti (1986) said that urea increased the digestible of protein and utilization of protein.

Bestari *et al.*, (2003) reported that fermented rice straw with probiotic (Buffalo Rumen microorganism) gave the best effect of digestible of crude protein on bull Ongole, compared to Elephant grass and unfermented rice straw. Yulistiani *et al.*, (2003) reported that urea increased digestible of NDF rice straw of 14%, compared to untreated rice straw. This was caused by urea digested the chain between lignin and cellulose or hemicellulose. Urea increased the digestible of rice straw hemicellulose and cellulose as big as 4.5% and 15.84%, respectively, compared to untreated rice straw, as reported by Prasad *et al.*, (1998). NDF is cell that contain hemicellulose, cellulose, lignin, silica and some protein (Perry *et al.*, (2004). Those components are parts of crude fiber.

The proximate analysis of agricultural waste concentrate showed that there was an increase in dry matter, crude protein, crude fiber, and sago because of fermentation. Dry matter contained in pod cocoa, rice bran, and sago, before and after fermentation were 86.27 and 86.91%, 91.37 and 96.49%, and 49.29 and 93.16%, respectively. Crude protein contained in pod cocoa, rice bran, and sago, before and after fermentation were 5.50 and 9.75%, 8.07 and 8.43%, and 1.45 and 5.06%, respectively. In overall, this condition gave an effect on digestible.

**CONCLUSIONS**

Male Etawah goats given complete feed based on various fermented agricultural by product showed no significant different in digestible, palatability, and daily weight gain with male Etawah goat given fresh elephant grass and commercial concentrate, indicated that those various complete feed can replace fresh forage and commercial concentrate.
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Carcass Production and Component of Lamb Provided Metanogenic Inhibitor Feed

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ABSTRACT: The aim of this research is to investigate effects using different level of medium chain fatty acids (MCFA) as methanogenic inhibitor substrate to evaluate production of carcass. Three different proportion of medium chain fatty acids, namely R0: 0% MCFA, R1: 1% MCFA, R2: 1.5% MCFA in 100% dry matter. Each treatment consisted of four sheep. The sheep were kept for three months before slaughtered. The data were analyzed using a variance analysis (completely randomized design), followed by Duncan’s new Multiple Range Test (DMRT) for the significant means. The variables measured were production of carcass consisted of body weight, carcass weight, dressing percentage, back fat thickness, lean, carcass fat and bone. The result indicated that R0, R1 and R2 treatment were not different significantly (p>0.05) on back fat thickness, lean, carcass fat and bone, meanwhile to body weight, carcass weight, dressing percentage was significantly (p<0.05). The conclusion of research was medium chain fatty acids 1 - 1.5% as metanogenic inhibitor feeds can increase the production of carcass with an increase in body weight, carcass percentage and not degrade the quality of carcass

Keywords: carcass production, lamb, methanogenic inhibitor feed,

INTRODUCTION

Methanogenic inhibitor feed is the feed if consumed can prevent the formation of methane in the rumen. Methane gas is one of the fermentation products of feed by rumen microbes. Many nutritionists of ruminant trying to reduce methane production, because they felt responsible for the contribution of livestock to atmospheric pollution by methane as one of the pollutants that have always been related with the destruction of ozone and global warming (Moss et al., 2000)

It is true by Steinfeld et al. (2006), the livestock sector accounts for the largest methane emissions of up to 35%. The statement discriminating of livestock should be studied in a wise and balanced, in view the consumption of livestock products of Indonesian society is still very low, growth is still very slow breeding, while farm product much needed public. However, in the midst issue of global warming, some researchers have conducted research for reducing methane in ruminants. One of the studies have been done inform that the role of medium chain fatty acids (MCFA) able to reduce methane in the rumen fermentation in vitro. According Sondakh et al. (2012) that the content of 1% MCFA able to reduce methane in the feed of 14.33% and if MCFA was increased to 1.5%, methane content decreased again to 25.30% in the in vitro fermentation. In the midst of efforts to reduce methane, in fact, there is a correlation between the decrease methane and increase propionate acid. Sondakh et al. (2012) stated that the addition of MCFA to 1.5% was not only reducing of methane but also able to increase the proportion of propionate acid. The increased propionate in rumen fluid is desirable for fattening purposes. Availability of propionic acid in the rumen resulted in the formation of glucose through gluconeogenesis. The more of glucose will be converted into glycogen in the body and to be stored in the liver and
muscles. Glycogen will be changed into lactic acid (anaerobic) or pyruvic acid (aerobic) and will produce adenosine triphosphate (ATP) and used as a source of energy for contraction, to pump Ca$^{2+}$ in relaxation time, and set the rate of balancing of Na and K (Stryer, 1998). The availability of energy as ATP is an indicator in determining the meat quality.

The increase in propionic acid when the methane reduced by MCFA is interesting to study to ruminant for knowing the carcass production.

**MATERIAL AND METHOD**

**Animal.** Twelve male sheep approximately 1 year old with an initial liveweight of 16-17 kg were kept in individual cages shaped stage in three months and, were randomly divided into three groups ration treatment. Each group consisted of four sheep.

**Feed.** Feed used were consisted of forage and concentrate in the ratio 60:40. Forages used were Elephant grass (*Pennisetum purpureum*), while the concentrate used were coconut cake, soybean cake and rice bran with different compositions for each treatment. The experiment consisted of three ration treatments, namely, (I) Ration treatment was containing MCFA 0%, (II) Ration treatment was containing MCFA 1.0% and (III) ration treatment was containing MCFA 1.5%. According to the results of previous studies feeding trial II and III able to reduce methane gas to 14.33% and 25.30% (Sondakh et al., 2012). For a clearer treatment of the experiment can be seen in Table 1.

**Table 1.** The composition of the nutrient content of the feed experiment, fat content and MCFA in coconut cake from each treatment

<table>
<thead>
<tr>
<th>Variable</th>
<th>MCFA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Feed materials (%)</td>
<td></td>
</tr>
<tr>
<td>Elephant grass</td>
<td>60.00</td>
</tr>
<tr>
<td>Concentrate</td>
<td>40.00</td>
</tr>
<tr>
<td>Coconut cake</td>
<td>0.00</td>
</tr>
<tr>
<td>The composition of nutrient</td>
<td></td>
</tr>
<tr>
<td>Crude Protein</td>
<td>17.08</td>
</tr>
<tr>
<td>Crude Fat</td>
<td>5.93</td>
</tr>
<tr>
<td>Crude Fiber</td>
<td>23.27</td>
</tr>
<tr>
<td>Extract Non Nitrogen</td>
<td>42.34</td>
</tr>
<tr>
<td>Ash</td>
<td>10.46</td>
</tr>
<tr>
<td>MCFA</td>
<td>0</td>
</tr>
</tbody>
</table>

Animals that have been weighed in the initial body weight, kept in individual cages and given food every day. Feeding is done at 08.00 and 15.00 and provided ad libitum. Before feeding, first feed weighed and then the next day weighed food remains being awarded and taken during the study. This study was conducted over 12 weeks.

After the animals reared for 12 weeks, the animals are slaughtered. Before slaughtering, the animals were body weight to obtain the life weight. Cutting is performed with multiple stages include stunning, the slaughtering, the separation of the head and legs, barking, the release of abdominal compounds, cleaning of carcasses and carcass division into 4 parts.
The variables measured were carcass production includes slaughter weight, carcass weight, dressing percentage, back fat thickness, percentage of carcass components (lean, carcass fat and bone). The dressing percentage is calculated carcass weight divided slaughter weight multiplied by 100%. Back fat thickness measurements were done on the back fat over the rib eye area between the ribs 12 and 13 using the ruler (millimeters) (Anonymous, 2010). Measurements carcass components, included lean, carcass fat and bone were weighing each carcass components then divided by carcass weight multiplied by 100%.

**Data analysis**

The data obtained were statistically analyzed using Analysis of Variance (ANOVA) with a completely randomized design in the direction pattern of each treatment with 4 replications. Differences between treatments were tested by using test Duncan Multiple Range Test (DMRT) (Steel and Torrie, 1980).

**THE RESULT AND DISCUSSION**

The research result of carcass production which consist of body weight, carcass weight, dressing percentage, the percentage of lean, carcass fat and bone are presented in Table 2.

**Table 2.** The average of sheep carcass production getting feed containing different MCFA

<table>
<thead>
<tr>
<th>Variables</th>
<th>0</th>
<th>1.0</th>
<th>1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body weight (kg)</td>
<td>24.01 + 0.87</td>
<td>25.15 + 0.85</td>
<td>26.04 + 0.61</td>
</tr>
<tr>
<td>Carcass weight (kg)</td>
<td>9.5 + 0.71</td>
<td>10.92 + 1.09</td>
<td>11.7 + 0.57</td>
</tr>
<tr>
<td>Dressing percentage (%)</td>
<td>40.16 + 1.85</td>
<td>43.50 + 1.45</td>
<td>44.96 + 0.92</td>
</tr>
<tr>
<td>Back fat thickness (mm)</td>
<td>2.82 + 0.09</td>
<td>2.87 + 0.09</td>
<td>2.9 + 0.08</td>
</tr>
<tr>
<td>Lean percentage (%)</td>
<td>65.16 + 0.12</td>
<td>65.13 + 0.15</td>
<td>65.12 + 0.10</td>
</tr>
<tr>
<td>Fat percentage (%)</td>
<td>15.67 + 0.23</td>
<td>15.72 + 0.29</td>
<td>15.75 + 0.19</td>
</tr>
<tr>
<td>Bone percentage (%)</td>
<td>17.23 + 0.24</td>
<td>17.45 + 0.17</td>
<td>17.53 + 0.26</td>
</tr>
</tbody>
</table>

*ns* non significantly  
*a,b* Different superscript at the same row indicate differ significantly (P<0.05).

The results showed that the content of MCFA ration significant effect (P <0.05) to slaughter weight. The Slaughter weight ranged from 24.01 kg - 26.04 kg. Based on data slaughter weight in Table 2 shows that treatment of MCFA 1.0 to 1.5% the slaughter weight is higher compared to the treatment without MCFA, meanwhile treatment 1.0% and 1.5% showed non significantly. The using MCFA 1.0 to 1.5% in the feed is able to raise sheep slaughter weight from 1.14 to 2.03 kg or an increase of 4.75 to 8.45%. The tendency is different the variable of slaughter weight due to the treatment of feed containing MCFA. The high slaughter weight in feed containing MCFA 1.5% was related to body weight daily weight gain. According Sondakh (2013) (unpublished) that the provision MCFA 1.5% MCFA can raise daily weight gain sheep. The Increase daily gain will determine the increase in slaughter weight animal.

Dressing percentage is an indicator of carcass quality. It is the first indicator of carcass quality after slaughter. The results showed that there were differences in the dressing percentage. Containing of MCFA 1.5% in feed is higher weight carcass if compared with no MCFA feed. Based on Table 2, feed containing MCFA of 1 - 1.5% give effect to the slaughter weight. This causes the
is difference of carcass weight. According to Purbowati et al. (2005), the percentage of carcasses was affected by body weight and feed. Similarly stated by Soeparno (2005) that some of the factors that influence the production of an animal carcass is the growth rate, body weight and nutrition. This is also reinforced by Nusi et al. (2011) and Perdana (2008) that increasing live weight will yield high carcass weight, so that the carcass produced will also increase. Wood et al. (2008) suggests also that the body weight have a real impact on carcass weight and other components.

Back fat thickness (subcutaneous) plays an important role in the indicators of carcass productivity because it can give an accurate estimation result to estimate the percentage of lean and carcass fat (Priyanto et al., 1993). Based on this research, back fat thickness at the feed given MCFA of 0 - 1.5% have not shown different results. Soeparno (2005) stated that an indicator of carcass productivity such as back fat thickness, percentage of lean and fat percentage can be affected by breed, nutrition, and sex of animal (Soeparno, 2005).

Important components of the carcass consisted of meat and muscle, carcass fat and bone. Carcass components is an indicator of the carcass quality. The results showed that the lean percentage for each treatment 0, 1 and 1.5% MCFA are 65.16, 65.13, and 65.12%. Feed containing MCFA 0 – 1.5% not cause differences in the percentage of lean. Lean percentage can be increased if the feed given high-energy, as is commonly done on dry-lot fattening that may increase the rate of formation of muscle tissue. The percentage of lean was influenced by back fat thickness. Lean percentage will decrease with increasing thickness of back fat (Priyanto et al., 1993).

The results showed that the percentage of fat for all treatment with MCFA 0, 1, and 1.5% are 15.67, 15.72 and 15.75%. MCFA content of the feed has not been able to increase the percentage of carcass fat. Carcass fat content has relationship with back fat thickness, so that the indicators of carcass quality can be determined from a thickness of back fat (Priyanto et al., 1993). Not different fat percentage is likely due weight back fat thickness remains relatively the same for each treatment. In the sense that livestock research for all treatments have not experienced a significant accumulation of fat. This is because the highest slaughter weight at the treatment of feed containing 1.5% MCFA reached 26.04 kg. According to Herman (2004) that a live weight of 33-40 kg (average 38.29 kg) of sheep are no showing growth. Butterfield (1988) states that after the cow reaches maturity, the growth of muscle (meat) will be relatively slow, fat will grow rapidly and bone are relatively constant (hardly grow). When cattle are no longer experiencing the growth of fat deposition will be increased.

The results showed that the percentage of bone for treatment MCFA 0, 1, and 1.5% are 15.67, 15.88 and 15.82 percent. Table 2 shows the data of the carcass components composition consisting of lean meat (lean), fat and bone suggests that the meat contain more followed by bone and fat. Carcass components of research results are consistent with results of previous researchers (Herman, 2004; Purbowati et al., 2005).

**CONCLUSION**

Medium chain fatty acids 1 - 1.5% as metanogenic inhibitor feeds can increase the production of carcass with an increase in body weight, carcass percentage and not degrade the quality of carcass.

**REFERENCES**


Correlation between the Slaughter Weight and Carcass Weight of Cattle in Kebumen, Central Java

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ABSTRACT: The experiment was conducted to find out the correlation between the slaughter and carcass weights of cattle (PO, SIMPO, and LIMPO) in Kebumen, Central Java. The materials were 180 cattle (male and female) were divided into three group of age i.e. 0-2.0, 2.5-4.0, and >4.5 years. The sex, age, and breed of cattle were observed before slaughtering. The carcass, meat, bone, and non carcass weights were observed after slaughtering. The data (correlation between slaughter, carcass, meat, bone, and non carcass weights were analyzed using simple and multiple regression analysis and analysis of variance (factorial pattern = 3 breed x 3 age x 2 sex) and the differences between means were tested by Duncan Multiple Range Test. The carcass, meat, bone, and non carcass weights were correlated negatively of PO (P<0.05). The slaughter weight were correlated positively with carcass and meat weights but it were correlated negatively with bone and non carcass weights of SIMPO (P<0.05). There were showed differences between breed cattle, sex, and age on slaughter, carcass, meat, bone, and non carcass weights (P<0.05). There were showed interactions between the breed with sex, sex with age, and breed with sex and age on bone weight, and non carcass weight (P<0.05).

Keywords: Correlation, Carcass weight, Body size, Cattle, Kebumen.

INTRODUCTION

Meat demand both on quality and quantity were increased from year to year according with population growth and lifestyle of the people. According to Ensminger (1969) there were three important factors that affect the demand of meat, the factors were: 1) increase of the population; 2) increase of income per capita; and 3) buying power. The increase of basic could affect awareness of the nutritional needs of the family as well as the increase of market living standarts market demand of meat both on quantity and quality. Between the traders of catle and farmer the interpretation of the live weight often only based on experience that might be inaccurate interpretation this estimation way. Based on the description needs to be done conduct the research to find out the relationship between slaughter weight and carcass weight of cattle in Kebumen, Central Java. The experiment was conducted to find out the correlation between the slaughter weight and carcass weight of cattle (PO, SIMPO, and LIMPO) in Kebumen, Central Java. The results of this experiment were expected to give information for breeders, breeding companies, the traders of cattle and goverment to know the relationship between slaughter weight and carcass weight of cattle.

MATERIALS AND METHODS

This experiment was conducted for 4 months starting on July 2014 until October 2014 which was located in slaughterhouse in Kebumen, Central Java. 180 male and female; 30 males of PO, 30 females of PO, 30 males of SIMPO, 30 females of SIMPO, 30 males of LIMPO, and 30 females of LIMPO cattle were use in this experiment. Slaughter weight, Carcass weight, meat
weights, bone weights, and non carcass weights weighed by using the scales. The data were collected in 3 slaughterhouse in Kebumen. The obtained data were tabulated and calculated for the average. Comparison of body size among the breed, sex, and age were analyzed with completely randomized design 3x2x3 factorial. The regression correlation were analyzed by using correlation and simple and multiple linear regression (Dajan, 1974; Sudjana, 1988; Steel and Torrie, 1993), with the carcass weight, the weight of the meat, bone and non carcass weights as the independent variable (X), while slaughter weight of cattle as the dependent variable (Y). Simple and multiple regression analysis stepwise method of used to find the regression equation of the linear model and calculated for the correlation and coefficient of determination to see the influence of independent variables on the dependent variable.

**RESULTS AND DISCUSSION**

Table 1. Variance, equations, regression correlation and significance coefficient dependent (meat weight) and the independent variable slaughter weight, carcass weight, bone weight, non carcass weight of cattle and PO, SIMPO, and LIMPO.

<table>
<thead>
<tr>
<th>No.</th>
<th>Variance</th>
<th>Equation</th>
<th>R</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Slaughter weight, carcass weight, bone weight, and non carcass weight of cattle PO</td>
<td>Y = -22,182 + (1.39 x 10^{-1} x X_1) + (7.38 x 10^{-1} x X_2) + (- 8.38 x 10^{-2} x X_3) + (2.9 x 10^{-2} x X_4).</td>
<td>0.920</td>
<td>Significant (P&lt;0.01)</td>
</tr>
<tr>
<td>2.</td>
<td>Slaughter weight, carcass weight, bone weight, and non carcass weight of cattle SIMPO</td>
<td>Y = -24,028 + (1.44 x 10^{-1} x X_1) + (7.38 x 10^{-1} x X_2) + (- 8.38 x 10^{-2} x X_3)</td>
<td>0.921</td>
<td>Significant (P&lt;0.01)</td>
</tr>
<tr>
<td>3.</td>
<td>Slaughter weight, carcass weight, bone weight, and non carcass weight of cattle LIMPO</td>
<td>Y = 148.839 + (2.316 x X_1) + (-1.12 x X_2) + (-1.23 x X_3) + (2.11 x 10^{-1} x X_4).</td>
<td>0.933</td>
<td>Significant (P&lt;0.01)</td>
</tr>
</tbody>
</table>

a. Predictors: (constant), live weight, carcass weight, bone weight, and non carcass weight
b. Dependent variable: weight of meat

Statistical calculations showed highly significant results (P<0.01) and the positive correlation the slaughter weight on three breeds of slaughter weight was followed by the increasing of carcass, meat, and non carcass weights, with the correlation coefficient (R) was 0.920 and determination coefficient (R^2) was 84.70 for PO cattle; R = 0.921 and R^2 = 84.80 for SIMPO cattle; and R = 0.933 and R^2 = 87.00 for LIMPO cattle. Means the slaughter weight was followed by the carcass, meat, and non carcass weights whit the determination prediction 84% for PO cattle, 84.8% for SIMPO cattle, while 87% for limpo cattle. The negative correlation the slaughter weight with bone weight on cattle PO, SIMPO and LIMPO. The slaughter, carcass, meat, bone and non carcass weights of PO, SIMPO, LIMPO cattle were highly significant different (P<0.01) on the different ages (0-2, 2.5-4, and >4.5 years) and different sex (male and female).

The experiment was in agreement with Aberle (2001) reported that the different breeds of cattle also influenced significantly on carcass weight because it will cause the different on slaughter, carcass, meat, bone, and non carcass weights which cause by the differences of weight gain. Results was obtained Yusuf (2002) which states that the positive correlation between the circumference of the chest with the weight cut. Prabowo (2012) stated that the positive correlation
between the weight of meat by carcass weight, slaughter weight. In cattle male SIMPO and LIMPO correlation coefficient between the weight of meat to slaughter weight, carcass weight, and non carcass weights have a very close relationship aimed at the regression coefficients.

Table 2. The average and standard deviation slaughter weight, carcass weight, the weight of the meat, bone weights, and non carcass weight of cattle nations, gender, and age.

<table>
<thead>
<tr>
<th>Type</th>
<th>Age (years)</th>
<th>Slaughter weights</th>
<th>Carcass weights</th>
<th>Meat Weights</th>
<th>Weight of Bones</th>
<th>Non Carcass Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO</td>
<td>0 – 2.0</td>
<td>380.23±70.71</td>
<td>198.92±52.78</td>
<td>135.27±38.18</td>
<td>153.95±91.01</td>
<td>63.65±24.55</td>
</tr>
<tr>
<td></td>
<td>2.5 – 4.0</td>
<td>484.27±56.65</td>
<td>252.05±45.86</td>
<td>168.07±33.58</td>
<td>82.58±22.57</td>
<td>211.36±29.87</td>
</tr>
<tr>
<td></td>
<td>&gt; 4.5</td>
<td>541.50±28.09</td>
<td>281.58±15.69</td>
<td>191.47±12.78</td>
<td>90.11±17.49</td>
<td>259.92±23.05</td>
</tr>
<tr>
<td>SIMPO</td>
<td>0 – 2.0</td>
<td>464.51±70.71</td>
<td>246.19±52.78</td>
<td>167.42±38.18</td>
<td>78.87±91.01</td>
<td>218.32±44.55</td>
</tr>
<tr>
<td></td>
<td>2.5 – 4.0</td>
<td>484.27±56.65</td>
<td>252.05±45.86</td>
<td>168.08±33.58</td>
<td>82.58±22.57</td>
<td>211.36±29.87</td>
</tr>
<tr>
<td></td>
<td>&gt; 4.5</td>
<td>552.78±29.49</td>
<td>298.51±16.57</td>
<td>202.99±13.42</td>
<td>85.52±7.95</td>
<td>254.27±24.43</td>
</tr>
<tr>
<td>LIMPO</td>
<td>0 – 2.0</td>
<td>467.12±70.71</td>
<td>256.92±52.78</td>
<td>177.27±38.18</td>
<td>79.65±91.01</td>
<td>210.20±44.55</td>
</tr>
<tr>
<td></td>
<td>2.5 – 4.0</td>
<td>487.78±57.55</td>
<td>254.08±45.89</td>
<td>170.21±32.43</td>
<td>84.91±29.71</td>
<td>210.95±29.96</td>
</tr>
<tr>
<td></td>
<td>&gt; 4.5</td>
<td>568.78±29.49</td>
<td>318.52±16.57</td>
<td>219.78±13.42</td>
<td>99.22±7.95</td>
<td>250.26±24.43</td>
</tr>
</tbody>
</table>

Results of analysis of variance calculations on the variable carcass weight, the weight of the meat, bone weights, and non carcass weight of cattle were highly significant (P <0.01) in cattle means PO, SIMPO, and had a relatively LIMPO carcass weight, the weight of the meat, bone weights, and non carcass weight were significantly different can be shown in Tables 2, PO cattle have carcass weight, the weight of the meat, bone weights, and non carcass weight was relatively low compared to cows and cattle SIMPO and LIMPO. While the sex and age of higher significant (P <0.01) in carcass weight means, the weight of the meat, bone weights, and non carcass weight of cattle PO, SIMPO, and LIMPO, significantly different between males and females, bulls have a carcass weight, weight meat, bone weights, and non carcass weight were heavier than cows, as well as age 0-2; 2.5-4.0 and >4.5 had a different weight, carcass weight, the weight of the meat, bone weights, and non carcass weight of bulls heavier than a cow, it was supported by slaughter weight and carcass weight steers more heavier than cows. Physiologically carcass weight, the weight of the meat, bone weights, and non carcass weight has a considerable influence on the development of body weight cut because the cattle was supported by the increase in weight gain and will be followed by weight gain carcass so the carcass weight, the weight of the meat, bone weights, and non carcass weight will gain weight as well as carcass weight, the weight of the meat, bone weights, and non carcass weight was the weight of the component pieces of the development were in line with the growth in cattle PO, SIMPO, and LIMPO (Aberle et al., 2001).

CONCLUSION

The slaughter weight, carcass weight, meat weight and non carcass weight were use positively correlated, but it were negatively correlated with bone on PO, SIMPO, and LIMPO cattle. Slaughter weight, carcass Weight, meat weight, bone weight, and non carcass weight of cattle were significant different on cattle PO, SIMPO, and LIMPO. There were interaction between the breed with sex, sex with age, breed with age and breed with sex with age on slaughter weight, carcass weight, meat weight, bone weight and non carcass weight.
REFERENCES


Production of Stingless Bees (Trigona sp.) Propolis in Various Bee Hives Design

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ABSTRACT: Trigona sp. is a group of stingless bees that live socially and in colony at the trunk of trees or woods, bamboo hole, sugar palm stalks and in soil (Michener, 2007; 2013; Erwan and Yanuartati, 2012). The habitat has been described in the Qur’an Surah An-Nahl verse 16:68, which means “and your Lord inspired to the bees, “take for yourself among the mountains, houses, and among the trees and (in) that which they construct”. The variation of habitat causes stingless bees of Trigona sp. are not widely known by general societies especially beekeepers because the limitation of science and knowledge, so the mastery of beekeeping process, transfer and multiple of colonies was very low. It has an impact on difficulty of controlling colony health and development, difficulty of harvesting propolis and damage the hive structure, so causes reduce the propolis production.

Trigona sp. a produces small amount of honey, but it produces propolis in higher quantity than the other bees or genus Apis (Michener, 2007; 2013). Propolis (bee glue) is a sticky dark colored material or resinous substance collected by honeybees from living plants, mix with wax and used in construction their nest (Bankova et al., 2000). Resin is used by female bees primarily during nest construction, often serving both as protection and a building material, as well as a biologically active compound (Roubik, 1989). Utilization of propolis by stingless bees Trigona sp.
to construct the entrance to protected from pests, bacteria and viruses.

Production of propolis stingless bees of *Trigona* sp. affected by activity exit and entrance hives of workers bee, productivity of queen bee, availability resin from plants and bee hives design. The solution for the problems in the native habitat by modifying the bee hives design using dry wood boards. The bee hives design that was used to provide comfort the stinglees bees of *Trigona* sp. to produce propolis, so to increasing the production of propolis. Information of propolis production on the stingless bees of *Trigona* sp. especially in various bee hives design is still very less. The aim of the research was to determine the production of stingless bees *Trigona* sp. propolis in various bee hives design.

**MATERIALS AND METHODS**

This research was done from September to October 2014 in Papak, Genggelang Village District of Gangga, North Lombok Regency West Nusa Tenggara Province. Material of the research was stingless bees of *Trigona* sp. as much as 25 colonies taken from sugar palm stalks. The bee hives design made from dried wood boards of borok (local name) that box shaped, while the nest made from the bamboos which consists of five racks with the size was 250 x 250 x 300 cm. In addition, the nest was direction to the source of food, so easier the worker bees to taken a food.

This research using complete randomized design with five treatments bee hives design and five replications (number of bee hives design). The bee hives design size are 35 x 17.5 x 13.5 cm as a control (Erwan and Yanuartati, 2012), 35 x 20 x 15.5 cm, 35 x 20 x 17.5 cm, 37.5 x 20 x 20 cm and 40 x 20 x 20 cm.

Transfer of stingless bees *Trigona* sp. colonies form the stalks to five bee hives design performed at night to avoid stress, so easier to transfer process. The colonies that the transfer was queen bee, five tablespoon of brood contain eggs and larvae, drones, and bee workers. The bee hives has been filled by stingless bees colonies placed randomly in the nest for about two months the beekeeping process. In addition, during the beekeeping process will be controlling once a week from pests especially ants.

The dependent variable was production of propolis, while the independent variables are activities exit and entrance of worker bees, temperature and humidity environment. Porduction of propolis was measured after two months of beekeeping process and taken from honey wrap and on the wall of bee hives. Propolis to be measured was raw propolis and not yet extraction. Production of propolis weighed on digital scales Shuma brand with a precision 1 gram which is expressed in unit of gram. For the activities exit and entrance of workers bee was count for 5 minutes every bee hives at Monday, Wednesday, and Friday which start at 08.00 to 11.00 am and 14.00 to 17.00 pm. The activity calculation using the two hand counters at a distance 1 meter from the entrance, so that the bee workers can be seen clearly. For the temperature and humidity environment was measured using thermo-hygrometer every Monday, Wednesday, and Friday which start from 08.00 am to 18.00 pm.

Data of propolis production, activities exit and entrance of workers bee was analyzed using variance analysis (Steel and Torrie, 1993) with the help of Statistical analysis software (SAS Inc. 2000), while the data of temperature and humidity environment was analyzed with descriptive analysis.

**RESULTS AND DISCUSSION**

Propolis (bee glue) is a sticky dark colored material or resinous substance collected by honeybees from living plants, mix with wax and used in construction their nest (Bankova *et al.*, 336
Stingless bees of *Trigona* sp. utilization of propolis are to construct the nest, entrance to protected from pests, bacteria and viruses, honey and pollen wrap. Production of propolis, activities exit and entrance of worker bees *Trigona* sp. research result can be seen in Table 1.

**Table 1.** Production of propolis, activities exit and entrance workers bee of *Trigona* sp.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Bee hives design (cm)</th>
<th>35x17.5x13.5</th>
<th>35x20x15.5</th>
<th>35x20x17.5</th>
<th>37.5x20x20</th>
<th>40x20x20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production of propolis (g)***</td>
<td>20.40±2.07</td>
<td>19.00±2.92</td>
<td>30.80±14.62</td>
<td>21.80±6.30</td>
<td>18.20±7.29</td>
<td></td>
</tr>
<tr>
<td>Activities exit workers bee (times/5 minutes)***</td>
<td>37.76±16.40</td>
<td>42.51±15.77</td>
<td>48.62±18.24</td>
<td>43.27±16.58</td>
<td>45.77±17.80</td>
<td></td>
</tr>
<tr>
<td>Activities entrance workers bee (times/5 minutes)***</td>
<td>38.96±14.20</td>
<td>43.97±15.91</td>
<td>50.14±18.37</td>
<td>46.16±16.30</td>
<td>47.56±18.03</td>
<td></td>
</tr>
</tbody>
</table>

2000; Tautz, 2008). Resin is used by female bees primarily during nest construction, often serving both as protection and a building material, as well as a biologically active compound (Roubik, 1989). The activities of workers bee was very active in covering gaps on the bee hives design using propolis and can be enclosed with a week. The covering of gaps is aimed to create the comfort condition in bee hives, so expected improve the production of propolis. The research result showed *Trigona* sp. was started to collect resin in out the nest for about 06.00 to 06.15 am with temperature about 23 to 34°C and humidity about 68%. The *Trigona* sp. incoming or entrance to the bee hives for about 18.00 to 18.15 pm with temperature about 29 to 30°C and humidity about 54%. It indicates that the activity for collect resin from plant by workers bee was requirement 12 hours.

The research result showed that production of propolis, activities exit and entrance stingless bees of *Trigona* sp. in various bee hives design was varies, but did not significantly different (P>0.05). It was showed that production of propolis was not affected by the bee hives design, but affected by activities exit and entrance of worker bees, productivity of queen bee and availability of resin from plants. The higher activities from the workers bee showed higher production of propolis in bee hives or otherwise. Production of propolis that higher to be found on bee hives 35 x 20 x 17.5 cm with mean 30.80 ± 14.62 g, while the lower production to be found on bee hives 40 x 20 x 20 cm with mean 18.20 ± 7.29 g.

The high of production propolis in bee hives 35 x 20 x 17.5 was caused by activities exit and entrance workers bee that higher with mean are 48.62 ± 18.24; 50.14 ± 18.37 times per bee hives for 5 minutes, respectively. It indicates that the exit activities of worker bees to collect the resin from plants and incoming into the colony to produce propolis, so improving production propolis than other bee hives design (Table 1). The lower production in bee hives 40 x 20 x 20 cm was caused activities of workers bee preoccupied by creating and caring for eggs as a candidate for a new queen bee, though the activities exit and entrance bee hives that higher than other design (Table 1). It condition was caused by queen bee in the bee hives was fled and occur in the first weeks after transfer colonies from stalks to bee hives.

The production of propolis was optimal because supported by temperature for about 26 to 35°C with humidity about 46 to 60%, so this condition was comfort zone for improving the production of propolis. Tautz (2008) explained that honeybees keep the temperature of the brood combs containing the pupae at about 35°C, so improve the growth and development of bees. The
entrance activity of workers bee indicates the amount of resin can be collecting from plants, while the exit activity indicates the number of workers bee to collect resin and the colored materials. Sihombing (2005) explained that production of propolis affected by productivity of queen bee, population of workers bee, and resin source of plants.

CONCLUSIONS

The conclusion of the research that bee hives design 35 x 20 x 17.5 cm resulting production of propolis, activities exit and incoming of worker bees higher than the other design with average 30.80 g, 48.62 and 50.14 times per 5 minutes, respectively.

REFERENCES


Morphological Characteristics and Performance Boerawa Goat in Tanggamus District Lampung Province

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ABSTRACT: Lampung Province is an area that has the potency for the development of farm businesses. One of suitable animals to be developed in Lampung Province is goat. The success of business development of farm animal cannot be separated from the influence of genetic and environmental factors. One effort that can be taken to improve the genetic quality of the goat is through crossbreeding. Crossbreeding between female Ettawah grade goats and male boer goats are known with the name Boerawa goat. Currently Boerawa goat are developed in Tanggamus District Lampung Province. The results of crossbreeding are expected to have higher performance than Ettawah grade goat. High performance of growth is the result of genetic inheritance of Boer goats that have superior growth characteristics. This research was conducted using survey method in Gisting, Tanggamus District Lampung Province. Qualitative data on the morphological characteristics and performance in a descriptive analysis from observations indicate that the morphological characteristics of goats crossing at the post weaning period is better. It can be seen from some morphological parameters that were observed, among others; body length, shoulder height, chest circumference, and of aspects of performance; litter size, birth weight, and ADG also showed significant improvement in this Boerawa goat

Keywords: Morphological Characteristics, Performance, Boerawa Goat, Lampung

INTRODUCTION

The development of farm animal in this millennium century is rapidly increasing, a long with the increasing human need for animal protein, especially meat from goat. Lampung Province is an area that is potential for development of farm business. The data from the council of Animal Husbandry and Health in Lampung Province (2011) Lampung Province has potential area to get capacity of 1.38 million Animal Unit (AU) and now the animal population in this area are only 506.352 AU. It means only 36.69% of the potential ability can be used. The Goat population is 1.081.150 or 151.422 AU.

Crossbreeding is one of good way to improve the local animal productivity crossed with other animals that has good genetic. Boerawa Goat is the crossbreeding between female Ettawa grade goat and male Boer goat. Boerawa goat has the difference morphological size with the parents. Mahmilia and Tarigan (2004) reports that the result of crossbreeding between female Ettawa grade goat and male Boer goat has the better morphological sizes than Kacang Goat. Morphological Characteristic (body sizes) includes the production and productivity value of Goat. The Body size can describe about the exterior performance, body weight and the basic in selection of animal breeding program (Diwyanto, 1994). Since the information about morphological and production of goat especially during 0-3 month (pre-weaning) is less, this research is very important to provide information about it.
MATERIAL AND METHODS

Material

This research was located in Campang Village, Gisting District, Tanggamus Regency at 2011-2013. The Object of Research is Boerawa Goat in there. The Equipment used in this research is balance of prohex capacity of 50.00 kg with accuracy 0.1 kg, Thermohygrometer, and writing tool.

Methods

The Methods used in this research is survey with case study in campang village, gisting District, Tanggamus Regency, Lampung Province. The Data’s are primary data and the secondary data. The Primary data collected in the field observation research were livestock management (the cage system, feed and feeding frequency) and weight of weaning goat sample, and also interview with the farmers. The secondary data collected from the farmers recording included the name of farmers, date and birth weight of sample goat.

Variables observed by Hardjosubroto (1994) is as follows:

1. The birth weight (kg) were collected by observing the farmers recording
2. The weaning weight (kg) were collected by weighing the doe after weaning from their mother.
3. The yearling weight (kg) collected by weighing the one year old goat.
4. Average Daily Gain of doe after birth until 1 year post weaning (kg/day) collected by decreasing the yearling weight with birth weight and dividing with the number of day per year
5. Boerawa Goat Characteristic (Chest Circumference, body length and shoulder height)
6. Livestock management collected by interviewing the farmers and observing in the field study.

RESULTS AND DISCUSSION

Morphological Characteristic

Morphological characteristic of one year old Boerawa goat was shown in the table 2. The animal body sizes influenced age, feeding, genetic, environment and sex (Gall, 1981). The table shows the different in body size average (morphological) every goat.

<table>
<thead>
<tr>
<th></th>
<th>Chest circumference (cm)</th>
<th>body length (cm)</th>
<th>shoulder height (cm)</th>
<th>Body weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>75.07</td>
<td>65.02</td>
<td>68.47</td>
<td>38.00</td>
</tr>
<tr>
<td>Highest</td>
<td>86.00</td>
<td>71.00</td>
<td>77.00</td>
<td>48.70</td>
</tr>
<tr>
<td>Lowest</td>
<td>71.00</td>
<td>61.00</td>
<td>62.80</td>
<td>31.50</td>
</tr>
<tr>
<td>standart deviation</td>
<td>3.78</td>
<td>2.47</td>
<td>3.92</td>
<td>3.78</td>
</tr>
</tbody>
</table>

This research shows that morphological characteristic of Boerawa Goat is higher than the result of Sulastri’s (2014) in which the chest circumference is 63.78 ±1.12 cm, body length is 58.01±1.01 cm and shoulder height is 53.68±1.98 cm. This condition gives description that the
livestock management of Boerawa goat is better. This condition illustrates that rearing management of Boerawa goat in Tanggamus have improved and give a better appearance.

### Tabel 2. The Performance Boerawa Goat

<table>
<thead>
<tr>
<th>Birth Weight (kg)</th>
<th>Weaning Weight (kg)</th>
<th>Yearling Body weight (kg)</th>
<th>ADG (g/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>3.41</td>
<td>21.18</td>
<td>38.00</td>
</tr>
<tr>
<td>Highest</td>
<td>4.00</td>
<td>24.00</td>
<td>48.70</td>
</tr>
<tr>
<td>Lowest</td>
<td>2.80</td>
<td>18.00</td>
<td>31.50</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.35</td>
<td>2.15</td>
<td>3.78</td>
</tr>
</tbody>
</table>

Some research indicated the results of the birth weight of Boerawa goat of $2.87\pm0.15$ kg/goat (Sulastri dan Qisthon 2007); $3.02\pm0.29$ kg/goat (Adhianto et al., 2012). Based on sex, the average birth weight of males was higher (3.10 kg/goat) than female (2.94 kg/goat) (Adhianto et al., 2013). The average of weaning weight is 17.30 kg/goat (Adhianto et al., 2013); 21.01±1.35 kg/goat (Sulastri dan Qisthon, 2007). In the yearling the weight is 38.38±0.94 kg/goat (Sulastri dan Qisthon 2007) and 43.67±5.51 kg/goat (Adhianto, 2013). The high differences of birth, weaning and yearling weight may be caused by genetic factors where Boerawa goat is a result of female Etawah grade and male Boer crossbreeding, and influenced by environment factors, especially management and feed.

Another research showed that ADG was 0.22±0.08 kg/goat (Harris et al. 2009); 0.110 kg/goat (Adhianto, 2013) which was higher than this research (0.099 kg/goat).

These conditions indicate that good management system need to be supported by genetic resources too. Therefore, breeding programs boerawa goat is very important to developed so as to produce better Boerawa goat.

### CONCLUSIONS

The result of the research showed that characteristic of Boerawa goat including the body size is better than the research that was conducted previously, but it must be supported with the genetic source for better performance of Boerawa goat.

### REFERENCES


Growth, Carcass Production and Meat Quality of Ongole Grade Cattle, Simmental Ongole Crossbred Cattle and Brahman Cross

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² C.V. Restu Bumi, Segoroyoso, Pleret, Bantul, Yogyakarta.
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ABSTRACT: The experiment was conducted to study the growth rate, carcass production and meat quality of Ongole grade (PO), Simmental Ongole crossbred (SimPO) and Brahman cross (BX) cattle grown in a feedlot system for 3 months. The study were used five head of PO, seven head of SimPO and six head of BX cattle with the respective initial body weight of 307.70+25.72 kg; 353.07+27.95 kg; and 357.00+52.24 kg. The age of cattle about 1.5-2.5 years. The cattle were fed with concentrates and elephant grass. At the end of the experiment all cattle were slaughtered. Meat samples used were Longissimus dorsi (LD) muscles. The variables observed were feed consumption, average daily gain (ADG), feed conversion ratio (FCR), carcass percentage, carcass components, meat physical quality and chemical composition. The obtained data were analyzed by using the analysis of variance of the completely random design and Duncan’s new multiple-range test. The results showed that there were significant differences (P < 0.05) on the growth variable of feed consumption, ADG and FCR. The feed consumption of BX cattle was higher than PO cattle, but was not significant differences between SimPO and BX, as well as between SimPO and PO cattle. ADG of BX cattle was higher than SimPO and PO cattle. FCR of PO cattle was higher than SimPO and BX cattle, but was not significantly different between SimPO and BX cattle. The percentage of carcass, meat, bone and meat-bone ratio were not significant differences between the cattle breeds. The physical quality of meat (water-holding capacity, cooking loss, tenderness) were significant differences (P < 0.05) between the breeds, but the pH did not differ significantly. The meat chemical composition (water, fat, ash content) were not significant differences, but the protein content was differ significantly (P < 0.05). It could be concluded that the growth of BX cattle were better than SimPO and PO, but SimPO was better than PO. The meat of PO and SimPO cattle were higher water-holding capacity than meat of BX cattle, but meat of BX cattle was more tender than meat of PO and SimPO cattle.

Key Words: Growth, Carcass, Meat Quality, Ongole Grade Cattle, Simmental Ongole Crossbred Cattle and Brahman Cross.

INTRODUCTION

Indonesia is a potential country to develop beef cattle industry. This development should be supported by several factors, such as feeder cattle, feeds availability, social condition and market opportunities. The breeds of beef cattle in Indonesia feedlot consist of local, crossbred and import cattle. Ongole grade (PO) cattle was local cattle formed as result of grading up between Java cattle and Sumba Ongole (SO) cattle in about 1930. Meanwhile, Simmental Ongole crossbred (SimPO) cattle is the result of crossbreeding between Simmental bull and PO cows by artificial insemination (AI) which has objective to increase the cattle production performance. Brahman cross (BX) cattle is an imported cattle from Australia, which is a result of crossbreeding between Brahman and Hereford-Shorthorn (HS) cattle. In Australia, the BX cattle is stabilised with a content of 50% Brahman, 25% Hereford and 25% Shorthorn bloodlines (Ngadiyono, 2012).

Feedlot or fattening is an exertion of cattle rearing on the final growth stadium, which aims to produce meat production through optimally gain weight by high quality feeding in a brief time (Tillman et al., 1998; Ngadiyono, 1995). By the feedlot system, cattle productivity, such as weight
gain, feed efficiency, carcass and meat production can be improved (Dyer and O’Mary, 1977). Genetic and environment factors, including growth, slaughter age, body weight, sex and breed can influenced of meat production. Feed composition and nutrition also influence the growth rate, and proportion of carcass component, specially meat and fat, also nutrition value of meat, including protein, water and fat (Soeparno, 2005).

There are some factors influencing fattening system, such as breed, age, slaughter weight, cattle type, sex, and nutrition (Dyer and O’Mary, 1977). Meat characteristics are determined by the physical quality and chemical composition. Meat characteristics constitutes factors determining the consumer assessment on meat quality, such as pH, tenderness, flavor, texture, aroma, color, cooking loss and water-holding capacity (Crouse, 1989; Soeparno, 2005).

The research was conducted to study the growth rate, carcass production and meat quality of Ongole grade (PO), Simmental Ongole crossbred (SimPO) and Brahman cross cattle grown in a feedlot system.

MATERIALS AND METHODS

The research was conducted by individual pen in Restu Bumi beef cattle fattening which was located at Segoroyoso, Pleret, Bantul, Yogyakarta for three months. Slaughtering of animals were done at Restu Bumi abattoir. The meat analyses were done at the Laboratory of Meat Processing Technology of the Faculty of Animal Science, Gadjah Mada University.

Material used in this experiments were beef cattle, that were five heads of Ongole grade (PO) cattle, seven heads of Simmental Ongole crossbred (SimPO) and six heads of Brahman cross (BX) cattle of about 1.5-2.5 years, with the respective initial body weight of 307.70±25.72 kg, 353.07±27.95 kg and 357.00±52.24 kg.

The cattle’s were grown in a feedlot system with a similar diet, namely 15% elephant grass and 85% of concentrate. The concentrate (in asfed) consist of 19.21% rice bran, 14.09% soybean hulls, 63.28% waste product of tapioca (onggok) and 3.42% cassava. The ration was given 3% of body weight of cattle and water was given ad libitum. At the end of the experiment all cattle were slaughtered in the abattoir to know the carcass and non-carcass production. The samples of meat were taken from Longissimus dorsi (LD) muscle. The meat samples were tested for physical quality, namely pH degree, water-holding capacity (WHC), cooking loss (CL), and tenderness (shear-force). Chemical composition included water, protein, fat, and ash (mineral). The variables observed were feed consumption, average daily gain (ADG), feed conversion ratio (FCR), carcass percentage, carcass component (meat, bone, and meat-bone ratio), non-carcass, meat physical quality and chemical composition.

The data were analyzed by using the analysis of variance of the completely random design and Duncan’s new multiple-range test (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

Feed consumption, average daily gain and Feed conversion ratio

The research of analysis showed that there were significant differences (P<0.05) on the growth variable of feed consumption, average daily gain (ADG) and feed conversion ratio (FCR) (Table 1). The DM, CP and TDN consumption of BX cattle was higher than PO cattle, but was not significant differences between SimPO and BX, as well as between SimPO and PO cattle. ADG of BX cattle was higher than SimPO and PO cattle, but SimPO was higher than PO cattle. Soeparno (2005) suggests that growth influencing factors includes genotype, sex, hormone and castration. Moreover, types of feed, consumption, and chemical composition of feed are have a large effect on growth. A high protein and energy consumption will results faster growth rate. FCR of SimPO and BX cattle were lower than PO cattle, but was not significantly different between SimPO and BX cattle. This FCR differences supposed to be resulted by the types of feed, animal’s breed and
management. Suwignyo (2003) on BX cattle with hay fermentation and concentrate as the feed which result FCR as much as 9.6-11.4 and Carvalho et al. (2010) on SimPO and PO cattle with concentrate and elephant grass which result FCR 18.47 and 22.55. Ideal FCR for cattle with weight of 300 kg is 9 kg/kg gain (Tillman et al., 1998).

### Table 1. Feed consumption, average daily gain and feed conversion ratio

<table>
<thead>
<tr>
<th>Variable</th>
<th>Breed of Cattle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO</td>
</tr>
<tr>
<td>DM (dry matter)</td>
<td></td>
</tr>
<tr>
<td>(kg/head/day)</td>
<td>10.07&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>(g/kg MBW)&lt;sup&gt;ns&lt;/sup&gt;</td>
<td>126.76</td>
</tr>
<tr>
<td>(% BW)&lt;sup&gt;ns&lt;/sup&gt;</td>
<td>2.95</td>
</tr>
<tr>
<td>CP (crude protein)</td>
<td></td>
</tr>
<tr>
<td>(kg/head/day)</td>
<td>1.41&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>(g/kg MBW)&lt;sup&gt;ns&lt;/sup&gt;</td>
<td>18.95</td>
</tr>
<tr>
<td>TDN (total digestible nutrients)</td>
<td></td>
</tr>
<tr>
<td>(kg/head/day)</td>
<td>7.02&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>(g/kg MBW)&lt;sup&gt;ns&lt;/sup&gt;</td>
<td>88.30</td>
</tr>
<tr>
<td>Initial body weight (kg)&lt;sup&gt;ns&lt;/sup&gt;</td>
<td>307.70</td>
</tr>
<tr>
<td>Final body weight (kg)</td>
<td>372.06&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Average daily gain (kg)</td>
<td>0.59&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Feed conversion ratio (FCR)</td>
<td>18.20&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a,b</sup>Different superscripts at the same row indicated significant differences (P < 0.05).
<sup>ns</sup> = non significant; MBW = metabolic body weight; BW = body weight; PO = Ongole grade cattle; SimPO = Simmental Ongole crossbred cattle; BX = Brahman cross.

### Carcass and non-carcass component

The research of analysis showed that there were significant differences (P<0.05) on slaughter and carcass weight as affected by the breeds of cattle. On the other hand, the percentage of carcass, meat, bone, and meat-bone ratio were not different significant (Table 2). The body weight is correlated to carcass percentage (Soeparno, 2005). The increase of body weight has effect on the decrease of meat and bone proportion in carcass, whereas fat proportion is increased. Fat percentage has negative correlation with bone and meat percentage, but positively correlated to meat-bone ratio (Rusman, 1997). The environmental and genetic factors are highly affecting carcass composition (Berg and Butterfield (1976). PO and SimPO cattle with concentrate and elephant grass which result carcass, meat dan bone percentage were 49.40; 81.31 and 18.93% for PO cattle and 51.18; 81.80 and 18.19% for SimPO, respectively (Carvalho et al., 2010).

### Table 2. Carcass and carcass component

<table>
<thead>
<tr>
<th>Variable</th>
<th>Breed of Cattle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO</td>
</tr>
<tr>
<td>Slaughter weight (kg)</td>
<td>363.10&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>
The 6th International Seminar on Tropical Animal Production
Integrated Approach in Developing Sustainable Tropical Animal Production
October 20-22, 2015, Yogyakarta, Indonesia

Carcass weight (kg) 195.00\textsuperscript{a} 232.14\textsuperscript{b} 250.33\textsuperscript{b}
Carcass percentage (%)\textsuperscript{ns} 53.83 50.79 49.36
Meat (kg) 158.20\textsuperscript{a} 190.37\textsuperscript{b} 207.01\textsuperscript{b}
\textsuperscript{ (%) \textsuperscript{ns}} 81.06 81.95 82.45
Bone (kg)\textsuperscript{ns} 36.80 41.76 43.31
\textsuperscript{ (%) \textsuperscript{ns}} 18.93 18.03 17.53
Meat-bone ratio\textsuperscript{ns} 4.30 4.54 4.81

\textsuperscript{a,b}Different superscripts at the same row indicated significant differences (P < 0.05).
\textsuperscript{ns} = non significant; PO = Ongole grade cattle; SimPO = Simmental Ongole crossbred cattle; BX = Brahman cross.

The external dan internal non-carcass percentage of PO, SimPO and BX cattle did not differ significantly. The external non-carcass (blood, head, legs, and hide) were 4.22; 4.97; 2.18; and 8.81% and the internal non-carcass (liver, heart, lungs, kidney, and digestive tract) were 1.11; 0.37; 0.62; 0.22; and 4.96%, respectively. There were not significant difference supposed to be caused by similar quality of feed in three breeds of cattle. Non-carcass components were affected by feed, slaughter weight and sex (Soeparno, 2005).

**Meat physical quality and chemical composition**

The meat physical quality (water-holding capacity, cooking loss, tenderness) were significant differences (P<0.05) between the cattle breeds, but the pH did not differ significantly. The meat chemical composition (protein and collagen) were significant differences (P<0.05) between meat of PO, SimPO and BX cattle, but the water, fat and ash content were not differ significantly (Table 3).

Table 3. Meat physical quality and chemical composition

<table>
<thead>
<tr>
<th>Variable</th>
<th>PO</th>
<th>SimPO</th>
<th>BX</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH \textsuperscript{ns}</td>
<td>5.67</td>
<td>5.68</td>
<td>5.73</td>
</tr>
<tr>
<td>Water-holding capacity (%)</td>
<td>10.02\textsuperscript{a}</td>
<td>10.18\textsuperscript{a}</td>
<td>7.11\textsuperscript{b}</td>
</tr>
<tr>
<td>Cooking loss (%)</td>
<td>31.50\textsuperscript{a}</td>
<td>34.83\textsuperscript{b}</td>
<td>36.21\textsuperscript{b}</td>
</tr>
<tr>
<td>Tenderness (kg/cm\textsuperscript{2})</td>
<td>8.69\textsuperscript{a}</td>
<td>7.48\textsuperscript{b}</td>
<td>7.23\textsuperscript{b}</td>
</tr>
<tr>
<td>Water (%) \textsuperscript{ns}</td>
<td>69.67</td>
<td>69.69</td>
<td>69.97</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>21.94\textsuperscript{a}</td>
<td>21.53\textsuperscript{b}</td>
<td>21.40\textsuperscript{b}</td>
</tr>
<tr>
<td>Fat (%) \textsuperscript{ns}</td>
<td>6.04</td>
<td>7.60</td>
<td>6.47</td>
</tr>
<tr>
<td>Ash (%) \textsuperscript{ns}</td>
<td>1.13</td>
<td>0.96</td>
<td>0.90</td>
</tr>
<tr>
<td>Collagen (%)</td>
<td>1.67\textsuperscript{a}</td>
<td>1.97\textsuperscript{b}</td>
<td>1.72\textsuperscript{a}</td>
</tr>
</tbody>
</table>

\textsuperscript{a,b}Different superscripts at the same row indicated significant differences (P < 0.05).
\textsuperscript{ns} = non significant; PO = Ongole grade cattle; SimPO = Simmental Ongole crossbred cattle; BX = Brahman cross.

Accordingly, the pH values were not significantly different, as also explained by Romans and Ziegler (1974). The pH obtained were generally similar to the normal pH of meat. PO and SimPO cattle had the higher WHC compared with BX cattle. On the contrary, the cooking loss of PO cattle was lower than SimPO and BX cattle. Cooking loss had negative correlation with WHC.
and related to the composition of protein and fatty acids (Setiyono et al., 2007). The muscle of BX cattle were more tender compared with PO and SimPO cattle. The differences in tenderness were likely to be due to breed type, muscle structures, contraction status of myofibril and also due to the less tendon and the larger cytoplasm of LD muscle (Soeparno, 2005).

CONCLUSION

The research could be concluded that the growth of BX cattle were better than SimPO and PO, but SimPO was better than PO. The meat of PO and SimPO cattle were higher water-holding capacity than meat of BX cattle, but meat of BX cattle was more tender than meat of PO and SimPO cattle.

REFERENCES


Growth and Rumen Environment of Pre-weaning Bali Calves Offered Different Forage-Based Calf Supplements

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ABSTRACT:Replacing part of the concentrate based calf supplement with high quality forages may result in reducing the price of the supplement which makes it affordable by small tenant farmer thereby improving its adoption rate. Sixteen pre-weaning Bali calves were involved in this experiment with the objective to investigate the effect of replacing 2/3rd of concentrate-based supplement with leucaena (Leucaena leucocephala), siratro (Macroptilium atropurpureus) and king grass (Pennisetum typhoides) on growth rate, rumen environment and blood metabolites of Bali calves. Calves were randomly grouped into four groups and they were offered a concentrate-based calf supplement (CSc) or different forage based calf supplement made by replacing 2/3rd of the concentrate on dry matter (DM) bases with leucaena (CSl), siratro (CSs), and king grass (CSg). Concentrate supplement was formulated using rice bran, corn meal and fishmeal to contain 18% crude protein. Parameters measured included mortality rate, growth rate, and rumen environment (concentration of total and individual volatile fatty acid, VFA). All forage-based calf supplement are as good as concentrate supplement in preventing calf losses since no calf died during the experiment. Calves consumed siratro-based supplement have comparable (P>0.05) growth rate with those offered the concentrate supplement and significantly higher (P<0.05) than those offered other forage-based supplement. Bali calves offered CSl had significantly lower (P<0.05) rumen total VFA concentration particularly that of propionate and butyrate. It can be concluded that siratro can be used to replace 2/3rd of concentrate supplement thereby can used for cost effective calf supplement.

Keywords: calf supplement, forage, growth rate, mortality rate, VFA

INTRODUCTION

The substantially high calf mortality and slow growth rate during pre-weaning period has been considered as predominat factor resposible for the low cattle productivity in cattle producing areas in Indonesia including The Province of East Nusa Tenggara. Supplementation of calves during the dry season before weaning has been proven to be a promising option to improve beef cattle production and hence potentialy benefiting small scale famers. Provision of a small amount (2% live weight, LW) of locally blended concentrate supplement to Bali calves before weaning can significantly reduce mortality rate (from 20 to 50% to less than 1%) and increase growth rate (206 versus 100 g/day live weight gain) (Jelantik et al., 2008). The yearling weight for the supplemented calves was almost double that of the control calves (Copland et al., 2011).

Whilts the supplementation strategy using concentrate-based supplements is readily accepted
by larger scale farmers, its adoption by small tenant farmer remained low. The most prominent reason is that even when the concentrate based supplement was composed of locally available feeds on local market, a concentrate based supplement was still considered to be expensive and unavordable by farmers (Parker et al., 2012). Therefore, replacement most of the concentrate-based supplement with high quality forages, hence become ‘a forage-based supplement’ may improve its adoption rate. This experiments was conducted to investigate the effect of replacement of 2/3rd of concentrate supplement with different forages, i.e. grass, leucaena and siratro (Macroptilium atropurpureus) that can be produced by farmer, on pre-weaning Bali calves survivability and performance.

**MATERIALS AND METHODS**

Sixteen pre-weaning Bali calves were involved in this experiment with the objective to investigate the effect of replacing 2/3rd of concentrate-based supplement with respectively leucaena leaf (Leucaena leucocephala), siratro (Macroptilium atropurpureus) and king grass (Pennisetum typhoides) on growth rate, rumen environment and blood metabolites of Bali calves. Calves were randomly grouped into four groups of four with balanced sex and they were offered a concentrate-based calf supplement (CSc) or different forage-based supplement made by replacing 2/3rd of the concentrate supplement on dry matter (DM) bases with fresh leucaena leaf (CSI), siratro (CSs), and king grass (CSg). Concentrate supplement was formulated using rice bran, corn meal and fishmeal to contain 18% crude protein. All supplements were introduced to calves one month after calving in a creep feeder during night time when cow-calf pairs were back from grazing.

Calves were weighed beweekly and the weight difference between two consecutive weighing was calculated as average daily gain (ADG). Any calf death was recorded and calculated for mortality rate. Rumen liquid was taken from calves at three months after supplementation and measured for pH and thereafter acidified to pH <3 using few drops of concentrated hydrochloric acid before frozen to await determination for concentrations of ammonia as well as total and individual volatile fatty acids (VFA).

**RESULT AND DISCUSSION**

Mortality rate of Bali calves offered different forage-based calf suplements was virtually zero since the was no calf died during the experiment. Results of the present experiment appeared were comparable to previous results with concentrate-based supplements. In a large scale experiment involving nearly 946 pre-weaning Bali calves, Jelantik et al. (1998) and Copland et al. (2011) reported that providing 2% BW locally blended concentrate supplement reduced mortality rate to 3% compared to 34% in the unsupplemented calves. Our finding showed that replacing 2/3rd of the concentrate supplement with different good quality forages were still able to prevent calf death. This could mean that farmer adoption of calf supplementation strategy can be expected to increase since high price fo concentrate supplements was one of the reason for low farmer adoption on such strategy (Parker et al., 2014). Therefore, it would be expected that cattle production can be substantially improved since the exceptionally high calf mortality, i.e. reaching a level of 47% (Wirdahati and Bamualim, 1990) up to 53% (Fattah, 1998), has been considered as the main factors contributing for the low cattle production in The Province of Nusa Tenggara Timur as well as other dry land areas in Indonesia.

Further benefit of calf supplementation on cattle production will be obtained when weight gain is also improved. Previous reports (Jelantik et al., 2008; Copland et al., 2011) recorded a
significant increase in average daily weight gain (ADG) when Bali calves were offered with concentrate supplement while their dam were out for grazing. In those experiments, the level of ADG for supplemented calves varied between 120 g to 249 g per day compared to 90 g in the unsupplemented calves. In the present experiment, ADG of supplemented Bali calves fell within that level. As shown in table 1, of the different forages evaluated to replace 2/3rd of the concentrate supplement, siratro (*M. atropurpureus*) gave the highest ADG make the only forages that gave comparable result to that of concentrate supplement. Meanwhile, ADG of Bali caves offered leucaena-based supplement was the lowest. Part of the explanation for the superiority of siratro to replace 2/3rd of concentrate in calf supplement is due to its nutritive value. With relatively high in crude protein content and degradability in the rumen (Bowen *et al.*, 2008), siratro was very close to CP content of concentrate supplement. Moreover, siratro is known to have negligible concentration on antinutritive factors (Norton and Poppi, 1996). Young calves are very sensitive to ANF (Lalles, 1993). This perhaps the reason for the low performance of Bali calves offered leucaena-based supplement. Leucaena leaf has been reported to contain high concentration of ANF in the form of mimmosine (Devendra, 1996).

Table 1. Means of daily weight gain and body linear measurements of Bali calves offered different forage-based calf supplements

<table>
<thead>
<tr>
<th>Variables</th>
<th>Calf Supplement</th>
<th>SEM</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADG (g/d)</td>
<td>CSc</td>
<td>187.50^ab</td>
<td>0.023</td>
</tr>
<tr>
<td></td>
<td>CSg</td>
<td>136.82^a</td>
<td>0.021</td>
</tr>
<tr>
<td></td>
<td>CSI</td>
<td>126.69^a</td>
<td>0.020</td>
</tr>
<tr>
<td></td>
<td>CSs</td>
<td>236.49^b</td>
<td>0.020</td>
</tr>
<tr>
<td>HG (cm/d)</td>
<td></td>
<td>0.118</td>
<td></td>
</tr>
<tr>
<td>WH increase (cm/d)</td>
<td></td>
<td>0.118</td>
<td></td>
</tr>
<tr>
<td>BL increase (cm/d)</td>
<td></td>
<td>0.088</td>
<td></td>
</tr>
</tbody>
</table>
| Values within similar raw followed by different alphabed shows significant difference (P<0.05) CSc=concentrate, CSg=1/3 concentrate 2/3 king grass, CSI=1/3 concentrate 2/3 leucaena, CSs=1/3 concentrate 2/3 siratro ADG = average daily weight gain, WH=wither height, BL=body length, HG=heart girt

Data on body measurements which indicate frame size of Bali calves recorded in the present experiment was in agreement with report by Leu-penu *et al.* (2008) who recorded increase in heart girt varied from 0.13 to 0.15 cm/d for Bali calves offered similar concentrate supplement. Increase in heart girt, body length and wither height did not differ (P>0.05) between calves offered concentrate or different forage-based supplements.

Another reason for better performance of Bali calves on siratro-based supplement may lay on the end product of fermentation in the rumen. Table 2 showed that the total VFA and particularly propionate concentration in rumen liquid of calves fed siratro-based supplement was very close to that in concentrate supplemented calves and significantly (P<0.05) higher than that of other forage-based supplement fed calves. This indicate better energy status of the calves since part of energy supply in young calves beside from milk is from VFA absorbed in the rumen (Orskov and Ryle, 1990). Moreover, propionate is known as glucogenic and readily converted into glucose to fulfill the requirement which then allowing more amino acids availability for tissue deposition (Preston and Leng, 1987) and higher weight gain. Higher VFA concentration also positively
correlated rumen pH and with better and faster rumen development. Optimal villae de
development of rumen wall requires acids particularly butyric acid (Davis and Drackley. 1998). In
general, all supplemented calves have low rumen pH, i.e. less than 6, indicating optimal and fast rumen
development. However, calves offered leucaena-based supplement had significantly (P<0.05)
higher rumen pH. This may be related to significantly lower total VFA concentration and higher
rumen ammonia concentration since leucaena contained highest crude protein compared to other
forages and it is partly degraded in the rumen (Jelantik, 2001). Nevertheless, fast growing rumen is
particularly important when for early weaning strategy which require fully developed rumen as soon
as possible enabling the calves to acquire solid feeds. Early weaning is considered as one strategy
to improve cattle production by removing feed requirement for suckling and hence the nutrient
intake can be directed for increasing body cow condition and more successful reproduction.

Table 2. Means of pH and volatile fatty acids (VFA) concentration of rumen liquid of Bali
calves offered concentrate or different forage-based supplement

<table>
<thead>
<tr>
<th>Variables</th>
<th>Calf Supplement</th>
<th>SEM</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CSc</td>
<td>CSg</td>
<td>CSI</td>
</tr>
<tr>
<td>pH</td>
<td>5.13a</td>
<td>5.16a</td>
<td>5.37b</td>
</tr>
<tr>
<td>Asetate</td>
<td>50.99</td>
<td>47.88</td>
<td>38.05</td>
</tr>
<tr>
<td>Propionate</td>
<td>16.68bc</td>
<td>12.01ab</td>
<td>10.56a</td>
</tr>
<tr>
<td>Butyrate</td>
<td>8.58b</td>
<td>6.84ab</td>
<td>5.88a</td>
</tr>
<tr>
<td>Total VFA</td>
<td>76.39b</td>
<td>66.73ab</td>
<td>54.49a</td>
</tr>
</tbody>
</table>

Values within similar raw followed by different alphabed shows significant difference (P<0.05)
CSc=concentrate, CSg=1/3 concentrate 2/3 king grass, CSI=1/3 concentrate 2/3 leucaena,
CSs=1/3 concentrate 2/3 siratro

CONCLUSION

All forages are able to replace 2/3rd of concentrate supplement to improve Bali calves
pre-weaning survivability. However, siratro (Macroptilium atropurpureus) is the best candidate
to replace most of concentrate supplement to improve rumen VFA concentration particularly
propionate and daily weight gain.

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Waste Utilization to Increase Productivity Growth Bali Cattle and Coffee Plants

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ABSTRACT: Usually, waste is regarded as having a negative outlook and both crop waste or animal waste is not utilized properly. Developing a natural potency of cattle in Bali is still quite large, especially in the central region and the marginal land. In Bali, there are some plantations covering an area of 166,454 ha of which consists of the coffee (39,923 ha), cocoa (6,223 ha), and vanilla plantations (448 ha). A research conducted in the Village Catur Kintamani, Bali using 60 heads of cattle fattening phase (kereman). As a control (P0) is feeding as usual (local farmers). P1: is P0 + 1% of body weight bran coffee/head/day, P2: is P0 + 1% BB + feed mixtures of rice bran and coffee bran/head/day and P3: P2 + 5 cc is Biocas/head/day. Results showed that the control (P0) reached daily weight gain of 0.33 kg/head/day significantly different from the P1, P2 and P3 that are each gained weight 0.55; 0.56 and 0.58 kg/head/day. Among treatment, P1, P2 and P3 showed no significant differences in daily body weight. Coffee plant compost treatments given in combination with differently biourin give seed yield of red spindle row (P1; P2, and P3) are, 6023.33; 6296.00 and 7771.87 g/tree. Between control P0 to P3 combination treatment showed significant differences.

Keywords: Bali cattle, gastrointestinal, bran coffee, fattening

INTRODUCTION

Developing a natural potency of cattle in Bali is still quite large, especially in the central region and the marginal land. In Bali, there are some plantations covering an area of 166,454 ha of which consists of the coffee (39,923 ha), cocoa (6,223 ha), and vanilla plantations (448 ha), etc. (Disbun, 2007). Coffee and cocoa wastes have the potency to be used as feed material amplifier (concentrate) for livestock. The physical composition of coffee and cocoa waste is quite large at around 48% of coffee fruit pulp and 77% for cocoa fruit shells (Zaenudin et al. 1995).

Nowadays the need of nutrition value, especially from animal protein per capita is still inadequate (Bambang Sugeng, 2004). Although the number of livestock increased when compared with the level of demand, which also increased, but there is still a gap. It has also anticipated by the government by launching a Self-Sufficiency Program Acceleration Beef and Buffalo (PSDSK). According Kusumo et al. (2010), realizing self-sufficiency in beef and buffalo is one of the main program of the Ministry of Agriculture today. Problems in achieving self-sufficiency in beef/buffalo among other local cattle Indonesia has a relatively low weight cut, one of Bali cattle compared to Bos taurus cattle due to cross in (in breeding) (Rasali and Rusdiana, 2013). Bali cattle are excellent cattle, in which the community in Bali mostly raises these cattle. Besides, not only the meat has a good quality, the carcass of Bali cattle also has a high percentage of 56-58%, when compared to other animals, (Guntoro, 2004). Judging from the carcass characteristics and body form compact and harmonious, Bali cattle is classified as ideal, even the value of the meat quality is superior to European beef cattle like Hereford and Shorton (Izhar Eka, et al. 2014). Bali cattle, has a privilege in terms of reproduction, carcass percentage and quality of the meat and skin, but has limitations in terms of speed of growth and the size of the body weight (Diwyanto and Priyanti, 2008).

Currently, the population of Bali cattle reaches 553,512 heads, far lower when compared to the population five years ago to reach 683,800 heads, which means every year experiencing a population decline. Within the last 5 years reached 19.05% decrease (Dept.Husb and Health. Prov. Dept. Husb and Health. Prov.).
Bali 2014). This indicates that there is a gap between the needs of existing inventory. On the other hand, the ratio between male and female cattle of the total population is 334,180 heads (60.37%) whereas the male cattle is 219,332 heads (39.63%) (Dept.Husb and Health. Prov. Bali 2014). With the touch of leather waste treatment technology in the form of coffee to be used as animal feed and livestock waste treatment either as a solid or liquid organic fertilizer, causing farmers to implement a more passionate integrated farming with good crops of rice fields or plantations. Because the waste rice fields or plantations after processing can be used as animal feed quality and animal wastes can be composted and biourin as fertilizer for crops. So livestock and crops can mutually utilize each waste is a cross, and the presence of cattle farmers can reduce plant maintenance input because it can save the cost of fertilizer (Suprio Guntoro, 2008). The purpose of this study was to examine the use of waste both in livestock and crop cross and mutually beneficial in one location.

**METHODOLOGY**

**Productivity Enhancement Technology in Bali Cattle Fattening Phase**

This study uses 15 cows for each treatment so that the number of cattle used 60 head weighing 250-300 kg / head. The design is as follows:

- **P0:** Cows are given feed as usual in the form of grass and forage
- **P1:** coffee bran feed P0 + 1% body weight+ Biocas 5 ml / head / day
- **P2:** P0 + 1%body weight (bran rice bran coffee +) / head / day
- **P3:** P2 + 5 cc Probiotics Bio-cas / head / day.

The animals were weighed every month for the next four months to see an increase in their body weight (daily weight gain). The data were analyzed using a completely randomized design (CRD). If there are any differences, then continued with test duncant (DMRT).

**Coffee Plant Productivity Enhancement Technology Using Organic Fertilizer.**

To study the coffee plant, designed experiments in a randomized block design (RBD) with 4 treatments:

- **P0:** Is coffee plants managed by farmers with fertilizer as usual
- **P1:** P0 + fermented manure (compost) 25 kg / tree / year
- **P2:** P0 + bio urine 20 liters / tree / year
- **P3:** P0 + 25 kg manure bio urine + 20 liters / tree / year

Description:
- Compost used is from cattle manure fermented using RB (*Rumino baccilus*)
- Bio Urine is urine of cattle are accommodated subsequently fermented using RB and Azotobacter

Arabica coffee plant is a treatment given coffee crop farmers aged 4-5 years with each of the 20 clumps in a replay. Giving treatment twice: at the beginning of the rainy season (October) and the end of the dry season (April). Treatment is given ½ dose per application. Parameters measured were yield components like number of productive branches per tree, number of bunch per branch, number of seeds per bunch, weight logs coffee per tree, weight of wet seeds per plant, seed weight per tree drying, seed weight per tree HS.

Variable soil physical and chemical properties were observed in utilization of organic fertilizer (compost and bio urine) in the three crops are as follows.

Data were analyzed by analysis of variance, if the treatment significantly (P <0.05) followed by LSD test level of 5% (Steel, R.G.D, and J.H Torrie. 1991)

**RESULTS AND DISCUSSION**

**Increased Productivity Bali Cattle Fattening Phase**

The mature male Bali cattle in Indonesia, the red color of his body turned black because of
the influence of sex-linkage with the pigmentation of the coat color gene (Sandhi et al., 1990, in Chalid Talib, 2002).

From Table 1 shows the average weight of cattle were reared reaching 260 kg/head. The weight of an ideal weight is to be going to (prospective fattening). Because if the Bali cattle had weighs 250-300 kg/head with age ± 2 years, is that cattle ready to be fattened for an adult and will not undergo further development of the body so that the feed given only for charging alone or just to fatten it.

The range of increase in body weight daily is between 17-35 kg/head/maintenance within 4 months, which means an increase in daily weight only reached or 0.21 kg/head/day.

Increased body weight achieved is an increase in body weight below the standard Bali fattened cattle fed traditionally, based on the availability of forage that is on site.

Harimurti et al (1977) cited by Harmadji (1990) stated that the increase in daily live weight of male Bali cattle ranged from 0.32 to 0.37 kg/head. While the results of previous studies by Suyasa, et al (2011) daily weight gain increased reach of 0.21 kg/head/day. The relatively low growth (0.21kg/head/day) on a traditionally fattening due to the lack of feed availability, which caused quite a long dry season around the site maintenance.

Table 1 shows that the control (P0), to obtain an increase in body weight of 29.7 kg within a period of 4 months and a significant increase in daily gain of 0.33 kg/head/day. whereas treatment P1, P2, and P3 respectively produce weight gain 69.6; 72.0 and 75.6 kg/head in the 4-month maintenance period in which the daily weight gain of each is 0.58, 0.60, and 0.63 kg/head/day. These data indicate that treatment of feeding an additional form of waste or waste coffee and rice (bran) influence daily weight gain (P <0.05) compared to controls. And between treatment P1, P2 and P3 treated coffee waste and rice bran showed no significant differences among the treatments, but P3 is added probiotic treatment showed increased Biocas higher weight than the other treatments (P1 and P2).

This shows that the provision of agricultural waste such as coffee and a bran or rice bran has the ability to increase body weight in male Bali cattle fattened. Results of “proximate analysis” shows that through fermentation with “Aspergillus niger” coffee waste protein content increased from 7.90% to 18.16%. While the coarse fiber content decreases from 19.1% to 13.31% and it showed that fermentation with Aspergillus niger could make such waste as feed material better quality (Parvati et al. 2009).

Suyasa, et al (1999) obtained an increase daily gain of male Bali cattle are fed an additional 2 kg of complete feed and 5 cc probiotics reach 0.63 kg/head and are fed an additional 2 kg of complete feed without probiotic is only able to achieve an increase in body weight daily 0.61 kg/head. Results achieved today looks higher (P2 and P3) when compared to the Suyasa, et al (2004) and Widiyazid, et al (1999), which is able to achieve body weight daily for fattened steers 0.60 kg/head/day and 0.62kg/head/day.

Table 1. Weight beginning, end weight, the weight difference and the mean increase of Bali cattle fattening phase.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Initial Weight (Kg)</th>
<th>Weight Final (kg)</th>
<th>Difference (kg)</th>
<th>Average (kg/head/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0</td>
<td>267.85&lt;sup&gt;a&lt;/sup&gt;</td>
<td>297.55</td>
<td>29.7</td>
<td>0.33&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>P1</td>
<td>262.71&lt;sup&gt;a&lt;/sup&gt;</td>
<td>332.31</td>
<td>69.6</td>
<td>0.58&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>P2</td>
<td>262.85&lt;sup&gt;a&lt;/sup&gt;</td>
<td>334.85</td>
<td>72.0</td>
<td>0.60&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>P3</td>
<td>265.71&lt;sup&gt;a&lt;/sup&gt;</td>
<td>341.31</td>
<td>75.6</td>
<td>0.63&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Description: The figures followed the same letters in the same column showed no real difference in the level of 5% LSD.
Increased Productivity Coffee with Organic Fertilization

Average highest seed yield of red logs obtained in the treatment of urine plus compost weighing 777.87 grams were significantly different from the control or an increase of 74.53%, but did not differ significantly with urine and compost treatment alone. The average yield obtained on the lowest red spindle control weighing 4453.07 grams were no significant with urine and compost treatment or tends to increase respectively by 35.26 and 41.39% (Table 2).

Table 2. Average grain yield logs of red, wet seed weight, seed coat wet weight per tree (g)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Trailers Red Seed Treatment Results per tree (g)</th>
<th>Weight Wet Seeds per tree (g)</th>
<th>Weight Wet Skin seeds per tree (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0</td>
<td>4453.07(^{b})</td>
<td>2302.88(^{b})</td>
<td>1844.97(^{b})</td>
</tr>
<tr>
<td>P1</td>
<td>6023.33(^{ab})</td>
<td>3151.68(^{ab})</td>
<td>2495.59(^{ab})</td>
</tr>
<tr>
<td>P2</td>
<td>6296.00(^{ab})</td>
<td>3261.79(^{ab})</td>
<td>2685.43(^{ab})</td>
</tr>
<tr>
<td>P3</td>
<td>7771.87(^{a})</td>
<td>4035.71(^{a})</td>
<td>3255.57(^{ab})</td>
</tr>
</tbody>
</table>

Description: The figures followed the same letters in the same column showed no real difference in the level of 5% LSD %.

Similarly, happened to the parameters of the wet seed weight per tree, where the treatment of urinary plus compost provides the highest yield 4035.71 grams only significantly different from the control or an increase of 74.87% but did not differ significantly with the other treatments (Table 2). When compared with the control treatment and composting urine showed no real difference only provide improved wet seed weight respectively 36.43 and 41.33%.

Table 2, where the weight of wet seeds per tree bark highest seed was obtained in the treatment of urinary plus weighing 3255.57 grams of compost were significantly different from the control or increased 76.46%, but did not differ significantly with treatment of urine and composted respectively 35.26 and 45.55%. Control treatment gives skin wet weight of seeds per tree no significant lows the treatment of urine or compost.

Increased crop yield components of coffee can not be separated from the treatment given. The addition of nutrients available from the compost and urine can increase the size significantly, where the organic fertilizer can help plants prepare better conditions for produce.

Kartini (1997) states that fertilization ideal is to use organic fertilizer twice a year at the beginning and end of the rainy season of at least 50 kg per tree for perennial crops. The proper use of organic fertilizer will be able to increase the fertility of physical, biological and chemical weathering of soil and is able to accelerate other organic materials become more readily available to plants. The assessment results Munier, et al., (2006) showed an increase in the average productivity of dry cocoa reached 345.5 kg/0.5 ha/4 months, or 1,382 kg/ha/year (introduction pattern) while the peasant habits just 153.7 kg/0.5 ha/4 months or 614.8 kg/ha/year. Adijaya research results, et al., (2009) showed that the treatment of cow manure, bio urine and combinations improve yield component that is the result of Arabica coffee beans oven dried rose 37.91% - 55.28% with organic fertilizer. Cow manure, bio urine or a combination thereof, can be used as organic fertilizer to increase production of Arabica coffee.

Some results of the study indicate organic fertilizer can increase growth and yield components on annual crops, due to decomposition and nutrient supplies available originating from organic fertilizers rather slow and low but able to suffice the needs during seed filling. Dose manure (cow or buffalo) given to plant cloves between 5-10 kg / tree / year (Anon, 2011). Application of liquid fertilizer (biourine and biocultural) on coffee and cocoa crops with a dose of 6 liters plus 4 kg
of compost/tree/year produces 30-35% higher production than the use of conventional compost dosage of 10-12 kg/tree/year (Sinar Tani, 2011). Further explained that cow urine N element content increased from 0.23% to 0.71% and the content of potassium increased from 202 ppm to 598 ppm. For goat urine N element content increased from 0.34% to 0.89% and the content of potassium increased from 759 ppm to 1,770 ppm. In addition to the biourine also contain stimulants of growth. While the biocultural (liquid fermented feces) has a higher P content.

Fertilization consistently and continuously with organic fertilizer that has been processed (higher quality) can increase soil fertility fertility seen from several variables such as pH, organic C, CEC and NPK land in the village Belanga (Sunanjaya and Parvati, 2010). According Nurhayati Hakim, et al (1989) suggest that organic fertilizer can increase the reserves of nutrients in the soil, improve soil structure and increase soil organic matter content. Its effect on soil chemical properties which can improve soil pH, increasing the content of C-organic increase soil CEC as organic material having a cation jerap power greater than colloidal clay and can release P from P fixed to be P-available to plants.

CONCLUSION

Bali cattle feedlot phase can be started with the initial weight 250-300 kg per cow, assuming the weight of the final weight of the growth that the rest stayed charging only or fattening. With additional food waste and coffee or rice bran daily weight gain of Bali cattle feedlot phase can be increased significantly reaching 0.58 to 0.63 kg/head/day. While the utilization of livestock waste either solid or liquid that has been processed to increase production, grain yield per plant red spindle, wet seed weight per plant, and seed coat wet weight per tree compared to the production of fertilizing the way farmers. Utilization of waste in the form of integrated agriculture will be able to increase the productivity of livestock or farm crops and will be environmentally friendly and sustainable for the long term.

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Effect of Different Lands on Heat Tolerance Coefficient and Body Weight Gain of Ram Fat Tailed Sheep

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ABSTRACT: Livestock productivity is influenced by genetic and environmental factors. Genetic factors contribute 30% and 70% environmental factors. Environmental factors, including: rearing management, feed, and livestock shelter (different lands). Different lands, the highlands and low, affected Ram Fat Tailed Sheep adaptability, especially daily body weight gain. Another influential factor was the availability of feed in the two altitudes. This research was conducted in the DEG’s Ranch, Solokuro village, Lamongan Residence (lowland, 30 m asl) and Agri Ranch, District Karang Ploso, Malang (highland, 700 m asl). The purpose of this study was to analyse the effect of different lands on Heat Tolerance Coefficient (HTC) and body weight gain. Research materials were DEG males aged 9-12 months with 10 rams at each land. Research methods were experimental and direct observation. Data were analyzed by unpaired t-test. The variables measured were HTC and body weight gain. The result showed that the altitude difference affect the body temperature, respiratory rate and body weight gain (P<0.05), but not it influenced the value of the HTC. The next research was suggested using Fat Tailed Sheep males and feed the same in altitude to accurately determine their adaptability.

Keywords: Adaptability, respiratory rate, body temperature, lowland, highland.
The Effects of Hair Colours Differences on the Performance of Etawah Grade Doe

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Faculty of Animal Science, Univeritas Gadjah Mada, Yogyakarta
Corresponding email: budisatria@ugm.ac.id

ABSTRACT: The research was conducted to identify the performances of Etawah grade does based on the hair color differences. The materials of the research were consisted of 27 Etawah grade does aged on 1.5-2.0 years old. Basal diets were groundnut leaves and elephant grass, and concentrate feed as additional feed. Twenty seven of Etawah grade does were divided into three treatments based on hair color, black head colors (T1), brown head color (T2) and mixed color (T3), each treatment was consisted of 9 Etawah grade does. Feed was given 3.5% on dry matter based, the ratio between forages and concentrate feed was 60% and 40%. Does were raised for 8 months, feed was offered twice a day. Feed offered was weighted, while the rest was weighted the day after. The doe was mated with buck according to their head color. The data were consisted of feed and nutrient intakes, absolute and relative average daily gain (ADG), feed cost per gain, service per conception, litter size, and kids birth weight. One way analysis of variance was applied to identify the mean differences. The result indicated that brown head color of Etawah grade does had the highest (P<0.05) feed intake (3.35 vs 3.02 vs 2.2 kg/h/d), dry matter intakes (3.11 vs 2.80 vs 2.53 kg/h/d), crude protein intakes (0.59 vs 0.53 vs 0.48 kg/h/d), absolute ADG (90.68 vs 64.34 vs 55.01 g/h/d) and relative ADG (0.26 vs 0.20 vs 0.18%), and the lowest feed cost per gain (15,780.03 vs 19,477.29 vs 18,877.78 IDR/kg) respectively, compared to black and mixed head colors of Etawah grade does. There were no significant differences were found on the service per conception, litter size and birth weight of kids. It can be concluded that the brown head color of Etawah grade does had the best performances as indicated by highest feed and nutrient intakes, highest absolute and relative average daily gain and the lowest feed cost per gain.

Keywords: Etawah grade doe, Head color differences, Performances

INTRODUCTION

The population of goats in Indonesia has increased gradually at an average rate of 4.6% in the last ten years, involving 3.5 million households. Nearly 99% of small ruminants are in hand of small-holders (Knipscheer et al., 1984; Soedjana 1993). The main reason why the majority of famers keep small ruminants in particular goat are they are easy to manage, have a ready market, act as a savings account in case farmers have urgent cash requirements, have socio-cultural roles and they produce manure to fertilize the land (Devendra 2002; Budisatria et al., 2010). In Indonesia there are many goat breeds kept by famers, one of them is called Etawah grade. Etawah Grade is the results of cross mating between Kacang goat and imported Etawah goat. Etawah Grade goats have been adapted to the Indonesian natural condition and habitat, and are widely found in Java island spreading to all over Indonesia. Goats of this type are considered having double function as meat producing type as well as milk producing type, although in Indonesia its function as milk producer has not been appreciated much yet (Williamson and Payne, 1993).

Farmers like to classify Etawah grade based on the length of its’ ears, which leads to an understanding of three types of Etawah grade goats. Type A goats have ears of more than 30 cm long, type B have ears between 20 to 30 cm long, and type C are less than 20 cm long ears. Another
interesting phenomenon is that farmers have preference on hair color, they believe that Etawah grade having black color on head, and combination of black and white have high productivity compared to other color and they have more expensive prices. Theoretically, this opinion comes out might be caused by genetic variation of the ancestors, blood profile of Etawah Grade has been closer to Etawah rather than to Kacang goats and so its productivity is also closer to Etawah. This fact has been clarified by Sumadi (2001), who found out that Etawah grade of A type had dominant color of black – white or white-black as much as 95.6%, while those of B type have black-white or white-black and white-brown or brown-white had been 55% and 45%, respectively. Etawah grade of C type on the other hand dominated by brown-white and brown had been 86% and 20%. Etawah grade had better productivity compared to Kacang goats or Bligon in respect of its body weight, birth weight, weaning weight, and daily body weight gain. Budisatria (2006) found out that daily weight gain of males at zero to 3 month old kept by farmers at lowland, moderate, and highland agro-ecology zones in Yogyakarta province were 100.2 g/day/goat, 114.4 g/day/goat, and 122.1 g/day/goat.

There was little information available with regard to the productivity of Etawah grade based on their differences hair colors. That information is necessary required, so the stakeholders have the right information in order to select or keep the Etawah grade goat. Therefore, the research was conducted to identify the effects of hair colors differences on the performance of Etawah grade doe, in terms of feed and nutrients intake, bodyweight, average daily gain, feed conversion, feed cost per gain and reproduction performances.

MATERIALS AND METHODS

The study was conducted for eight months. In total, 27 heads of Etawah grade does of 1.5-2.0 years old were used for this study, it was divided into three groups based on their color, namely black head color, brown head color and mixed color, therefore, each group consisted of nine Etawah grade does. Basal feed offered were consisted of groundnut straw and concentrate feed, the ratio was 40:60%. Feed were given 3.5% on dry matter based.

The data collection were consisted of feed (as feed) and nutrient intakes, feed conversion, feed cost per gain, absolute and relative daily gain, and reproduction performances including service preconception, litter size and birth weight. Feed intake was measured for every day. Feed were given twice a day in the morning and afternoon, feed offered and refused was weighed. Feed analyses were done to calculate dry matter (DM), crude protein (CP), crude fibre (CF), crude fat (EE) and nitrogen free extract (NFE) intakes.

Etawah grade does were weighed every two weeks, absolute and relatives daily gain were calculated. Based on dry matter intakes and gain, feed conversion was calculated while the price of feed (groundnut straw and concentrate) and the gain of does used to calculate feed cost per gain. The does were mated naturally using buck with the same color pattern. The service per conception was recorded. At the parturition stage, the numbers of kid per parturition (litter size) were recorded and kids born were weighed during 24 hours.

One way analysis of variance were applied to calculate the effect of hair color differences on feed intake and performances of does and continued by Duncans’ New Multiple Range Test (DMRT) for significant differences.

RESULTS AND DISCUSSION

The results indicated that Etawah grade doe with brown head color tend to have better feed intakes, dry matter, crude protein and crude fibre intakes compared to black or mixed color, while
crude fat and nitrogen free extract intakes did not significantly differs, as presented in Table 1. Feed and nutrients intakes are varied widely, its depend on the species, early body weight, age and physiological status, type and palatability of feed (Arora, 1995; Pond et al., 1995).

Table 1. Feed and nutrients intakes of Etawah grade doe

<table>
<thead>
<tr>
<th>Variables</th>
<th>Hair colour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Black</td>
</tr>
<tr>
<td>Feed intakes as feed (kg/head/day)</td>
<td></td>
</tr>
<tr>
<td>Grass ns</td>
<td>2.44</td>
</tr>
<tr>
<td>Concentrate</td>
<td>0.57a</td>
</tr>
<tr>
<td>Total intakes</td>
<td>3.02a</td>
</tr>
<tr>
<td>Dry matter intake (kg/head/day)</td>
<td>2.80a</td>
</tr>
<tr>
<td>Crude protein intake (kg/head/day)</td>
<td>0.53a</td>
</tr>
<tr>
<td>Crude fibre intake (kg/head/day)</td>
<td>0.57a</td>
</tr>
<tr>
<td>Crude fat intake (kg/head/day)</td>
<td>0.15</td>
</tr>
<tr>
<td>Extract free nitrogen intake</td>
<td>1.18</td>
</tr>
</tbody>
</table>

Different superscripts denote significant differences between means within rows (P<0.05)

Absolute, relative average daily gain and feed cost per gain of Etawah grade does with brown head color was significantly better than black or mixed head color, while feed conversion was remain the same, as presented in Table 2. The high daily gain of brown head color of Etawah grade does might be caused by high feed and nutrient intakes (Table 1), as Parakkasi stated that dry matter and organic matter intakes will significantly affect the daily gain, the higher feed intakes, higher daily gain will be achieved, while Mucra (2005) stated that when animal consume feed with relatively same crude protein and total digestible nutrients contents, the average daily gain will also the same. Gain will only be achieved whenever feed consumed by animals are higher than basic requirements for their live (Tillman et al., 1998).

Etawah grade does with brown head color had the lowest feed cost per gain compared to black and mixed colors (P<0.05), which indicated that those goat much more efficient on using feed and converted to gain. The lowest feed cost per gain of brown head color of Etawah grade caused by efficient feed conversion and high average daily gain.

Table 2. Bodyweight, average daily gain, feed conversion and feed cost per gain

<table>
<thead>
<tr>
<th>Variables</th>
<th>Hair colour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Black</td>
</tr>
<tr>
<td>Initial bodyweight (kg)</td>
<td>33.10</td>
</tr>
<tr>
<td>Absolute daily gain (g/head/day)</td>
<td>64.34a</td>
</tr>
<tr>
<td>Relatives daily gain (%)</td>
<td>0.20a</td>
</tr>
<tr>
<td>Feed conversion</td>
<td>15.17</td>
</tr>
<tr>
<td>Feed cost per gain (IDR/kg)</td>
<td>19,477.29a</td>
</tr>
</tbody>
</table>

Different superscripts denote significant differences between means within rows (P<0.05)

Non significant.
Reproduction is main indicator for doe productivity and will significantly affect the economic condition of keeping goat especially for animal industry purposes (Atta et al., 2012). In terms of reproduction aspects, the result indicated that there were no significant differences on service per conception, litter size and birth weight among Etawah grade does with different head color, as presented in Table 3. All does only need once time mating to be pregnant. Devendra and Burns (1994) stated that service per conception of goat in Indonesia normally around 1.5 times, while Budisatria and Udo (2012) found that service per conception of goat kept by small farmers in rural areas was 1.8-1.9 times.

Table 3. Doe reproduction performances

<table>
<thead>
<tr>
<th>Variables</th>
<th>Hair colour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Black</td>
</tr>
<tr>
<td>Service per conception (time)</td>
<td>1.00</td>
</tr>
<tr>
<td>Litter size (head)</td>
<td>1.36</td>
</tr>
<tr>
<td>Birthweight (kg)</td>
<td>2.41</td>
</tr>
</tbody>
</table>

nsNon significant.

The litter size of Etawah grade does in this study varied from 1.36 up to 1.67 head. Widi (2002) found that litter size of does were 1.40-1.45 head, while Budisatria dan Udo (2012) found that does kept by small farmers had relatively high litter size, it was 1.7 head. Many factors affect the numbers of kid born per doe, the main factor was feed, especially the rate of feed intakes, feed with high nutrient content mainly when it offered before ovulation will increase the numbers of ova being ovulated (Inounu, 1996). Birth weight of kid in this study did not significantly differs, however, kids delivered by Etawah grade does with brown head color tend to had the highest birth weight compared to kid delivered by black and mixed head color of Etawah grade does. The variation on birth weight mainly caused by genetic and environmental factors, including feed resources, feed availability, and feed offered, which directly will affect the efficiency of does to convert nutrient into fetus weight during pregnancy period (Devendra and Burns, 1994).

CONCLUSIONS

The study concluded that brown head color of Etawah grade does had better feed and crude protein intakes, and produce the highest absolute and relative average daily gain, also they had the most efficient conversion of feed to gain, in terms of feed cost per gain. Reproduction performances (service per conception, litter size and birth weight) amongst Etawah grade does with different head color remain similar.

REFERENCES


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Age and Body Weight at Puberty and Service per Conception of Ongole Crossbred Heifer on Smallholder Farming System

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ABSTRACT: Age at puberty of a heifer is an important parameter to determine its reproductive longevity. This study was done to identify the age and body weight at puberty and service per conception of Ongole crossbred heifer on the smallholders farming system, in Tri Andhini Rejo cattle farmer group, Tegalrejo, Yogyakarta. The observation had been done on 37 heads of heifer from October 2012 to October 2013. When heifers showed first signs of estrus, the data of age, weight and body size were collected. The heifers were weighed and measured then be grouped based on its puberty age, which predicted according to the turn of cattles incisors (I1d, I1, I2, and I3). The data of puberty age were calculated and analyzed descriptively, while the body weight and the body size of the heifers were analysed using one-way ANOVA test. Result of this study showed that the age at puberty of Ongole crossbred heifers were achieved on the four different age levels: I1d (1.5 years), I1 (2 years), I2 (3 years) and I3 (> 3 years), with the percentages were 32.4%, 40.5%, 24.3% and 2.7%, respectively. The average of body weights at puberty were 212.2±35.2 kg (I1d), 232.5±35.0 kg (I1), 202.7±20.3 kg (I2), and 219 kg (I3). Service per conception were 2.3, 1.9, 1.4 and 1.0 for I1d, I1, I2 and I3, respectively. It can be concluded that age and body weight at puberty were varied, might be resulted from varied management of cattle keeping by smallholders farmers.

Keywords: Ongole Crossbred, Age at puberty, Body weight, Service per conception, Smallholder farming system

INTRODUCTION

Puberty may defined as the time which estrus first occurs, being accompanied by ovulation (Peters and Ball, 2004). The age of onset of puberty is clearly important since this could possibly prevent a cattle’s availability for breeding at desired time. Some research results showed that Ongole crossbred heifers reached puberty varied at an age of 523 to 823 days hari (Anggraeny et al., 2006; Beliana, 2008; Okasari, 2010; and Iskandar, 2011).

Beside age at puberty, service per conception (S/C) is important as well. Some results showed that S/C of Ongole crossbred varied from 1.89±0.2 to 2.68±0.28 times (Astuti, 2006; Winarti and Supriyadi, 2010; Aryanti, 2010). Ajie (2014) reported that age of cattle influenced S/C; 5-6 years of cows resulted significantly (P<0.05) better S/ C (1.40±0.52) than 3-4 years of cows (1.70±0.48), or 7-8 years of cows (2.40±0.52). On average the S/C is 1.83±0.64.

This study is aimed to explore the age at puberty, body weight, and S/C of Ongole heifers in smallholder farming systems.

MATERIALS AND METHODS

Study area

This study was conducted in Tri Andhini Rejo farmer’s group, located in Bener Village, Tegalrejo Sub district, Yogyakarta Province, from October 2012 to October 2013.
Data collection

Thirty seven Ongole heifers belong to 19 farmers kept in a communal barn, which have not reached puberty, were selected. Recording sheets were used to record the identity of farmers and the cattle and reproduction activities such as onset of puberty, insemination, pregnancy palpation, and bull’s information. Farmers observed, recorded on the recording sheets and reported to us the onset of puberty of their heifers. We determined the age of the heifers which showed the first puberty by inspecting its teeth. Heifers with only temporary teeths exist ($I_d$) were estimated as 1.5 y of age; one pair of incisors ($I_1$) were estimated as 2 y; two pairs of incisors ($I_2$) were estimated as 3 y; 3 pairs of incisors ($I_3$) were estimated as 4 y and; 4 pairs of incisors ($I_4$) were estimated as more than 4 y (Rianto and Purbowati, 2010). Heifers were weighed using weight scale (FHK Ogawa Seki Co.Ltd. Tokyo, Japan) with capacity of 800 kg, and body sizes were measured.

Farmers were interviewed about their general information, background and motivation, and technical aspects such as cattle management.

RESULTS AND DISCUSSION

General information of the farmers

The average of farmer’s age is 51.1±15.4 y, with 18.2±23.8 y of average experience of cattle keeping. More than half (58%) of the farmers reached junior and senior high school and only 5% of the farmers finished undergraduate school. The main occupation of the interviewees was farming (84%) and the rest of 16% was businessmen. The purposes of keeping cattle, ranked from the most to less important are; producing calves, saving, hobby, producing manure and utilizing crop by-products.

Management of keeping cattle

All of the farmers keep the cattle in a communal barn, not close with their house. The farmers visited the barn once to five times in a day, with an average of 2.6 ± 1.0 times in a day, and spent 1.2 ± 0.4 hr to feed, give drink water, clean the barn and observe the estrus. Most of the farmers have good ability in detecting the estrus.

Feed offered to the cattle were forages and concentrates. Combination of native grasses and rice straw were mostly offered (52.6% of farmers); about twenty percent of farmers offered native grasses, rice straw and cultivated grasses; and 10% of farmers offered single native grasses in the ration. Few farmers offered cultivated grasses, maize straw and cassava leave. Less than half of the farmers (47.4%) offered concentrates which consisted of soy bean hull, rice bran and pollard. Forages were offered two (52.5%) until three (47.4%) times a day.

Age and body weight at puberty

Table 1 shows the age at puberty of Ongole crossbred heifers. Most of the heifers (73%) reach puberty at age of 1.5 – 2 y. It is in line with Anggraeny and Umiyasih (2007), that found that about 67.1% of heifers reached its puberty at above 1.5 y. Longer time of puberty indicate low reproductive performance (Bishop and Pfeiffer, 2008). Timing of puberty is highly variable (Peters and Ball, 2004) and influenced by genetic, nutrition level and growth rate before puberty (Waters, 2012). Nutrition level is very important in relation with puberty, as breed factor can not be manipulated (Williams, 2013). When related to feeding management of smallholder farms, it is assumed that variability on feeds, in term of quality and quantity, result on different puberty.
Table 1. Puberty age of Ongole

<table>
<thead>
<tr>
<th>Age at puberty</th>
<th>Number of heifers (heads)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_d$</td>
<td>12</td>
<td>32.43</td>
</tr>
<tr>
<td>$I_1$</td>
<td>15</td>
<td>40.54</td>
</tr>
<tr>
<td>$I_2$</td>
<td>9</td>
<td>24.32</td>
</tr>
<tr>
<td>$I_3$</td>
<td>1</td>
<td>2.70</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Environmental factors such as climate, season and availability of bull around the female also stimulate the onset of puberty (Utomo, 2013). Tropical cattle reach puberty later (25 – 33 months) (Eduvie et al., 1993; Kanuya et al., 1993; Osei et al., 1993) than cattle in sub tropic areas (less than 25 months) (Sargentini et al., 2007; Saenz et al., 2008). Cattle in the tropic often get less feed in longer period so that the heifer reach puberty later (> 2 y).

**Body weight at puberty**

Body weight of the Ongole crossbred heifers at puberty for each group of age is presented in Table 2.

Table 2. Body weight of Ongole crossbred at puberty for each group of age

<table>
<thead>
<tr>
<th>Body Weight</th>
<th>Age group</th>
<th>$I_d$ (n=12)</th>
<th>$I_1$ (n=15)</th>
<th>$I_2$ (n = 9)</th>
<th>$I_3$ (n = 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum (kg)</td>
<td></td>
<td>152.6</td>
<td>161.6</td>
<td>180.1</td>
<td>219</td>
</tr>
<tr>
<td>Maximum (kg)</td>
<td></td>
<td>288.0</td>
<td>285.0</td>
<td>234.0</td>
<td>219</td>
</tr>
<tr>
<td>Average (kg)</td>
<td></td>
<td>212.2±35.2</td>
<td>232.5±35.0</td>
<td>202.7±20.3</td>
<td>219</td>
</tr>
</tbody>
</table>

Age group of $I_1$ have the highest body weight at puberty (232.5±35.0 kg), followed by $I_3$, $I_d$ and $I_2$ with the body weight are 219 kg, 212.2±35.2 kg and 202.7±20.3 kg, respectively. In general, a female cattle has to have an average body weight of approximately 200 kg to get an estrus. It indicates that the growth rate is a determination of puberty age, as stated by Boyle (2007) and Waters (2012), that cattle reach puberty when the body weight is 60% to 70% of mature body weight.

**Service per conception (S/C)**

Table 3 presents the S/C of Ongole crossbred for each group of age.

Table 3. Service per conception of Ongole crossbred for each group of age

<table>
<thead>
<tr>
<th>S/C (time) (%)</th>
<th>Group of age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$I_d$ (n=12)</td>
</tr>
<tr>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>33.3</td>
</tr>
<tr>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>16.7</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Average (time)</td>
<td>2.33</td>
</tr>
</tbody>
</table>
The results show that S/C tends to be better in older puberty age. It might be because the reproduction organs are more ready on older age. However, it needs deeper study on the factors which influence S/C.

CONCLUSIONS

It is concluded that management of heifer on smallholder farming systems are varied, results variation on puberty age. Heifers have to reach 200 kg to get first estrus (puberty) with S/C is relatively high.

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Performance of Three Breeds of Sudanese Cattle

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ABSTRACT: The aims of this research was to study the body gain and feed conversion ratio in three local breeds of Sudanese beef cattle namely: (n= 46 Baggara, n= 10 Kenana and n= 74 Ambroro) and comparison between the breeds in the meat production, in Omdurman Islamic University farm - Faculty of Agriculture- in collaboration with family Bank). the calves has different initial weights ranging from 146 to 267 kg, and all animals fed by once concentrations at eight in the morning and five o’clock afternoon and provided by roughages (straws and hay). Data was analyzed by using randomized block design to comparison between the three breeds and variance analysis to distinguish between breeds. Results shown that there were no significant differences between the breeds in feed conversion ratio, but Kenana breed demonstrated highest rate of feed conversion than Baggara and Ambroro. Also Ambroro breed recorded a highest body gain in third measure at significant difference (P <0.05). Kenana calves had highest ability body gain and lowest FCR than Baggara and Ambroro cattle.

Keywords: Sudanese breeds, body gain, feed conversion ratio

INTRODUCTION

Nutrition has a relationship of various parts of the body growth, and large impact to determining the final weights of the animals, as well as the proportions of each body parts (Mohammed, 1989). Also He mentioned that in the nutritional requirements of developing beef cattle better to calculate it maintenance and growth requirement of the protein in one number (total requirements). (Baumgart, 1969) that the feed intake governed by physiological and environmental factors. (Cooper and willis, 1979) has found that dry matter intake as an absolute value it is increases according to animal size, and expressing this value as a percentage of the animal weight, It can be said that the feed intake decreasing when the animal growth gradually. (Neumann, 1977) Noticed that the feed intake effect by age, animal size, parts and feed grinding (Wilkins et al, 1972), type of feed (Mohammed, 2004), animal Factors “strength of chewing muscle and teeth “ (Bines, 1976), energy (Ahmed, 2005: El-toma, 2000), hormones (Rahama, 2005), Environmental factors (Mohammed, 1990).

Efficiency in meat animal production is measured by the body gain per unit of feed consumed, Feed conversion efficiency measured indirectly, which is a function of feed intake and body gain in a specified time. Changes that occur to the feed conversion efficiency can be traced back to the measurement efficiency in different environmental conditions (Robert et al., 1963). Feed conversion efficiency of Baggara cattle is 6.5 - 7.74 kilograms of dry matter per kilogram increase in live weight (El shafie and Mcleroy, 1964). And 8.75 - 9.75 (Gaili and osman, 1979), 8.37-8.75 (Ahmed et al., 1990). Feed conversion efficiency of Baggara cattle fed at (Sorghum stover) at different levels of concentrates 100, 75, 65 and 55% mixed concentrates are as follows 8.6, 10.8, 9.5 and 9.5 kg dry matter per kilogram live weight of the four groups, respectively (El Teyeb et al., 1990). When animal weight is increasing, feed conversion efficiency is the decreasing (Thissen et al., 1984), they also found that feed conversion efficiency it is between 5.52 to 13.41 of Sudanese beef cattle.
MATERIALS AND METHODS

Data and Experimental Animals

An animal’s brought from different parts of Sudan, west Sudan (Kordufan and Darfur) states and Central Sudan (White Nile) state from natural pastures areas. Animal kept at the semi intensive feeding system, the space allocated for one calf 4.5 meters square. Calves adapted progressively on concentration feed, gave 0.5 kg/head at first day concentrated diet with increase the quantity 54 kg daily until 12th days. After that all calves consume 7000 kg concentration feed weekly, and calves provided by roughages (hay, cereal straw) to the calves at morning and evening.

Table 1. Analysis of Concentration Diet Content for Three Breeds.

<table>
<thead>
<tr>
<th>Feedstuff</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molasessses</td>
<td>46%</td>
</tr>
<tr>
<td>Wheat barn</td>
<td>20%</td>
</tr>
<tr>
<td>Groundnut cake</td>
<td>10%</td>
</tr>
<tr>
<td>Cereal grains(Feteritah)</td>
<td>10%</td>
</tr>
<tr>
<td>NaCl</td>
<td>1%</td>
</tr>
<tr>
<td>Limestone</td>
<td>1%</td>
</tr>
<tr>
<td>Urea</td>
<td>2%</td>
</tr>
</tbody>
</table>

Body gain parameters measured every two weeks by scale (Avery -Made in England-000 kg by 1kg Divisons-Type 3205 COE -Number 563 F7728-6) subtracting the first weight from Next weight.

Feed conversion ratio: Feed conversion ratio was calculated by the following equation:

\[
\text{Feed conversion ratio} = \frac{\text{consumed feed weight in one week}}{\text{body gain weight in one week}}
\]

Statistical analysis used randomized block design to analyze an experiment data, to comparison between the three breeds and variance analysis to distinguish between breeds. And every significant difference between means used computerized software SPSS program version 15.

RESULTS AND DISCUSSIONS

Table 3. Effect of breed on average body gain every two weeks.

<table>
<thead>
<tr>
<th>Breeds</th>
<th>Measure</th>
<th>First Body gain</th>
<th>Second Body gain</th>
<th>Third Body gain</th>
<th>Total Body gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenana</td>
<td>7.00 ±3.29</td>
<td>11.7 ± 3.70</td>
<td>15.90 ± 3.14</td>
<td>35.6±5.20</td>
<td></td>
</tr>
<tr>
<td>Ambbroro</td>
<td>7.27 ±1.81</td>
<td>11.64 ± 2.04</td>
<td>17.67 ±1.73</td>
<td>35.06±2.86</td>
<td></td>
</tr>
<tr>
<td>Baggara</td>
<td>8.91 ±1.52</td>
<td>12.49 ±1.71</td>
<td>11.23 ±1.45</td>
<td>31.30±2.40</td>
<td></td>
</tr>
<tr>
<td>General mean</td>
<td>7.73</td>
<td>11.94</td>
<td>14.93</td>
<td>33.98</td>
<td></td>
</tr>
</tbody>
</table>

Significant levels p> 0.05 No sign. No sign. * No sign.

Notice; Table3. Numbers described a mean ± standard deviations
The 6th International Seminar on Tropical Animal Production
Integrated Approach in Developing Sustainable Tropical Animal Production
October 20-22, 2015, Yogyakarta, Indonesia

No sign. = No significant
* = significance at 0.05 level

**Table 4. The effect of breed on the average feed conversion ratio every two weeks**

<table>
<thead>
<tr>
<th>Breeds</th>
<th>Measure</th>
<th>First Body gain</th>
<th>Second Body gain</th>
<th>Third Body gain</th>
<th>Total Body gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenana</td>
<td></td>
<td>18.69 ± 7.55</td>
<td>9.11 ± 8.86</td>
<td>8.88 ± 7.05</td>
<td>12.22 ± 7.82</td>
</tr>
<tr>
<td>Ambroro</td>
<td></td>
<td>19.47 ± 4.15</td>
<td>22.29 ± 4.88</td>
<td>6.41 ± 3.88</td>
<td>16.05 ± 4.30</td>
</tr>
<tr>
<td>Baggara</td>
<td></td>
<td>23.56 ± 3.48</td>
<td>18.00 ± 4.09</td>
<td>17.93 ± 3.25</td>
<td>19.83 ± 3.60</td>
</tr>
<tr>
<td>General mean</td>
<td></td>
<td>20.66</td>
<td>16.47</td>
<td>11.07</td>
<td>16.03 ± 5.24</td>
</tr>
</tbody>
</table>

Significant levels
p > 0.05  No sign.  No sign.  No sign.

Notice; Table 4. Numbers described a mean ± standard deviations
No sign. = No significant

**Body gain**

Table 3 shows the effect of breed on body weight results shown that the first and second measurements from starting of the fattening period there were no significant differences between breeds, but in third observation Baggara breed has shown that biggest body gain than Kenana and Ambroro respectively at a significant difference level (P < 0.05) of the third measure, where the body gain of Ambroro breed is a highest (17.67 ± 1.73) kg (3th measure), Kenana (15.90 ± 3.14) and Baggara (11.23 ± 1.45) respectively. This results agreed with (Abu El azaim, 1996) that the Kenana breed had high ability body gain which is similar to Baggara breed and surpass them Baggara in feed conversion efficiency. As for the total body gain no significant differences between three breeds, whenever the general means of body gain is 33.98 kg at 45 days with average daily gain 750g per day.

**Feed conversion efficiency (FCE)**

Table 4. The effect of breed on the feed conversion ratio during the experimental period, The results shown that the first measurement from the beginning of the fattening period there were not significant differences between breeds. Kenana breed demonstrated higher feed conversion ratio than Ambroro breed (18.96 ± 7.55). In the second measurement also there was no significant difference (P > 0.05) in feed conversion ratio between breeds, but Kenana calves were the highest FCR than Baggara and Ambroro breeds: (9.11 ± 8.86), (18 ± 4.09) and (22.29 ± 4.88) respectively. In third measuring also there was no significant difference (P > 0.05) Ambroro breed was highest FCE than Kanana and Baggara breeds: 6.41 ± 3.88, 8.88 ± 7.05 and 17.93 ± 3.25 respectively. The general average of feed conversion ratio of three breeds 16.07 during fattening period, and the daily an average conversion ratio is 1.45, this result was not agreed with (Thissen et al, 1984) feed conversion efficiency it is between 5.52 to 13.41 of Sudanese beef cattle also FCR of Kenana was decreased at last experimental period than Baggara and Ambroro because it is best adaptable to environmental conditions than others breeds.
CONCLUSION

This study carried out to investigate body gain and feed conversion efficiency of three breeds of Sudanese cattle which demonstrated that Kenana calves had highest ability body gain and lowest FCR than Baggara and Ambmoro cattle.

ACKNOWLEDGEMENT

This study funded by family bank and administration of Omdurman Islamic university. The authors thank Dr. Mohammed Osman Esa, for helping to statistical analysis.

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Biosecurity Measurements in Poultry Farming System in Kuwait

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ABSTRACT: The poultry industry in Kuwait is one of the most important animal production industries and its sales value exceeds $70 million annually. Poultry is highly susceptible to disease outbreaks that may cause irreversible economical loses to the poultry industry. It is extremely important that poultry industry in Kuwait implement a comprehensive biosecurity program in their farms to ensure better quality production. Most of the poultry industries in the world have developed biosecurity measures to maintain the safety of poultry from biological hazards and be used for protection and disease control of the poultry. However, in many cases, these program measures including vaccination are not applied or followed properly because a comprehensive program usually is not in effect. During this one year study, a comprehensive biosecurity program was established. This program included international regulations related to biosecurity measures for poultry farms. One of the major poultry company was considered as a case study for the project. The results indicated that the company is implementing a biosecurity program in all farms. However, the company’s program was modified and improved using the update regulations and measures related to biosecurity program worldwide. In addition to the isolation, traffic control, and sanitation procedures, the biosecurity program contained recommendations of poultry biosecurity. These recommendations were divided into two sections. Section1: step-by-step follow tips, and Section 2: educational and warning biosecurity signs. It is important to follow all regulations recommended by the biosecurity program and implement them carefully in the farm to succeed in the protection from diseases.

Keywords: Biosecurity, Poultry, Kuwait, Farming systems

INTRODUCTION

Biosecurity is a term created out of a need to protect poultry from an intentional or unintentional threat of a biological agent. In other words, it means keeping the germs away from poultry and keeping the poultry away from germs. In addition, Cardona and Kuney (2001) and Woodger (2005) defined biosecurity as a set of practices designed to prevent disease causing organisms from coming in contact with resident birds on the farm. These practices, when followed correctly, will reduce the potential for the introduction and spread of disease causing organisms in the sites. Biosecurity is even more important today because of the crisis of the avian flu disease, which has been in the global news lately because of its seriousness. It has been reported that the financial loss in only one farm in Pennsylvania, USA, in 1997, due to the outbreak of avian influenza exceeded $344,000 (Davison et al., 1999). Furthermore, Winkel (1997) reported that the financial losses because of the lack of biosecurity is due to costs related to mortality, costs related to reduced production, costs of poor feed conversion and costs of treatment.

It is therefore clear that establishing a biosecurity program in any poultry farm is a must for the potential success and profitability of the poultry operation. It is the purpose of the present project to provide a detailed biosecurity program to be implemented first at KUPCO as a case study and based on the favored outcome of the program; the program can then be implemented in other poultry companies in Kuwait.
MATERIAL AND METHODS

The current project was implemented in cooperation with Kuwait Poultry Farm Company. The company participated in the project in an in-kind support in the form of facilities needed for the project implementation and some manpower assistance such as farm managers. The project consisted of mainly two tasks. The first task was assessment of the existing biosecurity in the company and the second task was on the development and application of a new company biosecurity program. The assignment included biosecurity rules and regulations available at the company, the status of isolations at the company, availability of security procedures for the different facilities, management procedures at Poultry Company, rodents and pest management control at the company, and sanitation and disinfection procedures. In addition the company’s records on diseases, poultry losses, and productivities were revived, different assessment and evaluation forms were developed for the broiler and hen-laying farms as for the hatcheries, slaughter house and other farm sites (Al-Saffar et al., 2006).

RESULT AND DISCUSSION

Based upon findings of task 1 and also on the fact that any general biosecurity program should include three major elements including isolation, traffic control, and sanitation (Cardona and Kuney, 2001; and Vaillancourt, 2001), a new biosecurity program was designed and developed specifically for poultry company with the cooperation of the decision makers of the company as well as with the company’s veterinarians to ensure the success of the program. This program included the establishment of rules and regulations for the following: farm management procedures including all practices related to poultry houses biosecurity, procedures established for the preparation of receiving new flocks, the use of all-in all-out practice, the staff management of people working in the poultry houses and other production facilities. In addition, isolation procedures including the confinement of the birds within a controlled environment, isolation of buildings by fencing, isolation of birds by age, were established. Traffic control procedures included the establishment of check-points for the visitors and the rules and regulations that must be applied by visitors who are allowed to visit any of the company’s facilities, control of any traffic into the farm and traffic patterns within the farm including movement of staff and workers. Sanitation and disinfection procedures included the measures used, the time and frequency of its use, disinfection of materials, people, and equipment in the farm and the cleanliness of the personnel on the farm.

Several meetings were held between the project leaders and the farm managers to discuss the application of the updated biosecurity program in the poultry company. In addition, a lecture was given to the general manger and production manager to discuss the biosecurity program at Poultry Company. Finally, in order to meet the objective of monitoring the applications of the development and modified biosecurity program, meetings with the poultry company management will be conducted to ensure the implementation of the new program.

CONCLUSIONS

Biosecurity program is an important practice to be used in all poultry farms in Kuwait for protection and disease control. As a result of the current project, a modified, improved and advanced biosecurity program was developed to be used at poultry company as well as at all poultry farms and poultry companies in Kuwait. In addition to the isolation, traffic control, and sanitation procedures, the biosecurity program contained recommendations of the poultry biosecurity.

Recommendations

These recommendations were divided into two sections. Section 1: step-by-step follow tips, and Section 2: educational and warning biosecurity signs. It is important to follow all regulations recommended by the biosecurity program and implement them carefully in the farm in order
to protect the farm from diseases. Biosecurity level should be strengthened in breeder farms and during disease outbreak. Finally, farm workers should be educated on the importance of the biosecurity programs and should be trained on the implementation of the program regulations.

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Effect of Mating and Polymorphism Insulin Like Growth Factor Binding Protein 2 Gene on Body Weight and Heritability of Kampung Chicken

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ABSTRACT: Insulin-like growth factor binding protein 2 (IGFBP 2) regulates a broad spectrum of biological activities involved in growth, development, and differentiation. Single nucleotide polymorphisms C1032T of IGFBP2 gene was used to genotyped parents and their progenies of Kampung chicken using PCR-RFLP method. Found 3 genotypes that were CC, CT and TT. Four pairs mating that were CC><CC (1), TT><CT (2), CT><CT (3), and CC><CT (4), were raised to produce their progenies. Then the progenies was raised until 12 week of age and weekly weighed individually. Weekly body weight was analized by analysed one way of variance, heritability and breding value was analyzed by formula of Falconer and MacKay (1997). The result showed that eventhough the weekly body weight inconsistency in weight gain but progeny of mating 3 and 4 had better body weight than progeny of mating 1 and 2. Weekly body weight heritability was low to high (0.013 - 0.681), moderate heritability was on age 2 week (0.446) and high heritability was on 12 week of age (0.681). Breeding values were gain wider with the increasing age. Progeny of mating number 1 and 2 showed slower growth rate than number 3, and the best growth rate was progeny of number 4 at periode 8 to 12 week age. It was concluded that IGFBP2 gene was associated with growth and parameter genetic in Kampung chicken.

Keywords: Kampung chicken, IGFBP2, body weight gain, heritability

INTRODUCTION

The Kampung chicken is not the pure native chicken, and is defined as the locally developed slow growing type of chicken. In Indonesia, Kampung chickens dominate meat type chicken market for decades. It raised around 10 – 12 week of age. The Kampung chicken have better resistance against heat stress and many diseases, and their eggs and meat possess better eating qualities. Growth performance of Indonesia Kampung Chicken is still low. Egg production around 25.32 – 28.85 %, egg weight 36.79-37.24 g, fertility 68.76-69.31 %, hatchability 48.91-26.56%, and weight of hatching egg is only 26.13-26.56 g (Sri-Sudaryati, 2010a).

The genes that are part of the somatotropic axis play a crucial role in the regulation of growth and development of chickens (Nie et al., 2005). The insulin-like-growth factor (IGF) system is well defined, with profound effects on the growth and differentiation of normal and malignant cells. In biological fluids, IGFs are normally bound to IGF-binding proteins (IGFBPs). (Hwa et al., 1999). The chicken IGFBP2 gene spans approximately 38 kb and is located on chromosome 7 (Schoen et al., 1995). It consists of 4 short exons and 3 long introns, encoding a 275-amino acid polypeptide hormone (Schoen et al., 1995), 289 amino acid and is regulated by growth hormones and the target tissue are liver, brain, lung, and kidney (Qin, 2010).

The genotype-phenotype association analysis showed that the difference induced by the haplotypes derived from the 5 SNP was more significant than that by the single SNP (Lei, 2005). Li et al. (2006) shown that chicken IGFBP2 gene intron 2 C1032T (accession number AY 326194)
polymorphism was associated with growth and body composition traits in an F2 population. Lei et al. (2005), Li et al. (2006), and Sri-Sudaryati (2014) used single nucleotide polymorphisms of C1032T of insulin-like growth factor binding protein 2 (IGFBP2) gene to genotype Kampung chickens by PCR-RFLP method.

The study was to know the effect of mating based on genotyped to study on growth and weekly growth heritability.

MATERIALS AND METHODS

Studied previously (Sri-Sudaryati et al, 2010b) had done successfully to genotyped the C1032T SNP in intron 2 of Kampung chicken IGFBP2 gene using PCR-RFLP method. The digestion of the PCR product of C1032T gave rise to restricted patterns namely CC (477 bp), CT (477/527 bp) and TT (527 bp).

Four males and 12 females which were genotyped IGFBP2 gene were used in this experiment. Four mating pairs based upon genotyped by polymorphism insulin-like growth factor binding protein 2 (IGFBP2) gene of Kampung chicken were used to produce generation 2. Three females were kept with one female per a litter house for ease of parent identification. The mating pairs were: 1. CC><CC, 2. TT><CT, 3. CT><CT, and 4. CC><CT. During 0-6 week of age, the chicken were fed by commercial broiler feed contain 21% CP and ME 3.200 kcal/kg, and then changed with Kampung feed until the bird reach 12 week of age. Kampung chicken contains 13% CP and 2.150 kcal/kg ME. Body weights of the progeny were taken at day 0 (hatching) and at the end of every week. Birds were individually weighed in order to determine their relative growth (RG) as RG = 100 × \( \frac{G2 - G1}{\sigma^2} \) (deSmit, 2005). G1 is outset body weight and G2 is the latest body weight. Relative growth were taken 0-4, 4-8, and 8-12 weeks periodically.

Body weight and RG were analyzed by one way analysis of Varian (Kaps and Lamberson, 2004). Genetic parameter such as heritability and breeding value were estimated by Falconer and MacKay (1997). \( h^2 = \frac{\sigma^2_s}{\sigma^2_s + \sigma^2_w} \), \( h^2 \) is heritability, \( \sigma^2_s \) is sire component variance, \( \sigma^2_w \) is waste component variance. Coefficient Breeding value of each sire was calculated by equation, \( I = \frac{0.25 \times Z_n h^2}{1 + (0.25 \times \frac{h^2}{1-n}) h^2} \) where I is coefficient breeding value, n is total progeny, and \( h^2 \) is heritability.

Blood sample of progeny from mating pairs number 2,3, and 4 were taken to identified genotyped by polymorphism IGFBP2 gen in order to evaluate the association between genotyped and body weight, RG and sex.

RESULTS AND DISCUSSION

The PCR-RFLP method was developed successfully for genotyping the C1032T SNP in intron 2 of the chicken IGFBP2 gene. From the mating TT><CT produced 45 progeny, and 16 females and 6 males was chosen randomly to be identified polymorphism IGFBP2. The mating CT><CT produced 59 progeny, 19 females and 5 males of them were identified too. The mating CC><CT produced 50 progeny and 16 females and 8 males of them were successfully screened. Mating betweeen CC><CC was not screened and had 75 progeny. Three genotypes were detected and defined as CC, CT, and TT.

Progeny body weight (Table 1) were differ at 0, 2, 6, 10 and 12 week old. Body weight at one day old chick showed that progeny from mating 1 and 4 were lower than 2 and 3, but at one week old changed become 1 and 3 were lower than 2 and 4, and the highest was number 4. The lowest
weight at three week of age was the progeny of mating number 3. Inconsistensi of body weight was done until the chicken reach 12 week of age. Overall body weight gain of mating number 3 and 4 were better than mating number 1 and 2. All progeny of mating number 1 were all CC genotypes, whereas progeny of mating number 2 were CT and TT genotypes. Progeny of mating number 3 had 3 genotypes and progeny of mating 4 had CC and CT genotypes. The inconsistency of body weight gain of all the mating pairs may be because the effect of allele, genotype, alleles and genotypes frequencies or may be because the diversity of Kampung chicken was very high.

### Table 1. Weekly body weight (g/bird) and heritability ($h^2$)

<table>
<thead>
<tr>
<th>Age, wks</th>
<th>CC&gt;&lt;CC (n=75)</th>
<th>TT&gt;&lt;CT (n=45)</th>
<th>CT&gt;&lt;CT (n=59)</th>
<th>CC&gt;&lt;CT (n=50)</th>
<th>$h^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>22.52±2.32</td>
<td>23.67±2.99</td>
<td>23.58±2.36</td>
<td>22.98±2.77</td>
<td>0.270</td>
</tr>
<tr>
<td>2</td>
<td>67.86±13.59</td>
<td>70.29±9.19</td>
<td>61.69±13.54</td>
<td>72.72±11.69</td>
<td>0.446</td>
</tr>
<tr>
<td>4</td>
<td>177.50±26.58</td>
<td>178.07±21.97</td>
<td>186.02±35.95</td>
<td>182.98±25.96</td>
<td>0.016</td>
</tr>
<tr>
<td>6</td>
<td>325.12±46.61</td>
<td>293.67±49.43</td>
<td>314.68±74.35</td>
<td>314.58±49.15</td>
<td>0.132</td>
</tr>
<tr>
<td>8</td>
<td>452.05±68.70</td>
<td>440.76±55.77</td>
<td>471.95±75.26</td>
<td>456.58±56.30</td>
<td>0.073</td>
</tr>
<tr>
<td>10</td>
<td>516.67±74.95</td>
<td>515.62±54.34</td>
<td>547.71±69.04</td>
<td>544.58±62.06</td>
<td>0.183</td>
</tr>
<tr>
<td>12</td>
<td>646.00±89.40</td>
<td>614.53±71.80</td>
<td>690.10±81.12</td>
<td>708.86±92.51</td>
<td>0.681</td>
</tr>
</tbody>
</table>

a,b,c Means within a row with no common superscript are different (P≤0.05)
A,B,C Means within a row with no common superscript are different (P≤0.01)

The range value of body weight heritability from DOC until 12 week was 0.073 until 0.681. Moderate heritability value was at 2 week body weight (0.446) and the highest heritability value was when chicken reach 12 week old (0.681). Upper-low body weight heritability value was when chicken at 0, 2, and 9 week of age (0.202-0.270). The heritability value of native chicken either in Africa and Asia was low. Dana, et al (2010) reported that heritability of Ethiopian native chicken body weight at 6 week old was low (0.15±0.08) and medium value when hatch body weight (0.40±0.23). Santosh, et al (2012) reported that heritability of Indian native chicken of Aseel breed had heritability 0.3 and Kadaknath breed had heritability value 0.39. Heritability body weight value of Cameron native chicken according Manjeli, et al (2003) was 0.31±0.03 at hatch time, 4 week old was 0.35±0.03, and 8 week old was 0.34±0.05 and at 12 week old was 0.35±0.05.

### Table 2. Weekly breeding value

<table>
<thead>
<tr>
<th>Age, wks</th>
<th>CC&gt;&lt;CC (n=75)</th>
<th>TT&gt;&lt;CT (n=45)</th>
<th>CT&gt;&lt;CT (n=59)</th>
<th>CC&gt;&lt;CT (n=50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-11.01 to 9.26</td>
<td>-11.29 to 6.90</td>
<td>-8.38 to 6.90</td>
<td>-11.63 to 10.31</td>
</tr>
<tr>
<td>2</td>
<td>-73.87 to 67.15</td>
<td>-35.75 to 35.61</td>
<td>-67.04 to 49.25</td>
<td>-46.95 to 51.37</td>
</tr>
<tr>
<td>4</td>
<td>-32.20 to 32.33</td>
<td>-20.30 to 16.83</td>
<td>-31.21 to 42.11</td>
<td>-22.50 to 20.47</td>
</tr>
<tr>
<td>6</td>
<td>-181.61 to 151.03</td>
<td>-123.33 to 131.40</td>
<td>-201.61 to 296.13</td>
<td>-162.40 to 193.77</td>
</tr>
<tr>
<td>8</td>
<td>-191.95 to 183.70</td>
<td>-134.31 to 117.48</td>
<td>-191.00 to 175.44</td>
<td>-147.74 to 121.62</td>
</tr>
<tr>
<td>10</td>
<td>-212.00 to 293.17</td>
<td>-159.30 to 168.54</td>
<td>-293.49 to 232.32</td>
<td>-178.48 to 216.32</td>
</tr>
<tr>
<td>12</td>
<td>-364.33 to 424.43</td>
<td>-249.91 to 341.80</td>
<td>-452.70 to 245.47</td>
<td>-380.54 to 453.93</td>
</tr>
</tbody>
</table>
Breeding values range wider when chicken become older, and breeding value has correlation with heritability. Heritability at 2 week of age is higher than at 3 week of age, the breeding value at 2 week is better than at 3 week old. Individual chicken has own breeding value. The breeding value showed the expectation of progeny for the next future. Since highest heritability value happened at 12 week body weight, it had better chosen chicken with highest breeding value at 12 week old. The highest breeding value were progeny from 4, 1, 2, 3 respectively.

CONCLUSIONS

It conclued that weekly body weight progeny of mating CT><CT and CC><CT better than progeny of mating CC><CC and TT><CT. Heritability weekly body weight value was low at 3, 4, 5, 6, 7, 8,10, and 11 week old (0.013-0.183), upper-low at 0, 1, and 9 week old, moderate at 2 week of age and high at 12 week of age. Breeding value become wider range with the increasing age. Progeny of mating number 4 had the best growth rate, and all showed that native chicken had slow growth rate.

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The Residue Profile of Ciprofloxacin in Broiler Muscle and Liver

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ABSTRACT: The disadvantages of using antibiotic in broiler are the length of withdrawal time that cause loss production because of prolonged feed consumption and maintenance, and increase the risk of drug residue. The ciprofloxacin is a fluoroquinolone antibiotic that recommended in poultry therapy because of its effectiveness to gastrointestinal infection. This research focused on the residue left in broiler muscle and liver resulted from therapeutic application of ciprofloxacin. The experiment conducted to 30 days old of broiler (n = 28) that received the single dose of 50 mg/kg body weight ciprofloxacin intravenously, meanwhile 3 chickens as control did not inject. After drug injection, 3 chickens of each sampling interval were taken to be sacrificed and to collect the abdominal muscle and liver by necropsy procedure. The intervals collecting samples were h1, h8, d1, d3, d5 and d7 after injection. The abdominal muscle and liver were minced, homogenized and extracted, then analyzed using high performance liquid chromatography method. The results showed the fluctuated drug levels between intervals, both in muscle and liver. The drug residue level in liver was higher in all intervals compared to muscle. The drug levels in muscle and liver at intervals 1 hour until 7 days post injection were 1.64 ± 0.52 and 7.6 ± 0.60, 3.01 ± 0.06 and 7.15 ± 0.29, 1.31 ± 0.01 and 4.31 ± 0.23, 0.87 ± 0.06 and 7.78 ± 0.35, 1.21 ± 0.07 and 4.01 ± 0.27, 1.18 ± 0.08 and 5.56 ± 0.63 µg/g, respectively. All the levels for both tissues were still above the maximum residue limits according to Indonesian Standard (Standar Nasional Indonesia/SNI). It concluded to prolong the withdrawal time of ciprofloxacin application in broiler longer than 7 days, to achieve the safe product to consume.

Keywords: Ciprofloxacin Residue, Broiler, Muscle, Liver

INTRODUCTION

Ciprofloxacin (CIPF) in broiler management was registered under Indonesian agricultural ministry as much 20 commercial products (Anonymous, 2012). As the member of fluoroquinolone group such as enrofloxacin (ENF), the drug was applied intensively in domestic, aquiculture and farm animals for therapeutic purposes. In broiler management, CIPF was formed as metabolite of ENF beside the CIPF therapy applied itself. The drug is effectively against an aerobic negative bacteria, Brucella, Chlamydophylla, Mycobacterium and Mycoplasma (Maddison et al., 2008). The intracellular penetration of drug is similar as high as fluoroquinolone group that make the risk of residue of drug formed in tissues are potentially concerned.

Many researches had deducted to know the ENF residue formed in tissues of poultry and fish in Indonesia, but had not yet documented of CIPF in broiler. The infected Oreochromis niloticus with pathogenic bacteria were injected with therapeutic dose of ENF as 10 mg/kg of body weight by oral and muscually, and after four weeks the tissues still had the excess level of drug of maximum residue levels allowed (Aryanti, 2014). The pharmacokinetic profiles of ENF...
in broiler describe the long elimination of half-life in liver and muscles (209.54 and 266.13 h, respectively), which may results the longer withdrawal time of this compound (Ariyani, 2014). The liver and muscle seemed to be the organs that contain the higher ENF levels compare to others, such as blood or kidney. Antibiotic residue in edible animal tissues usually caused by the compound from therapeutic or feed additive agents. Drug residue in edible tissues caused liver, blood and kidney toxicities, allergy reaction, and gut micro flora population imbalance (Haagsma, 1988). The lack of withdrawal time knowing for many compounds also contributes to the residue issue. Many farmers had violated using antibiotic that generate the resistance or residue issue also. The Indonesian maximum limits residue of CIPF in edible tissues has not been established, so the limit was represented by the ENF limit, 0.01 µg/g. This experimentally study was performed to evaluate the CIPF level in broiler muscle and liver in several sampling intervals before it harvest to consumed.

**MATERIALS AND METHODS**

The 28 New Loghman broilers were maintained since 1- d old chicks, fed with standard feed and had vaccinated, for 30 days and gained at least 1 kg of body weight. The 50 mg/kg dose of CIPF (Tokyo chemical industry(TLI)/Japan) were injected intravenously via brachialis vein for all animals. The three animals were used as control and did not inject. The intervals for tissue collection were h1, h8, d 1, d 3, d 5 and d 7 after injection. For each interval the 3 broilers were taken and sacrificed to find the liver and abdominal muscle. The samples then miniced and homogenized, extracted 1 g with 2.5 mL 1% acetonitrile (1 mL anhydrous acetic acid in 100 mL acetonitrile), vortex for 5 minutes then centrifuged 3000 rpm for 5 minutes. Supernatant collected and evaporated with N2 gas. The dry residue then reinstituted with 1.5 mL of phosphate buffer pH 7.4 and 1 mL of hexane, vortex and centrifuged 3000 rpm for 10 minutes. The supernatant were taken, hexane was discharged. The supernatant then reinstituted again for three cycles, and the accumulated supernatant filtered with millipore filter 0.45µm, and kept in freezer until analysis.

The high performance liquid chromatography method had validated as the preliminary study. The results showed good linearity, precision, and accuracy to measure the CIPF in the liver and muscle. Limit of detection (LOD) and quantification (LOQ) were 0.005 and 0.01 µg/g, respectively. The HPLC equipment used was Shimadzu version 6.1 with Shimpack ODS column 5 µm of diameter 150 mm length, pump LC-10 Advp, detector UV SPD-10 A, controller system SCL-10 Avp, oven CTO-10 Avp, and degasser DGU-14. Volume samples injected in loop was 25 µL by microsyringe (SGE, Australia). Mobile phase used in analysis was phosphate buffer solution (0,68 mL of phosphoric acid 85% to 1 L of aquabidest, adjusted pH 3 with triethylamine) and acetonitrile ( 80:20 (v/v)) (Patriana, 1997). The adjusted flow rate was 1 mL/min, column temperature 30 °C and detected at ultra violet wavelength of 278 nm (E-Souza, 2002). The level of drug measured as peak area at certain retention time of chromatogram compare to standard curve of CIPF that validated at preliminary study.

**RESULTS AND DISCUSSION**

The peak area of CIPF has detected clearly and not overlaps with other peak at 2.8 – 3.0 minute. Drug level measured with standard curve of CIPF and gives the results as mention in Table 1.
Table 1. The residue of CIPF in liver and muscle of broiler after single dose of 50 mg/kg of body weight intravenously

<table>
<thead>
<tr>
<th>sampling intervals (after drug injection)</th>
<th>concentration (µg/g) (mean±sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>muscle</td>
</tr>
<tr>
<td>h1</td>
<td>1.64 ± 0.52</td>
</tr>
<tr>
<td>h8</td>
<td>3.01 ± 0.06</td>
</tr>
<tr>
<td>d 1</td>
<td>1.31 ± 0.01</td>
</tr>
<tr>
<td>d 3</td>
<td>0.87 ± 0.06</td>
</tr>
<tr>
<td>d 5</td>
<td>1.21 ± 0.07</td>
</tr>
<tr>
<td>d 7</td>
<td>1.18 ± 0.08</td>
</tr>
</tbody>
</table>

h = hour, d = day

All the residue levels show the higher values in liver compared to muscle. This may reflect the metabolism site of the drug majorly occurring in the liver. As described by Anandon et al. (2001), the intravenous application of CIPF gave a fast distribution phase and a slowly elimination rate. Based on the volume of distribution and half-life of the drug, it showed that CIPF was easily penetrated into tissues and the elimination rate values in broiler were longer than other species. The perfusion rate of the liver is better than muscle, which leads more drug to the liver following blood flow. Ariyati (2014) stated that after 7 days post injection ENF intravenously with the same dose, the residue level in muscle and liver was 0.27±0.13 and 1.67±0.37 µg/g, respectively. As the metabolite of ENR, CIPF was found in the liver and has the same bacterial activity as ENF. The residue of CIPF in the liver or muscle (Table 1) was higher than prior research, which may indicate the elimination rate of CIPF was slower than ENF in broiler. At the end of the experiment day, it has not been seen the significantly tendency of decreasing curve although the maximum concentration of CIPF has been achieved at 8 h and d3 after injection for muscle and liver, respectively.

Figure 1. The residue profile of CIPF in liver and muscle after single dose of 50 mg/kg of body weight intravenously

Figure 1 shows the fluctuating concentration of CIPF in the liver and muscle. It seems that the elimination phase of the drug has not been achieved yet, which may be caused by the high dose given. Otherwise, the dose had been used in the research of ENF residue in broiler by Widiastuti (2008).
and Randall et al. (2006), whose were mentioned the dose had good efficacy and antibacterial action. The dose was well tolerated by broiler, that implied with no clinically abnormal or toxicity signs showed during the experiment.

The concerning of using antibiotic in production animals is the residue that may contain in the product. The withdrawal time is the time required after administration of a drug to an animals needed to assure that drug residues in the marketable product is below a determined maximum residue limit (MRL). The pharmacokinetic parameters relatively explain to this term is elimination phase that are half-life or clearance of drug. As it seen at the Figure, the elimination phase (long decreased outline-curve) has no appeared, and the levels of drug in all sampling intervals are still above the MRL (0.01µg/g) for both tissues. It concluded that need longer time to reach the time that assure the drug has no harm effect when it consume. There is no exactly period consideration for withdrawal time, as long the dose and duration of time of therapy was emphasize to eradicate the infection instead of the safe of product. It would take several days until a month to wait the safety product to consume. Chang et al.(2009) explained that either high or repeated dose of drug cause the residue in tissues that will remain for a long time, so that it have to extend the withdrawal time. The residue profile of CIPF reflects the high residue level either in muscle and liver in broiler that may need a maximum residue limit for CIPF to be established. Otherwise the application of drug including the dose, duration and administration for therapeutic purpose has to be considering.

**CONCLUSIONS**

The application of high therapeutic single dose of ciprofloxacin in broiler cause the high level of drug left in muscle and liver. The residue profile showed the fluctuating and high level of drug until seven days post injection. The residue may harm and hazardous, so it needs to be considering the application of drug for therapeutic purposes for yield the safe product to consume. The application of dose of 50 mg/kg body weight in broiler cause the residue as high as 1.18±0.08 and 5.56±0.63 µg/g in muscle and liver at d 7 post injection, respectively. These levels are still above the maximum residue limit for enrofloxacin 0.01 µg/g according to Indonesia National Standard.

**REFERENCES**


Selection for 10 Weeks Old Body-Weight on Sentul Chicken

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ABSTRACT: Sentul chicken is native chicken breed originally from Ciamis district, West Jawa. It has been a dual purpose breed which had legally claimed (decree by Minister of Agriculture of the Republic of Indonesia, No. 698/Kpts/PD.140/2/2013, 13th of February 2013) as one of the native breeds identified in Indonesian. Selection on to this breed has been done for three generations with selection criteria of male 10 weeks old body weight. Selection intensity was 25% of the highest body weight. About 500 chicks were hatched per generation per line. The birds were raised intensively under optimum ration. Results showed that there were Grey- and White-lines. The average predicted response of selection based on differential and intensity selection of the grey-line male chicken were 25.55 and 37.41 g/generation, respectively. While actual and realized responses were 43.50 and 55.33 g/generation, respectively. The average predicted response of selection based on differential and intensity selection of the white-line male were of 30.23 and 40.94 g/generation, respectively, whilst predicted responses with the actual and realized responses were 38.50 and 55.33 g/generation. This exercise showed some potential benefits of local chicken, which could be further valuable explored.

Keywords: Sentul-chicken, selection, body-weight

INTRODUCTION

Along with the increasing effort of chicken farmers as a response to increasing national native-chicken meat demand (Febroni et al., 2015), Sentul chicken was chosen to be one of indigenous breeds to be selected as meat type chicken. Sentul chicken was obtained from Ciamis district, West Java province. This indigenous breed was claimed legally as a breed of Indonesian chicken, decreed by Ministry of Agriculture of The Republic of Indonesia No. No. 698/Kpts/PD.140/2/2013, 13th of February 2013.

Selection of Sentul chicken for 10 week body weight has been begun in 2010. The selection has been carried out in the Indonesian Research Institute for Animal Production (IRIAP). The aim of selection was to improve the growth of selected Sentul chicken to meet market weight of the average of 800 – 1000 gram/bird by the age of 10 weeks. The selected Sentul chicken was named as SenSi (Sentul selekSi). The paper presented information on the selection responses of SenSi chicken up to third generations.

MATERIALS AND METHODS

There were about of bird population up to average of 200 hens and 50 cocks per line (Grey and White lines, Iskandar et al., 2012) in every generation, mated artificially and selected for three generations. Along with selected lines for two generations, there was a group of control population. In the third generation, the raising of the control population was terminated due to the insufficient available cages. Sex identification was carried out when the young chicken reached six weeks of age. Every individual chick was marked with numbered wing-band accordingly to
the lines it belonged.

The one day old chicken (doc) were vaccinated with Marek’s right away and followed with other health program similar to the health program applied to commercial egg type of modern chicken. The individual doc was then weighed. About 500 docs of each line for three generations were raised up to 10 weeks of age under intensive management. The birds were confined in space-sufficient wire-cages, placed in a concrete building provided with sufficient ventilation, room temperature and light.

The chicken were fed diets of 17% crude protein with 2800 kcal ME/kg containing sufficient nutrients required for growing egg type of modern chicken. Feed and drinking water were served ad libitum.

At the age of 10 weeks, selection for body weight was applied to male chicken only. Selection intensity was 25% of the highest live body weight following the selection for plumage. The different plumage other then grey or white were discard and cockerels with single comb, were also discards. The selected chicks were then moved to litter type of confinement up to the age of 16 weeks and they were moved again to individual cages. Artificial insemination was applied to within the same line with mating ratio of one male to four females. The eggs were then incubated weekly in the automatic hatching machine. This breeding procedure was applied to every generation.

Response to selection was calculated following equations: i) Predicted response (R) which was calculated base on selection differential, \( R= h^2S \); where \( h^2 \) = heredity value; \( S \) = the different value between average population and selected population; ii) Predicted response calculated base on selection intensity, \( R= ih^2\sigma_p \), \( i \) = selection intensity (25%), where \( h^2 \) = heredity value, \( \sigma_p \) = table value of truncated normal distribution (1.271); iii) Actual response to selection, \( R \) = different between selected and control population; iv) Realized response to selection, \( R \) = different between one generation to another. The average heritability was calculated by following formula suggested by Becker (1992).

RESULTS AND DISCUSSION

Body weight response to selection for 10 weeks-old male’s body weight in Table 1, showed that predicted responses were lower than actual or realized responses. The average predicted response of selection based on differential and intensity selection of male chicken were 25.55 and 37.41 g/generation for Grey-SenSi. The average predicted response of selection based on differential and intensity selection of White-SenSi, were 30.23 and 40.94 g/generation, respectively.

Actual and realized response to selection of both lines showed higher value than the predicted responses (Table 2). The grey-line showed the actual and realized response to 10 weeks old body weight selection of 43.50 and 55.33 g/generation, respectively. The White-SenSi showed almost similar to the values of Grey-SenSi. The actual and realized response to 10 weeks old body weight selection of White-SenSi was 38.50 and 55.33 g/generation.

The body weight achievement in this experiment was actually very much lower than that of reported by Larivière et al. (2009) in Ardennaise-Belgium traditional chicken selected for 11 weeks old body weight. The predicted responses, which were lower than actual responses was due to fluctuation in responses from one generation to another as it was influenced by the instable environment condition. Newcastle disease outbreak in third generation killed about 60% of population, which could removed some chicken those had more weight. Climate changing within year was also affecting chicken performance from one generation to the next. However, as the aim of the selection program to produce improved native chicken, the last generation of the lines would be expected to have the best performance.
Table 1. Predicted selection response of 10 week body-weight of male Grey-and White-SenSi chicken calculated based on selection differential and intensity (25%)

<table>
<thead>
<tr>
<th>Lines</th>
<th>Generation</th>
<th>Average population 10-weeks body-weight (g/bird)</th>
<th>Selected population 10-weeks body-weight (g/bird)</th>
<th>Selection differential (g/bird)</th>
<th>Standard deviation (g/bird)</th>
<th>$h^2$ value</th>
<th>Selection Response Calculated by Selection differential (g/bird)</th>
<th>Calculate by Selection intensity (g/bird)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grey</td>
<td>Base</td>
<td>801</td>
<td>957</td>
<td>156</td>
<td>68</td>
<td>0.24</td>
<td>37.13</td>
<td>20.57</td>
</tr>
<tr>
<td></td>
<td>First</td>
<td>724</td>
<td>886</td>
<td>162</td>
<td>132</td>
<td>0.24</td>
<td>38.56</td>
<td>39.93</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>940</td>
<td>1067</td>
<td>127</td>
<td>158</td>
<td>0.24</td>
<td>30.23</td>
<td>47.79</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>967</td>
<td>1000</td>
<td>81</td>
<td>81</td>
<td>0.24</td>
<td>7.85</td>
<td>24.50</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25.55</td>
<td>37.41</td>
</tr>
<tr>
<td>White</td>
<td>Base</td>
<td>801</td>
<td>708</td>
<td>93</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>First</td>
<td>707</td>
<td>874</td>
<td>167</td>
<td>134</td>
<td>0.24</td>
<td>39.75</td>
<td>40.53</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>947</td>
<td>1110</td>
<td>163</td>
<td>149</td>
<td>0.24</td>
<td>38.79</td>
<td>45.07</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>944</td>
<td>995</td>
<td>11</td>
<td>123</td>
<td>0.24</td>
<td>12.14</td>
<td>37.21</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30.23</td>
<td>40.94</td>
</tr>
</tbody>
</table>

The average of body weight of male SenSi chicken reached the market weight (Febroni et al., 2015) with slight high in standard of deviation, showing slight instability between generations.

Table 2. Actual and realized selection response of 10 week body-weight of male Grey-and White-SenSi chicken

<table>
<thead>
<tr>
<th>Lines</th>
<th>Generation</th>
<th>Selected population 10-weeks body-weight (g/bird)</th>
<th>Control population 10-weeks body-weight (g/bird)</th>
<th>Actual selection response (g/bird)</th>
<th>Realized selection response (g/bird)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grey</td>
<td>Base</td>
<td>801</td>
<td>708</td>
<td>-41</td>
<td>-77</td>
</tr>
<tr>
<td></td>
<td>First</td>
<td>724</td>
<td>765</td>
<td>-58</td>
<td>-94</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>940</td>
<td>812</td>
<td>128</td>
<td>216</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>967</td>
<td>27</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
<td></td>
<td>43.50</td>
<td>55.33</td>
</tr>
<tr>
<td>White</td>
<td>Base</td>
<td>801</td>
<td>708</td>
<td>-58</td>
<td>-94</td>
</tr>
<tr>
<td></td>
<td>First</td>
<td>707</td>
<td>765</td>
<td>-58</td>
<td>-94</td>
</tr>
<tr>
<td></td>
<td>Second</td>
<td>947</td>
<td>812</td>
<td>135</td>
<td>240</td>
</tr>
<tr>
<td></td>
<td>Third</td>
<td>944</td>
<td></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
<td></td>
<td>38.50</td>
<td>55.33</td>
</tr>
</tbody>
</table>

The similar analysis was also used to evaluate response to selection on population of male White-SenSi and the result showed the similar pattern with slight lower body weight response.
Heritability value as calculated from actual data of the second generation of 0.24±0.13 was actually lower than heritability estimates of native large Beladi chicken (0.41±0.20 of Khalid et al., 2012) but similar to Iranian native fowl (0.24±0.01 of Shalehinasab et al., 2013) and Ardennaise-Belgium traditional chicken (0.29±0.13 of Larivière et al. 2009).

CONCLUSIONS

There were two lines of Sentul chicken breed, selected for 10 weeks old body weight, prepared for further selection to produce improved native SenSi (as a name for the lines) chicken for meat type. The lines were Grey-SenSi and White-SenSi. The selection criterion was 25% of the highest male’s 10 week body weight in the population in each generation.

The average predicted response of selection based on differential and intensity selection of the male Grey-SenSi chicken were 25.55 and 37.41 g/generation, respectively. While actual and realized responses were 43.50 and 55.33 g/generation, respectively. In the male White-SenSi showed the values of 30.23 and 40.94 g/generation, respectively for predicted responses calculated based on differential and selection intensity. Actual and realized responses of the male White-SenSi, were 38.50 and 55.33 g/generation, respectively.

REFERENCES

Analysis of Reproductive Potential and Hatchability of Naked Neck and Normal Hens

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ABSTRACT: The difference between a feather conditions, namely naked neck and normal feathered in chicken gives the qualitatively genetic differences by Na gene and its allele na. This study was conducted to analyze the relationship between the condition of the feather and of reproductive potential. Five males of Naked neck, each paired with four females of Naked neck and two females of Normal. Production of eggs from each female were collected and then incubated, to studies the reproductive potential through egg fertility and hatchability. Completely randomized designs by the variance analysis were used to determine the effects of the feather conditions, and the hierarchical analysis of variance was to determine of the genetic potential. The results showed that the feather conditions did not significantly affect the egg production. The fertility of naked neck chicken (95.72±03.88%) was significantly higher (P<0.05) than normal chicken (92.67±10.61%) and the hatchability of naked neck chicken (73.69±21.69%) was significantly lower (P<0.05) than normal chicken (83.76±04.84 %). Embryo mortality of naked neck chicken (19.85±11.04%) was significantly higher (P<0.05) than normal chickens (17.97±11.50%). Eggs weight and doc weight did not show a significant difference. Heritability of egg weight in chickens was low (h² = 0.07), and the repeatability (R = 0.69) was quite high. The heritability of doc was underestimated (h² = -0.19), although the repeatability was still high (R = 0.59).

Keywords: Naked Neck and Normal Native Chicken, production, reproduction, repeatability and heritability.

INTRODUCTION

Local chicken (Native Chicken) is a native Indonesian germplasm assets are very valuable. Its presence there was almost total throughout the countryside in Indonesia. Experts agree that today’s modern chickens (layers and broilers) is a descendant of the red jungle fowl (Gallus Gallus gallus = bankiva) that originating from Southeast Asia (Scannes et al. 2004; North, 1984), and some experts said that since 5000 years BC domestication process had begun in Indonesia (Abelien, 1986 cit. Sidadolog, 2011). Local chickens grow and develop in according to the process of adaptation to the environment. Domestication process resulted in some changes morphologic as a result of natural selection to survive in harsh environments. The change caused of a very extensive phenotypic diversity and the ranging of the difference in weight, production and reproduction until the coat color and body as well as the shape and the structure of the body. The variation of local chickens became so widespread, for example in the form and body size, shape of comb, color, growth and spread of coat color.

One variation that is often found in the critical and hot conditions was the lake of feather growth on the neck, which was then referred to the Naked Neck Fowl. The naked neck feathered is a genetic trait controlled by autosomal genes Na-, as a dominant against its allele na (Devenport, 1914 cit. Rajkumar et al. 2009). Naked neck trait was inherited to the offspring with proportions
according to Mendel ratio. Allegedly the gene of naked neck was gene mutation that took place in the evolution of process that becoming immortal trait. It is a process of mutation experienced by local chicken (Schmitten, 1989 cit. Sidadolog, 1991). In tropical areas such as Indonesia, where the conditions of temperature and humidity was high and also coupled with the existence of climate change, especially the temperature variation is responsible for the decreased productivity and increased stress (Yuwanta et al., 1983; Yuwanta, 1999), reduced reproductive efficiency, decreased immune resistance (Rajkumar et al., 2011). Patra et al., (2002) stated that the Naked Neck were more tolerant to heat stress than the normal feathered chicken, because the exhaust heat can take place better. Decreasing of mass of fur will increase the effective of surface area of the body for heat dissipation and simultaneously improve the heat dissipation through the area around the neck. The positive effect on the mechanisms of body thermoregulation was to improve heat dissipation through the skin (Sidadolog, 1991) and possibly also have an effect on reproductive ability and hatching results. Research was studying the genetic aspects of the role of heredity in reproducing ability and results in chickens hatching naked neck.

**MATERIAL AND METHOD**

This experiment were conducted with adult local native naked neck and normal feathered chickens, that all chicken used is the adult chicken with a lifespan of more than eight months, and are ready to spawn. Five males naked neck were paired with four females of naked neck and two females of normal, respectively, to produce chicks as next generations. Total hens needed were twenty naked neck and ten normal feathers hens. Each mating group was reared in five pen-floor stalls with trap-nested to make a simple identification of produced eggs and chicken. All chickens were fed by commercial feed as in followed table 1.

<table>
<thead>
<tr>
<th>Feed</th>
<th>Water (max. %)</th>
<th>Protein (% min.)</th>
<th>Fat (max. %)</th>
<th>Fiber (max. %)</th>
<th>Ash (min. %)</th>
<th>Ca. (min. %)</th>
<th>P. (min. %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parents</td>
<td>13.00</td>
<td>17.0-18.0</td>
<td>4.00</td>
<td>6.00</td>
<td>12.00</td>
<td>3.70</td>
<td>0.60</td>
</tr>
<tr>
<td>Chicks</td>
<td>13.00</td>
<td>19.0-21.0</td>
<td>3.00</td>
<td>5.00</td>
<td>7.00</td>
<td>0.90</td>
<td>0.60</td>
</tr>
</tbody>
</table>

Sperms of male naked neck were collected periodically four weeks to measure volume and concentration, and also from normal feathered as comparative things. Eggs production were collected as hatching eggs every day and hatched weekly to produce day old chicks and to measure fertility and hatchability of naked neck and normal feathered hens. Data with relating to production, reproduction and hatching results were analyzed by variance analysis with mathematical-statistical model:

\[ Y_{ijk} = \mu + G_i + F_j + GFi_j + e_{ijk} \]

Where, \( Y_{ijk} \) is the observation data, \( \mu \) is the average data, \( G_i \) is the effects of group mating \( I (=1,2,3,4 \text{ and } 5) \), \( F_j \) is the effects of feather condition \( J (=1, 2) \), \( GFi_j \) is the interaction of group mating \( i \) and feather condition \( j \), and \( e_{ijk} \) is the individual error.

To estimate the heritability and the repeatability were used the hierarchical analysis of variance with mathematical-statistical model as:

\[ Y_{ijk} = \mu + M_i + Fi:j + e_{ijk} \]
Where, $Y_{ijk}$ is the observation data, $\mu$ is the average, $M_i$ is the effect of male $i$, $F_{ij}$ is the effect of female $j$ within male $i$, and $e_{ijk}$ is the individual error. Based on this analysis were followed the estimation of variance components of $\sigma^2$ male ($\sigma^2\delta$), $\sigma^2$ female ($\sigma^2\varphi$), $\sigma^2\epsilon$ and $\sigma^2\text{Total}$.

**RESULT AND DISCUSSION**

The chicken paired with a ratio of one male to six females, respectively, have a body weight data can be seen in table 2. The average body weight of male was 2.319 g with deviation standard of 388.23 g. The weight of naked neck hens was 1.522 ± 235.75 g was lighter than normal hens (1.696 ± 290.14 g), but both of hens group was not different significantly.

**Table 2.** The average of body weight (g/bird) of males and females based chicken feather condition

<table>
<thead>
<tr>
<th>Body Weight</th>
<th>Numbers</th>
<th>Naked Neck $x \pm sd$</th>
<th>Normal feathers $x \pm sd$</th>
<th>Population $x \pm sd$</th>
<th>Stat.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>5</td>
<td>2.319 ± 388.23</td>
<td>-</td>
<td>2.319 ± 388.23</td>
<td>ns</td>
</tr>
<tr>
<td>Female</td>
<td>30</td>
<td>1.522 ± 235.75</td>
<td>1.696 ± 290.14</td>
<td>1.609 ± 274.42</td>
<td>ns</td>
</tr>
</tbody>
</table>

$ns = $ statistically not significant

The sperm production of naked neck cocks (table 3) was higher in volume (0.52 ml/bird) and concentration (1.95%) than in normal feathers, 0.32 ml/bird and 1.53%, respectively, but the difference was not significantly.

**Table 3.** Sperms quality of naked neck and normal cock

<table>
<thead>
<tr>
<th>Males</th>
<th>Sperm Volume (ml/bird)</th>
<th>Sperm Concentration (%)</th>
<th>Stat.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naked neck</td>
<td>0.52 ± 0.17</td>
<td>1.95 ± 0.85</td>
<td>ns</td>
</tr>
<tr>
<td>Normal feathers</td>
<td>0.32 ± 0.28</td>
<td>1.53 ± 0.95</td>
<td></td>
</tr>
</tbody>
</table>

The egg production between naked neck and normal feathered did not show the significant difference in the overall population, although the variations tended to be different for each mating group. The egg production of both feather condition was high, 40.91 ± 5.38% in naked neck and 49.93 ± 11.37% in normal feathered. Naked neck hens shown more uniform homogeneous in production (13.15%) compared to normal feathered (22.77%). These results have not been consistent with the results of research conducted by El-Safty et al. (2006) which states that egg production of naked neck chicken was higher than normal feathered, especially in the tropical environments. While the sperm volume and concentration of naked neck was higher than normal feathered cock (table. 2), then it was seen that the egg fertility of naked neck chicken (95.72 ± 3.88%) was significantly higher (P<0.05) than normal feathered hens (92.67 ± 10.61%), In other site, the hatchability of normal feathered (83.76 ± 4.84%) was also significantly higher (P<0.05) than naked neck hens (73.69 ± 21.69). This statement was consistent with previous studies (Sidadolog, 1992; Rahayu, 2000). It was caused of the embryo mortality in naked neck hens (19.85±11.04%) was also significantly higher (P<0.05) than normal feathered hens (17.97±11.50%). Egg production, egg fertility and sperm volume and concentration were better at naked neck chickens showed that the gene $Na$ on naked neck chicken have a positive influence on the production and reproduction in chickens. The egg weight of naked neck and normal feathered chicken were 42.35 ± 4.08 g
and 42.66 ± 4.70 g and doc weight were 28.46±2.96 and 28.35±3.34 g, respectively, were not significantly different.

Table 4. Production of eggs, hatching eggs, fertility, hatchability and quality hatching chickens naked neck and normal females during 75 days of observation.

<table>
<thead>
<tr>
<th>Mating Group</th>
<th>Male</th>
<th>Female (n)</th>
<th>Egg Production (%)</th>
<th>Egg Fertility (%)</th>
<th>Hatchability (%)</th>
<th>Embryo Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naked Neck 1</td>
<td>Naked Neck</td>
<td>2</td>
<td>36.67±10.11</td>
<td>100.00±0.0</td>
<td>35.71±50.51</td>
<td>-</td>
</tr>
<tr>
<td>Neck 2</td>
<td>Normal</td>
<td>2</td>
<td>38.00±21.92</td>
<td>100.00±0.0</td>
<td>87.50±17.68</td>
<td>-</td>
</tr>
<tr>
<td>Naked Neck 2</td>
<td>Naked Neck</td>
<td>4</td>
<td>42.67±12.36</td>
<td>95.50±5.26</td>
<td>84.21±17.52</td>
<td>-</td>
</tr>
<tr>
<td>Neck 3</td>
<td>Normal</td>
<td>2</td>
<td>34.67±2.83</td>
<td>95.83±0.25</td>
<td>80.49±1.87</td>
<td>-</td>
</tr>
<tr>
<td>Naked Neck 3</td>
<td>Naked Neck</td>
<td>3</td>
<td>48.89±3.06</td>
<td>98.99±1.75</td>
<td>81.01±2.09</td>
<td>-</td>
</tr>
<tr>
<td>Neck 4</td>
<td>Normal</td>
<td>1</td>
<td>60.00±0.00</td>
<td>97.30±0.00</td>
<td>88.89±0.00</td>
<td>-</td>
</tr>
<tr>
<td>Naked Neck 4</td>
<td>Naked Neck</td>
<td>4</td>
<td>41.00±7.80</td>
<td>90.57±4.94</td>
<td>77.78±11.35</td>
<td>-</td>
</tr>
<tr>
<td>Neck 5</td>
<td>Normal</td>
<td>2</td>
<td>30.67±11.31</td>
<td>96.30±5.24</td>
<td>84.67±12.26</td>
<td>-</td>
</tr>
<tr>
<td>Naked Neck 5</td>
<td>Naked Neck</td>
<td>3</td>
<td>35.33±10.61</td>
<td>93.54±0.29</td>
<td>89.76±4.38</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>2</td>
<td>41.33±12.73</td>
<td>73.91±36.89</td>
<td>77.27±19.28</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>Naked Neck</td>
<td>19</td>
<td>40.91±05.38</td>
<td>95.72±03.88</td>
<td>73.69±21.69</td>
<td>19.85±11.04</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>9</td>
<td>40.93±11.37</td>
<td>92.67±10.61</td>
<td>83.76±04.84</td>
<td>17.97±11.50</td>
</tr>
</tbody>
</table>

ns. = not significant. Superscript a and b, shown the significant different by P<0.05.

Based on the mating group of naked neck x naked neck chicken and naked neck x normal feathered shown that the egg weight of the naked neck x naked neck (42.35 ± 4.08 g) was not significantly different from the egg weight naked neck x normal feathered (42.66 ± 4.70 g). These results differ from previous studies (Sidadolog, 1992) which found that egg weight of naked neck greater than egg weight normal feathered chicken.

Table 5. Egg Weight and DOC Weight (g) produced in mating of Naked Neck Males with Naked Neck and Normal Females for 75 days observation

<table>
<thead>
<tr>
<th>Item</th>
<th>Group Mating</th>
<th>Population</th>
<th>Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Egg weight</td>
<td>Naked(♂):Naked(♀)</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Numbers of females</td>
<td>(bird)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numbers of eggs</td>
<td>(stuck)</td>
<td>398</td>
<td>306</td>
</tr>
<tr>
<td>Egg weight average</td>
<td>(g/stuck.)</td>
<td>42.35 ± 4.08</td>
<td>42.66 ± 4.70</td>
</tr>
<tr>
<td>Heritability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h²(♂)</td>
<td></td>
<td>- 0.07</td>
<td>0.07</td>
</tr>
<tr>
<td>h²(♀)</td>
<td></td>
<td>2.52</td>
<td>0.49</td>
</tr>
<tr>
<td>h²(♂ + ♀)</td>
<td></td>
<td>1.22</td>
<td>0.28</td>
</tr>
</tbody>
</table>
The 6th International Seminar on Tropical Animal Production
Integrated Approach in Developing Sustainable Tropical Animal Production
October 20-22, 2015, Yogyakarta, Indonesia

<table>
<thead>
<tr>
<th>Repitability of Egg weight</th>
<th>VPñ/VP of Egg weight</th>
<th>B. Doc weight</th>
<th>Numbers of females (bird)</th>
<th>Number of DOC (bird)</th>
<th>Doc weight average (g)</th>
<th>Heritability</th>
<th>Repitability of doc weight (R)</th>
<th>VPñ/VP doc weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.60 ± 0.076</td>
<td>0.64</td>
<td></td>
<td>12</td>
<td>152</td>
<td>28.46±2.96</td>
<td>1.09</td>
<td>0.56 ± 0.112</td>
<td>0.60</td>
</tr>
<tr>
<td>0.77 ± 0.06</td>
<td>0.79</td>
<td></td>
<td>11</td>
<td>128</td>
<td>28.35±3.34</td>
<td>-0.33</td>
<td>0.65 ± 0.109</td>
<td>0.69</td>
</tr>
<tr>
<td>0.69 ± 0.07</td>
<td>0.72</td>
<td></td>
<td>23</td>
<td>280</td>
<td>28.41±3.13</td>
<td>-0.19</td>
<td>0.59 ± 0.08</td>
<td>0.63</td>
</tr>
</tbody>
</table>

♂= male, ♀ = female
ns. = not significant

Heritability (h²) of egg weight was low (0.07) in all populations, and in the group of naked neck x naked neck (-0.07) and in the group of naked neck x normal feathered (0.07). This was supported by the high appearance of dominant genes by heritability in h²(♀), for group naked neck x naked neck was over estimate (2.52) and the group naked neck x normal feathered was high (0.48). Repeatability value of egg weight was indicating a high value of 0.60 ± 0.076 in group of naked neck x naked neck, and 0.77 ± 0.06 in the group of naked neck x normal feathered and 0.69 ± 0.065 for all of population. This value illustrated that the genetic potential egg weight is high.

The average of doc weight from naked neck x naked neck and the naked neck x normal feathered were not significantly different. These were 28.46±2.96 g and 28.35±3.34 g, respectively. The heritability of doc weight of naked neck x naked neck was over estimate of 1.09 and of naked neck x normal feathered was underestimate of -0.33. It shown that the effects of dominance gene for doc weight was high, as shown in the h²(♀) 0.99 and -2.49. The repeatability value of doc weight was still high, 0.56 ± 0.112 and 0.65 ± 0.109 respectively.

REFERENCES


Localization and Molecular Size of Mucin2 Glycoproteins Forming the Gut Mucosal Barrier in the Indonesian Indigenous Naked Neck and Normal Feathered Chickens

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ABSTRACT: The cecum of chicken gut may be more susceptible to pathogens because of colonization of microbes. Lower segment of gut is also the primary tissue where microorganisms may invade from external environment colonizing in the cloaca. Mucin composed of glycoproteins play significant roles in the barrier against infection on the mucosal surface. The aim of this study was to determine the differences in the mucosal barrier formation in the lower segment of gut between Indonesian naked neck and normal feathered chickens. The lower segments of gut (rectum, colon, and cecal tonsil) of Indonesian indigenous naked neck and normal chickens were collected. The expression of mucin2 gene in the gut mucosa was analyzed by reverse-transcription-polymerase chain reaction (RT-PCR). Localization and molecular size of the mucosal glycoproteins were analyzed by western blot methods. WGA and Jacalin lectins were used for western blot analysis. Mucin-2 gene was expressed in mucosal gut of rectum, colon, and cecal tonsil in both naked neck and normal chickens. Western blot analysis showed single band in both WGA and Jacalin in mucosal gut of rectum, colon, and cecal tonsil in both naked neck and normal chickens. These results suggest that mucin2 gene as well as glycoprotein containing WGA and Jacalin positive sugars covers the surface of mucosal gut in both naked neck and normal chickens, probably to form mucosal barrier.

Keywords: Indonesian naked neck chickens, Mucosal gut, Mucin-2, Glycoprotein.

INTRODUCTION

In general, mucosal barrier systems formed by mucus gel, epithelial cell junctional structures, and leukocyte activity, play important role to prevent infection by pathogenic agents in mucosal tissues. Mucins have the ability to form a physical barrier and act as adhesion decoys to invading agents (Linden et al., 2008a), and they may prevent pathogen penetrance by inhibiting bacterial adhesion to the mucosal epithelium surface (Berry et al., 2002). Mucins either have direct antimicrobial activity or carry other antimicrobial molecules (Linden et al., 2008b). Cell surface mucins may also initiate intracellular signaling in response to bacteria, and thus they have both a barrier and reporting function on the apical surface of mucosal epithelial cells (Linden et al., 2008a). If microorganisms cross an epithelial barrier and begin to replicate in the mucosal tissues, phagocytic cells including the monocytes or macrophages, or polymorphonuclear leukocytes (PMNs) recognize, ingest, and destroy them (Murphy et al., 2007; Macia et al., 2012). Thus, it is of great importance to identify the mechanism by which mucin is synthesized and epithelial tight junctions are formed in the oviduct of hens to prevent infection of this organ and contamination of eggs by pathogenic agents.

Glycoprotein sugar-residues could be identified and characterized by lectins. Lectins bind to a specific sugar residue of glycoprotein with high affinity. WGA, a lectin from wheat germ agglutinin (Triticum vulgaris), binds specifically to N-acetylglycosamine (GlcNAc) and N-acetyleneuraminic
acid (sialic acid). Jacalin lectin, the major protein from jackfruit (Artocarpus heterophyllus) seeds, shows highly specific binding to galactose (Gal) and N-acetylgalactosamine (GalNAc) (Kabir, 1998; Tatsuzuki et al., 2009; Fallis et al., 2010).

Reports of mucin glycoprotein expression in the Indonesian naked neck and normal feathered chickens were very limited. Therefore, the aim of this study was to determine the differences in the mucosal barrier formation in the lower segment of gut between Indonesian naked neck and normal feathered chickens.

**MATERIALS AND METHODS**

**Experimental birds**

Indonesian native naked neck and normal fethered chicken with the age and weight of the relatively uniform were used in this study. All chickens were identified according to non feather distribution, namely naked neck and normal feathered chickens. The lower segments of gut (rectum, colon, and cecal tonsil) of Indonesian indigenous naked neck and normal chickens were collected. The expression of mucin2 gene in the gut mucosa was analyzed by reverse-transcription polymerase chain reaction (PCR). Localization and molecular size of the mucosal glycoproteins were analyzed by SDS-PAGE and western blot methods. WGA and Jacalin lectins were used for western blot analysis.

**PCR analysis for expression of mucin2**

Total RNA was extracted from the mucosal tissues of rectum, colon, and cecal tonsil using Sepasol RNA I Super. They were treated with DNase to remove genomic DNA and were reverse-transcribed using ReverTra Ace according to the manufacturer’s instructions. PCR was performed using Takara Ex Taq. Primers used for mucin2 analysis were as follows (forward: 5’-GTC GAT TGT CAC TCA CGC CTT-3’; reverse: 5’-ACT TGC CTG AAT CAC AGG TGC-3’). PCR products of mucin2 were separated by electrophoresis. PCR was performed as described by Ariyadi et al. (2012).

**SDS-PAGE and Western blot**

SDS-PAGE and Western blot was performed as described by Abdelsalam et al., 2010. Rectum, colon, and cecal tonsil tissue was homogenized separately in a 5 times volume of homogenization buffer. The samples were centrifuged at 12,000 X g for 20 min at 4 °C. The supernatant was collected and the protein concentration was measured using a protein assay reagent (Bio-Rad Lab, Hercules, CA, USA) using bovine serum albumen as the standard protein. The samples were separated by Tricine-sodium dodecyl sulphate-polyacrylamide gel electrophoresis (Tricine SDS-PAGE; 16% separating gel and 4% stacking gel) as described by Abdelsalam et al. (2011). Samples were mixed with sample buffer. Each 10 µl sample mixture was run on gels. After SDS-PAGE, the proteins in the gel were electrophoretically transferred onto a PVDF membrane (Bio-Rad Lab.) at 270 mA for 1 h. The membrane was soaked in methanol for 10 min and then washed briefly with Tris-buffered saline containing 0.1 % Tween20 (TBS-T) (20 mM Tris HCl, pH 7.6, 0.8 % (w/v) sodium chloride and 0.1 % (v/v) Tween 20). It was incubated with 5% (w/v) casein milk solution in TBS-T for 60 min and then incubated with biotinylated-WGA or Jacalin lectins diluted at a concentration of 10 µg/ml in TBS-T overnight at 4 °C. The membrane was then washed in TBS-T.
for 30 min (10 min X 3) before incubation with avidin-peroxidase complex diluted at 1:5,000 in TBS-T for 1 h at room temperature. The membrane was washed with TBS-T for 30 min (10 min X 3 times) and the lectin-precipitates on the membrane were visualized by DAB solutions for 1 min.

RESULTS AND DISCUSSION

Figure 1 shows the expression of mucin2 gene in the rectum, colon, and cecal tonsil of both Indonesian indigenous naked neck and normal feathered chickens. Mucin2 gene was expressed in the rectum, colon, and cecal tonsil of both Indonesian indigenous naked neck and normal feathered chickens. Electrophoresis of PCR product showed that mucin2 gene was expressed at 441 bp, where the band of mucin2 was denser in the naked neck than of the normal feathered chickens.

It was supported by Smirnov et al. (2005) that the mucin glycoprotein was expressed in the chicken jejenum and ileum. Rajkumar et al. (2010) that the immune competence was higher in the naked neck chickens than of the normal feathered chickens.

![Mucin 2 gene](image)

**Figure 1.** Expression of mucin2 gene in the rectum, colon, and cecal tonsil of both Indonesian indigenous naked neck and normal feathered chickens. Electrophoresis of PCR product showed that mucin2 gene was expressed.

Western blot analysis by WGA lectin showed the single band in the rectum, colon, and cecal tonsil of both Indonesian indigenous naked neck and normal feathered chickens. The molecular size of glycoprotein containing sugar residue was approximately 66.2 kDa. Western blot analysis by Jacalin lectin showed the single band in the rectum, colon, and cecal tonsil of both Indonesian indigenous naked neck and normal feathered chickens. The molecular size of glycoprotein containing sugar residue was approximately 66.2 kDa.

CONCLUSIONS

These results suggest that mucin2 gene as well as glycoprotein containing WGA and Jacalin positive sugars covers the surface of mucosal gut in both naked neck and normal feathered chickens, probably to form mucosal barrier.
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competence, serum biochemical and carcass traits in chickens under a tropical climate.

populations in chicken small intestine are changed by dietary probiotic and antibiotic growth

chain expression of normal term human placental villi using lectin histochemistry combined
Milk Quality of Anglo Nubian X Etawah Grade Goats and Saanen X Etawah Grade Goats at First Kidding Period

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ABSTRACT: Goat milk has been well-known as useful human consumption due to its nutrition content and medical for many diseases. To improve productivity of dairy goats is through crossbreeding between local breed and adapted exotic breed. A study was carried out to evaluate milk quality of Anglo Nubian (AN) x Etawah grade (PE) goats and Saanen (SA) x Etawah Grade goats. There were 26 does first kidding that consisted of 15 ANxPE does and 11 SAxPE does used in this study. All does were raised and given same feeding and management system at Dairy Goat Unit of Indonesian Research Institute for Animal production. A weekly single hand milking data was collected for milk quality from 12 weeks evaluated by lacto-scan. Data were analyzed using linear model from SAS program. Results indicated that there were significant difference (P<0.01) in fat and total solid milk content between the two genotypes, with overall means (%) for fat content 5.01 and 4.88, protein 3.02 and 2.98, lactose 4.94 and 4.97 and total solids 13.68 and 13.17 for ANxPE and SAxPE. The weeks of lactation affected fat and protein contents (P<0.01). It can be concluded that ANxPE does produced acceptably fat and protein content. This study might be used as early information used for recommendation in increasing goat milk production and quality.

Keywords: goat crossbreeds, milk composition

INTRODUCTION

Goats are mainly kept for meat production and their milk is rarely consumed. However, nowadays, there is an increasing consumption of goat milk due to its better-quality such as lower cholesterol, higher vitamin and valuable amino acid than cow milk, also can be used as infant food (Abbas et al., 2014; Asresie et al., 2014). Besides, goat milk has been used several medicinal values as therapeutic virtues for dietetic and ulcers problems or people allergic to cow milk and inflammatory diseases which led to an increased interest in goats milk as a functional food, and it now forms a part of the current trend to healthy eating (Abbas et al., 2014). In many countries the prize of goat milk is much higher than cow milk (Kosgey et al., 2013).

Etawah grade (PE), a local goat breed, is one of the dairy goat breed in Indonesia. They have been well-known for their adaptability in harsh environment thus smallholder farmers like to raise them. However, their milk production is still low ranged 0.2-1.2 liter/head/day (Sutama et al., 2014; Praharani, 2014a). To meet the demand of goat milk, consequently, the milk production of PE has to be increased through improving management and genetic.

Many crossbreeding program in dairy goat has been done to increase goat productivity in producing milk (Assan, 2013; Norberg et al., 2014). There are many dairy goat breed with excellent milk production such as Saanen, Toggenburg, Alpine and Anglo Nubian that has been used for crossbreeding to local goats in many countries. The Saanen goats performed the highest milk production. However, Anglo Nubian has the highest adaptability in the tropic condition with the highest fat content of milk (Goetsch et al., 2011). In Indonesia, Etawah grade has been crossbred to Saanen goats for many years, resulted to increased milk production 0.8-1.2 liter/head/day (Sutama et al., 2014).

Indonesian Research Institute for Animal Production has done a crossbreeding program using Anglo Nubian bucks mated to Etawah Grade does since 2012. First crossbred kids were born
in 2013 and have been observed their productivity. Praharani (2014\textsuperscript{a}) and Praharani \textit{et al.} (2014\textsuperscript{b}) reported that growth rate from birth to puberty of F1 \textit{ANxPE} was higher than \textit{Ettawah Grade}.

Milk composition and quality are important attributes that determine the nutritive value and consumer acceptability. There are several studies reported goat milk yield and composition are affected by breed/genotype, age/parity of does, lactation stage/month, season and plane of nutrition (Goetsch \textit{et al.}, 2011; Adass \textit{et al.}, 2013; Pesantez and Hernandez, 2014). Evaluation of goat milk composition especially in \textit{ANxPE} has not been done since they were still doeling. Therefore, this study was to investigate goat milk composition in \textit{ANxPE} compared to \textit{SAXPE} at first kidding.

**MATERIALS AND METHODS**

This study was carried out at the Dairy Goat Unit of Indonesian Institute for Animal Production, in Bogor, located on 250-350 m above sea level. The study had been done for 12 weeks. About 26 does were used in this study consisting of 15 \textit{ANxPE} and 11 \textit{SAXPE} does at first kidding aged between 15-18 months. All animals were reared in the same management system. They were fed 0.8 kg/head/day of concentrate 16-17\% Crude Protein and 65-70\% TDN. Forages containing of King grass were given about 4-5 kg/head and 0.5-0.6 kg/head/day of legumes (Caliandra, Leucaena, Gliricidae). Clean water were available ad libitum.

Does were milked twice a day (morning and afternoon) by hands. Morning-milked sample were evaluated using lacto-scan to obtain milk composition of fat, protein, lactose, solid non fat (SNF), and total solid (SNF + fat). The mean of fat and protein level of milk for 12 weeks were plotted in graph. The data generated were subjected to analysis of variance using the General Linear Model (GLM) of SAS (2003). Genotype and weeks of lactation were included in the model as source of variation. Effects were considered significant at 0.01 level or less using P-DIFF test.

**RESULTS AND DISCUSSION**

**Effects of Genotype**

Table 1 shows the composition of goats’ milk analyzed during 12 weeks of lactation. Overall averages of milk composition contents (%) were: fat 4.91, protein 3.00, lactose 4.95 and total solid 13.47 for both genotype. Table 1 showed fat 5.01 and 4.88, protein 3.02 and 2.98, lactose 4.94 ad 4.97, and total solids 13.68 and 13.17 for \textit{ANxPE} and \textit{SAXPE}, respectively. These findings were ranged of some reviews in milk composition from several breeds (Mayer and Fiechter, 2012; Abbas \textit{et al.}, 2014).

Effect of genotype on milk content were only significant in fat and total solid (P<0,01) in agreement with Goetsch \textit{et al} (2011) that goat milk composition affected by breed/genotype. The \textit{ANxPE} had higher fat and total solid compared to \textit{SAXPE}. Addass \textit{et al.} (2013) found breed effects on fat and total solid content in Sahel goat milk, Sokoto Red and Dwarf. The present study indicated that Anglo Nubian milk had higher fat content than Saanen, in agreement with Fernandez (2013) that found higher fat and protein in Anglo Nubian. The protein and lactose content in both genotype were not different (P>0,05) that were similar to Zarkawi \textit{et al.} (2013) studied in Syrian Mountain goats, Damascuss x Syrian Mountain goats in Syria and found that protein and lactose were not affected by breed. Sumarmono \textit{et al.} (2012) found fat content 5,17\% in PE goats close to \textit{ANxPE} in the present study.

Comparing the results of fat, protein, lactose and total solid milk compositions obtained in the present study with those of other goat breeds. Average fat content (%) in the milk of both genotype was higher than those reported in \textit{Ettawah grade} goats of 3.74-5.4\% (Sumarmono \textit{et al.}, 2012; Wibowo \textit{et al.}, 2013); 4.65\% reported in Anglo Nubian goats in \textit{USA} and 4.57\% in Cuba (Fernandez, 2013). Some literature found fat content 4\% in \textit{Saanen} goats in Sudan and Swiss
(Gadir et al., 2011), 3.59% in USA and 3.56% in Cuba (Fernandez, 2013). However Anglo Nubian x Saanen crossbreds produced 4.17% of fat content (Gadir et al., 2005) and 3.45% SaanenxKilis in Turkey (Guzeler et al., 2012). This present study had lower fat content in SAxPE than those reported by Prasetyo (2012) found 6.34%.

Table 1. Means, LSMeans and standard error of milk composition of ANxPE and SAxPE and effect of genotype and week of lactation

<table>
<thead>
<tr>
<th>Parameters</th>
<th>N</th>
<th>Means</th>
<th>Genotype</th>
<th>Weeks of lactation</th>
<th>Genotype</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ANxPE</td>
<td>SAxPE</td>
<td></td>
</tr>
<tr>
<td>Fat</td>
<td>312</td>
<td>4.91</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>5.01±0.04</td>
<td>4.88±0.04</td>
</tr>
<tr>
<td>Protein</td>
<td>312</td>
<td>3.00</td>
<td>0.7547</td>
<td>0.0043</td>
<td>3.02±0.01</td>
<td>2.98±0.01</td>
</tr>
<tr>
<td>Lactose</td>
<td>312</td>
<td>4.95</td>
<td>0.2250</td>
<td>0.7009</td>
<td>4.94±0.01</td>
<td>4.97±0.02</td>
</tr>
<tr>
<td>Total Solid</td>
<td>312</td>
<td>13.47</td>
<td>&lt;0.0001</td>
<td>0.4640</td>
<td>13.68±0.07</td>
<td>13.17±0.09</td>
</tr>
</tbody>
</table>

a,b superscripts of different column in the same row were significantly different (P<0.01)

In the present study, the mean of protein content of Saanen were lower than 3.62-3.86% in Turkish Saanen (Guzeler et al., 2012) and 3.48% in USA or in Sudan and Swiss (Sabil et al., 2011). Also the protein content of Anglo Nubain in this study were lower 4.38% in Nubian goats and 2.84% in Anglo Nubian in USA. When Anglo Nubian were crossed to Saanen, they produced 3.66 % of protein content (Gadir et al., 2005) and 3.81% SaanenxKilis in Turkey (Guzeler et al., 2012). The present study obtain lower than those reptried by Sumarmono et al. (2012) found that lactose in PE goat milk was 3.55-4.27 %. Prasetyo (2012) found protein content 4.97% in SAxPE.

The mean of lactose in this study were lower than those reported by Sabil et al., (2011) that found 4.50% of lactose in Saanen goats in Sudan and Swiss. However it was lower compared to who found 4.53% in Anglo Nubian and 4.54% in Saanen raised in the same management in USA. The ANxSA crossbreds produced 4.91% of lactose content (El Gadir et al., 2005) and 4.12% SaanenxKilis in Turkey (Guzeler et al., 2012). Sumarmono et al. (2012) found that lactose in PE goat milk was 3.55 % lower compared to present study. While Prasetyo (2012) found lactose content 3.19% in SAxPE.

Concerning the last studied component (total solids), average values were higher Syrian Mountain and crossbred goats, respectively (Addass et al., 2013), which were higher than 9.53% in Turkish Saanen goats (Guzeler et al., 2012), and 13.45, % reported in Nubian goats in the USA (Soryal et al., 2005). While ANxSA crossbreds produced 13.48% of total solid (Gadir et al., 2005). The total solid of PE goats was 13.05-14.01% close to present study (Sumarmono et al., 2012; Wibowo et al., 2013). The crossbred of Saanen and PE (Sapera) goats produced total solid of milk 11.65-12.45% (Susilowati et al., 2013) lower than this present study due to different environment and kidding period.

Effect of Weeks of Lactation

According to Table 1, weeks of lactation affected fat and protein content (P<0.01), but lactose and total solid were not different (P>0.05) along 12 weeks. These findings were in agreement with some literature stated that stage of lactation affected milk composition (Guzeler et al., 2012; Mayer and Fiechter, 2012; Addass et al., 2013).

The changes fat and protein showed in Figure 1 and 2 by genotype, respectively. The fat content was lowest between week 4 and 5 and the highest was at week 1 and 12 (P<0.01). The curve pattern of milk fat for both genotypes was similar. There was a trend of decreasing in fat contents during first month of lactation, however, increasing trend after week 5. Addas et al. (2013) studied on Sahel and Sokoto goat in Nigeria found that fat content reached the highest at early lactation. However, the pattern of fat content were different from those found by Gadir et al.
(2005) studied on Saanen x Anglo Nubian in Sudan due to the difference on kidding period. While Mayer and Fiechter (2012) plotted fat content decreased from week 10 to 12, similar to this present study, however, there was no data on fat content before week 10 and data were pooled from some different breeds in their study.

The curve pattern of milk protein for both genotypes was different. As seen from Figure 2, average of protein was decreasing during the early weeks of lactation and it started to increase after the 6th week. The lowest of protein contents was at week 3 and 6 (P<0.01) for ANxPE and SAxPE, respectively. While the highest of protein content was at 12 for both genotypes (P<0.01). This pattern was similar to Guzeler et al. (2012) studied on SaanenxKillis in Turkey. However, it was different from Addas et al. (2013) studied on Sahel and Sokoto goat in Nigeria found that protein content reached the highest at early lactation. Also, the pattern of protein content were different from those found by Gadir et al. (2005) studied on Saanen x Anglo Nubian in Sudan due to the difference on kidding period. While Mayer and Fiechter (2012) plotted protein content increased from week 10 to 12, similar to this present study, however, there was no data on fat content before week 10 and data were pooled from some different breeds in their study.

CONCLUSIONS

Fat and total solid of ANxPE were higher than SAxPE, but protein and lactose content were similar. Weeks of lactation affected fat and protein for both genotypes above. Milk contents (fat, protein, lactose and total solid) of ANxPE and SAxPE indicated in good quality. This is the first information report in ANxPE concerning the studied parameters and might be used for recommendation in increasing goat milk production and quality.
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Performance of Dairy Cattle with Dietary Supplementation of Rumensin, Garlic peels (Allium sativum) and Organic Mineral

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ABSTRACT: The objective of this research was to determine milk production and quality of dairy cattle and feed digestibility of dairy cattle feed that was supplemented with rumensin, garlic peels (Allium sativum) and organic minerals. The research was conducted corresponding to three treatments including basal feed with 0.3g/head/day rumensin (T0), basal feed derived from BBPTU-HPT Baturraden combined with 30 ppm/kg DM garlic peels (T1), and basal feed combined with 30 ppm/kg DM garlic peels and mineral organic (1.5 ppm Cr, 0.3 ppm Se and 40 ppm Zn-lisinat) (T2). Data were subject to analysis of variance in completely randomized design (CRD) with 7 replicates. The results showed that supplemented rumensin, garlic skin and organic mineral did not significantly affect (P>0.05) nutrient intake (DM, OM, CF and CP), nutrient digestibility (DM, OM and CF), and milk production and quality. However, treatment significantly affected (P<0.01) crude protein (CP) digestibility.

Keywords: Garlic skin, organic mineral, nutrient digestibility

INTRODUCTION

Rumensin belongs to ionophore which is effective to improve feed efficiency. Ionophore lowers acetic proportion and increases propionic proportion in rumen and affects CH₄ production. Some studies demonstrated that inhibiting methane production using ionophore did not last long (Johnson and Johnson, 1995). One of the overcoming strategies was utilizing herbal plants.

Garlic (Allium sativum) is prevalent plant for bacteria agent to repair microbe ecosystem in cattle digestive tract especially in the tropics (Wanapat et al., 2013). Garlic contains organosulfur like allicin (C₆H₁₀S₂O), diallyl sulfide (C₆H₁₀S), diallyl disulfide (C₆H₁₀S₂), allyl mercaptan (C₃H₆S) (Lawson, 1996). Busquet et al. (2006) stated that supplementing garlic was proven effective to decrease acetic acid and increase propionic acid compared to Yuca extract, tea tree oil and Cinnamaldehyde. Garlic also lowered methane and volatile fatty acid ratio (CH₄:VFA). Garlic skin contains 7-time concentration polyphenol than garlic bulb (Kim et al., 2009), and allicin belongs to poliphenol expected to lower methanogen.

Recent result indicated that supplementing mineral Cr, Se, and Zn with garlic powder improved in vitro rumen efficiency (Prayitno and Hidayat, 2013) and goat milk production (Prayitno et al., 2014). The objective of this research was to determine milk production and quality and feed digestibility of dairy cattle with rumensin, garlic skin (Allium sativum), and organic mineral (Cr, Se, and Zn) dietary supplementation.
MATERIALS AND METHOD

Twenty one prepartum FH dairy cattle aged one month on second lactation weighing 644±72 kg was allotted in individual cages with conventional feed comprising of Napier grass : concentrate (70:30) as basal feed (12.85% CP, 23.95% CF, 63.9% TDN). The treatments consisted of T0: basal feed with 0.3g/head/day rumensin, T1: basal feed derived from BBPTU-HPT Baturraden combined with 30 ppm/kg DM garlic peels, and T2 : basal feed combined with 30 ppm/kg DM garlic peels and mineral organic (1.5 ppm Cr, 0.3 ppm Se and 40 ppm Zn-lysinate). Feeds were given two times a day at 06:00 and 13:00. Milking was performed two times a day at 04:00 and 15:00 postpartum for 6 weeks. Feed and feces collections were under total collection method for 5 days, oven-dried at 40°C for 48h to determine dry matter, then composited and ground. Milk production was recorded at each milking.

RESULTS AND DISCUSSION

3.1 Feed Consumption

The research demonstrated there was no different dietary DM, OM, CF and CP intakes. Similarly, Wanapat et al. (2013) stated that herbal plant supplementation did not affect nutrient digestibility except crude protein. It was supported by Yang et al. (2007) who did not find difference in dry matter consumption after dietary supplementation using mixed essential oil or garlic oil. Furthermore, Odongo et al. (2006) revealed no consumption difference in feed supplemented with monesin (ionophore) with control feed because feed nutrient composition was not changed.

Table 1. The effect of supplementing rumensin, garlic peels and organic mineral in dairy cattle feed on dry matter, organic matter, crude fat and crude protein

<table>
<thead>
<tr>
<th>Daily Consumption parameter (kg/head)</th>
<th>T0</th>
<th>T1</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter (DM)</td>
<td>10.13±1.77a</td>
<td>9.76±1.84a</td>
<td>9.34±0.44a</td>
</tr>
<tr>
<td>Organic matter (OM)</td>
<td>8.15±1.44a</td>
<td>7.88±1.46a</td>
<td>7.50±0.37a</td>
</tr>
<tr>
<td>Crude fat (CF)</td>
<td>0.20±0.04a</td>
<td>0.19±0.04a</td>
<td>0.19±0.01a</td>
</tr>
<tr>
<td>Crude protein (CP)</td>
<td>1.35±0.22a</td>
<td>1.42±0.31a</td>
<td>1.29±0.02a</td>
</tr>
</tbody>
</table>

T0 : basal feed with 0.3g/head/day rumensin, T1 : T0 + 30 ppm/kg DM garlic peels, and T2 : T1 + organic mineral (1.5 ppm Cr, 0.3 ppm Se and 40 ppm Zn-lysinate). Values bearing different superscripts within column are significantly different (P<0.05).

3.2 Nutrient Digestibility

The results showed that supplementing rumensin, garlic peels and mineral (Cr, Se dan Zn) into dairy cattle diet did not significantly affect nutrient digestibility except for crude protein. It was in line with Wanapat et al. (2013) and Prayitno et al. (2013) that supplementing garlic could lower crude protein digestibility. Protein digestibility was closely related to nitrogen digestibility, and higher protein digestibility in T1 was in accordance with Spears (2990) that ionophore like rumensin could increase protein digestibility 3.5% due to the improved nitrogen absorption (Muntifering et al., 1980).
The 6th International Seminar on Tropical Animal Production
Integrated Approach in Developing Sustainable Tropical Animal Production
October 20-22, 2015, Yogyakarta, Indonesia

Table 2. The effect of supplementing rumensin, garlic peels and organic mineral in dairy cattle feed on dry matter, organic matter, crude fat and crude protein digestibilities

<table>
<thead>
<tr>
<th>Digestibility parameter (%)</th>
<th>T0</th>
<th>T1</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter</td>
<td>73.59±4.26a</td>
<td>73.63±9.05a</td>
<td>71.16±7.30a</td>
</tr>
<tr>
<td>Organic matter</td>
<td>76.11±2.87a</td>
<td>76.77±8.37a</td>
<td>73.08±7.01a</td>
</tr>
<tr>
<td>Crude fat</td>
<td>77.27±10.30a</td>
<td>73.00±22.15a</td>
<td>74.49±11.56a</td>
</tr>
<tr>
<td>Crude protein</td>
<td>92.71±2.68c</td>
<td>79.49±6.71a</td>
<td>81.70±6.63ab</td>
</tr>
</tbody>
</table>

T0: basal feed with 0.3g/head/day rumensin, T1: T0 + 30 ppm/kg DM garlic peels, and T2: T1 + organic mineral (1.5 ppm Cr, 0.3 ppm Se and 40 ppm Zn-lisinat). Values bearing different superscripts within column are significantly different (P<0.05).

3.3 Milk Production and Quality

The result indicated, there was no significant difference among treatments on milk production and quality (P>0.05). Supplementing mineral and garlic peels could not improve milk production assumedly due to the negative effect from the combined two materials. Also, rumensin supplementation could not improve milk production, as supported by Odongo et al. (2007) that milk production resulted from dietary supplementation with 24mg/kg DM rumensin did not affect the control feed (19.7 vs 19.1 kg/day). Furthermore, Indrijani (2001) stated that besides feed factor, milk production was influenced by genetic factors, environmental factors, and the interaction of both factors.

Table 3. The effect of rumensin, garlic peels and organic mineral on milk production and quality

<table>
<thead>
<tr>
<th>Parameter</th>
<th>T0</th>
<th>T1</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk production (kg 4% FCM)</td>
<td>20.69±4.48a</td>
<td>21.37±11.87a</td>
<td>16.12±3.37a</td>
</tr>
<tr>
<td>Milk components (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fat</td>
<td>4.81±0.80a</td>
<td>4.93±0.32a</td>
<td>4.96±0.56a</td>
</tr>
<tr>
<td>- Protein</td>
<td>3.34±0.11a</td>
<td>3.42±0.10a</td>
<td>3.46±0.17a</td>
</tr>
<tr>
<td>- Lactose</td>
<td>5.02±0.17a</td>
<td>5.13±0.15a</td>
<td>5.19±0.26a</td>
</tr>
<tr>
<td>- Solid non fat (SNF)</td>
<td>9.13±0.31a</td>
<td>10.68±3.61a</td>
<td>9.17±0.14a</td>
</tr>
<tr>
<td>Production (g/day)*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fat</td>
<td>1015 ± 331a</td>
<td>1073±676a</td>
<td>814±272a</td>
</tr>
<tr>
<td>- Protein</td>
<td>1893 ± 438a</td>
<td>2227±1185a</td>
<td>1447±127a</td>
</tr>
<tr>
<td>- Lactose</td>
<td>1041 ± 241a</td>
<td>1093 ± 597a</td>
<td>831 ± 134a</td>
</tr>
<tr>
<td>- Solid non fat (SNF)</td>
<td>1893 ± 438a</td>
<td>2227 ± 1185a</td>
<td>1447 ± 127a</td>
</tr>
</tbody>
</table>

T0: basal feed with 0.3g/head/day rumensin, T1: T0 + 30 ppm/kg DM garlic peels and T2: T1 + organic mineral (1.5 ppm Cr, 0.3 ppm Se and 40 ppm Zn-lisinat). Values bearing different superscripts within column are significantly different (P<0.05).

CONCLUSION

Supplementing rumensin, garlic peels and mineral organic did not significantly affect nutrient intake (DM, OM, CF and CP) and nutrient digestibility (DM, OM and CF), milk production and quality, but highly significantly affected crude protein (CP) digestibility.
REFERENCES


Trends Dairy Population and Milk Production in Boyolali, Central Java, Indonesia

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ABSTRACT: This study is one part of the business development strategy research of dairy cattle in Boyolali, Central Java. This study aimed to analyze the trend of the population of dairy cattle and milk production in Boyolali, Central Java. This study was conducted between November 2010 until January 2011 in the district of Boyolali by using the survey method. Total respondents were used in this study were 266 farmers. Primary data was collected by interviews based on a questionnaire that has been prepared. Secondary data were obtained from the Central Bureau of Statistics, Department of Animal Husbandry and Fisheries, and local governments Boyolali. The average of dairy lactation ownership is 6.40 AU. The average production of cow's milk in Boyolali is still low at 8 liters/head/day. Trend dairy cow population is $Y=4.7182e^{0.0063x}$, production trend equation is $Y=5.8567 e^{0.0052x}$. Both equations are used to estimate the size of the population of dairy cattle and milk production in the coming years. Trend population of dairy cows, milk production is increasing every year.

**Keywords:** population of dairy cows, milk production, trend

INTRODUCTION

Indonesia's government had policies for development of dairy cattle such as; an increase in population of dairy cows, technical service support for marriage by artificial insemination (AI), training of field staff, aid credit package of dairy cattle distributed to farmers through cooperatives, marketing collateral fresh milk from the farmer to the milk processing industry (Directorate general of livestock, 2014). Dairy population is still dominant in Java reached more than 99% of the total population of dairy in Indonesia, in Sumatra just reached only 0.4% of the population of Indonesia, as well as a few others scattered on the island of Sulawesi, Kalimantan, Bali and Nusa Tenggara (Ministry of agriculture–Central bureau of statistic, 2011). Dairy population is the largest in East Java and Central Java next West (Central bureau of statistic, 2012).

Dairy products from year to year is increasing, in line with the increasing number of population, level of education, and public awareness of the role of nutrients, especially protein for life. Farm products, especially milk have good prospects. It supports dairy farm allow continues to grow. Dairy cattle is one of the livestock sub-sector commodities. With the commodity dairy cattle in the livestock sector it is expected that the fulfillment of animal protein in Indonesian society. The average milk production in Indonesia increased by 7.92% annually (Directorate General of Fisheries and Animal Health, 1996).

Milk consumption of Indonesian society over the years continued to increase. Increased milk consumption in Indonesia is not followed by an increase in milk production. The increase in milk production which is 7.92% less than the rate of increase in milk consumption is 13.73% (Directorate general of livestock, 1996). This is a problem in the fulfillment of the milk, if not offset by increased consumption of milk increased production of milk in the country, the government
needs to continue to grow so that it can affect the amount of imported milk continues. This will have an impact on domestic milk prices and will slow down the business competitiveness of dairy cattle Indonesia. According Wisnugroho et al (2005) that the consumption of cow's milk increases with the increasing public awareness of the importance of consuming fresh milk. However this is not backed up by efforts to achieve domestic milk production to meet the growing demand for milk. Demand higher milk into a market potential that need attention.

Free trade in Indonesia resulted in fresh dairy products in Indonesia will compete with imported dairy products. Repair various supporting factors in dairy farming should continue to be pursued, such as: productivity, maintenance management, handling of fresh milk (Anggraeni, 2006). Milk production is still low, it is a problem that must be solved. Milk production is influenced by two factors: genetic and environmental factors (Anggraeni, 2000). Environmental factors that influence milk production is feed, ambient temperature, parasites and diseases and livestock management and milk from the milking until ready for sale. On the other hand dairy farming activities have the potential strength, in terms of aspects ranchers and natural carrying capacity that began in colonial times until now still survive. This requires attention to the potential for development in order to increase the productivity of dairy so as can fullfil the needs of domestic milk and increase the income for farmers.

Dairy farm in Boyolali district, which is one potential area for development of dairy cattle business, although still traditional farms. Boyolali district is one potential area, as the area is support for the development of dairy cattle. Dairy cattle production activities has long been taking place, that since 1900, where Boyolali district is one of the places that already have a cow breeding pure FH, which then happened interbred with local cows that produce offspring called Peranakan Holstein Friesian (PFH). Dairy cattle still survive in Boyolali although traditional farms, so we need to analyzed population of dairy cattle and milk production in Boyolali.

Trend analysis is an analytical method that is intended to estimate or forecast in the future. Good forecasting require various kinds of information are quite a lot and observed over a period of time that is relatively long, so that the results of the analysis can be known until how big fluctuations occur and what are the factors that influence these changes (Rusli, 2014). Trend is used to estimate future conditions based on data in the past. The exponential trend is a trend that the value of the independent variable rise is not linear, when expressed in the form of a mathematical equation as a linear equation, $y' = ab^x$ (Rusli, 2014).

MATERIAL AND METHOD

Material

The research material that is 266 dairy farmers in Boyolali and recording from the Central Bureau of Statistics, Department of animal husbandry and fisheries, and the Local Government in Boyolali. Secondary data is data obtained by the relevant agencies, including the population of dairy cows, milk production, and population.

Method

The method used is survey method. Methods of analysis using exponential trend analysis of the data population of dairy cows and milk production in Boyolali district, central Java. $Y' = abx$ log $y' = \log a + x \log b$, where:

- $Y'$ = future of dairy milk production
- $a$ = constants
- $b$ = the average increase in production per year
RESULT AND DISCUSSION

Milk Production

The average milk production in Boyolali is still low at 8 liter/head/day. Frieshien Holstein dairy production is the highest compared with the nations of other dairy cow, the milk fat content is lower (Sudono, 1999). To optimize the production of milk in Boyolali, farmers should be able to combine and manage the factors of production in order to obtain high milk production both physiological factors and environmental factors.

If the dairy cattle business is managed more optimally it is expected that the production of cow’s milk in Boyolali can be increased. Dairy’s milk from farmers usually taken to the calf and its own consumption, and then deposited into cooperatives respectively, both Mojosongo cooperative, Musuk cooperative, and Cepogo cooperative.

Trends Dairy Population and Milk Production in Boyolali

Trend is a tendency to move up or down in the long term derived from the average change over time and the value is quite flat (smooth). This movement could indicate an increasing trend (positive result) and the tendency of decrease (negative result). The development of the population of dairy cows, milk production, and the number of people in Boyolali increase in the number of population. It can be a reference that the dairy farm business in Boyolali progress although not huge every year, but this increase can be measured by the development of the milk production. The highest increase in population of dairy cows occurred between years 2010-2011 in the amount of 7.1%. One factor that supports the increase in dairy population that is the institution that helps dairy cattle business well so that the dairy population in Boyolali not decreased.

The production of dairy’s milk in Boyolali has increased and decreased. The increase in milk production was highest between the years 2010 - 2011 in the amount of 7.6%. Reduction in milk production also occurred between the years 2004 - 2005 is 1.1 %. This decrease is thought to result from a decline in dairy population in Boyolali district, but it is also less farmers to maximize the use of technology that has been introduced through counseling.

Based on population data and the production of 2004 - 2013 can be analyzed using a regression trend analysis method trend exponential equation dairy population is $Y=4,7182e^{0.0063x}$, milk production trend equation $Y=5.8567e^{0.0052x}$, and population trends in Boyolali is $Y=5,9661e^{0.0008x}$. Both equations are used to estimate the size of the dairy population and milk production in the coming years. Results of the data dairy population, milk production, and population using trend analysis. Trend graphs dairy population and milk production can be seen in Figure 1.

![Figure 1. Graph the trend dairy population and milk production in Boyolali](image)

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Figure 1 shows that the trend of the dairy population, milk production and the number of people in Boyolali tends to increase every year. Increased production of milk in Boyolali is a positive aspect for the area, because of the expected production of milk produced in the area can meet the needs of milk processing industry and consumption of population in Boyolali. Fresh milk from farmers who paid into cooperative later deposited into milk processing industry such as Sari Husada, Susu Bendera, and the Cita Nasional. Milk production is increasing every year into a great opportunity to be deposited to milk processing industry about Boyolali. Boyolali district itself has few industries that have the potential to accommodate fresh milk.

Table 1. Estimated dairy population, milk production, and population in Boyolali

<table>
<thead>
<tr>
<th>Year</th>
<th>Dairy Population (head)</th>
<th>Milk Production (liter)</th>
<th>Boyolali Population (people)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>90612.23</td>
<td>46908700</td>
<td>1035812</td>
</tr>
<tr>
<td>2015</td>
<td>90613.31</td>
<td>46908701</td>
<td>1035813</td>
</tr>
<tr>
<td>2016</td>
<td>90614.39</td>
<td>46908703</td>
<td>1035814</td>
</tr>
<tr>
<td>2017</td>
<td>90615.48</td>
<td>46908704</td>
<td>1035815</td>
</tr>
<tr>
<td>2018</td>
<td>90616.56</td>
<td>46908705</td>
<td>1035817</td>
</tr>
<tr>
<td>2019</td>
<td>90617.64</td>
<td>46908706</td>
<td>1035818</td>
</tr>
<tr>
<td>2020</td>
<td>90618.73</td>
<td>46908707</td>
<td>1035819</td>
</tr>
<tr>
<td>2021</td>
<td>90619.81</td>
<td>46908708</td>
<td>1035820</td>
</tr>
<tr>
<td>2022</td>
<td>90620.89</td>
<td>46908709</td>
<td>1035821</td>
</tr>
<tr>
<td>2023</td>
<td>90621.98</td>
<td>46908710</td>
<td>1035822</td>
</tr>
</tbody>
</table>

In Table 1, we can see the large population of dairy cattle and milk production over the next ten years. In this study, the data used to make estimates of future years are archived in the Central Bureau of Statistics, Department of Animal Husbandry and Fisheries, as well as the Local Government Boyolali from 2014 until 2023. Increased production of milk in Boyolali expected to meet the needs of milk processing industry and consumption of residents in Boyolali. Fresh milk from farmers who paid into cooperative later deposited into milk processing industry such as SGM, Milk Flag, and the National Cita. Milk production is increasing every year into a great opportunity to be deposited to milk processing industry about Boyolali. Boyolali district itself has few industries that have the potential to accommodate fresh milk.

Population of dairy cows, milk production, and population in Boyolali increasing from year to year. Milk production in 2004 to 2008 have not been able to meet the needs of the population in the district Boyolali milk. In 2009 began the production of milk can meet the needs of the population of fresh milk in Boyolali, it happens also in subsequent years. Consumption of fresh milk in Boyolali in 2009 supported by the increase in population of dairy cows by 0.46% which is accompanied with the increase in milk production by 2.17% and 0.22% increase in the total population.

In 2010 there was an increase dairy productivity because milk production increase 24% where the increase in dairy population is only 0.72%. The increase in population and fresh milk production occurred before the eruption of Mount Merapi affected, but after the eruption of Mount Merapi is precisely that increased dairy cow population is equal to 28.83% through a dairy cow aid program of the government.
CONCLUSION

Trend dairy population, milk production and population in Boyolali tends to increase every year. Increased production of milk in Boyolali is a positive aspect for the area, because of the expected production of milk produced in the area can meet the needs of Milk processing industry and consumption of population in Boyolali. Milk production is increasing every year into a great opportunity for both Milk processing industry deposited into and out around Boyolali. Boyolali expected to produce their own dairy cooperative and facilitated by local government.

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Changes in Pathogen Number during Preservation of Milk Derived from Mastitic Dairy Cows

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ABSTRACT: Pathogens are sometimes undetected in mastitic milk after cultivation. It was found that several innate immune components such as antimicrobial peptides exist in milk and that their concentration increases in mastitic milk. Therefore, we hypothesized that pathogen in milk is killed by innate immune components during preservation of milk. The present experiment was undertaken to confirm this hypothesis. Milk was collected from mastitic udders (somatic cell count > 300,000 cells/ml) of dairy cows in the southern region of Japan. After preservation of milk at room temperature for 0, 0.5, 1, 2, 3, 4 and 5 h, milk was put on media and cultured for 18 to 48 h to count formed colony. Streptococci was detected in 40% of milk and 10% of them contained Streptococcus uberis. Coliform and Staphylococcus aureus were observed in less than 20% and 10% of milk, respectively. Coagulase negative Staphylococci, Yeast-like fungus and Corynebacterium bovis were also detected in less than 10% of milk. The number of Staphylococcus aureus in milk has not changed significantly during 5-h cultivation. The number of Streptococcus uberis in milk decreased slightly compared with that at 0 h, but there was no significant difference. In the milk with Coliform, number ratio was significantly decreased to under 50% at 4 h compared with that at 0 h. Number ratio was significantly decreased at only 0.5 h of culture in milk with Coagulase negative Staphylococci, Yeast-like fungus, Corynebacterium bovis and their ratio further declined at 5 h of culture to under 20% in Coagulase negative Staphylococci or 10% in Yeast-like fungus and Corynebacterium bovis. These results suggest that pathogenic microbes in high-somatic cell count milk decreased during preservation at room temperature. Therefore, reduction of microbes from the time of collection to examination should be taken into consideration to evaluate milk contamination.

Keywords: Dairy cow, Somatic cell count, Milk, Preservation, Pathogen

INTRODUCTION

Mastitis is an inflammatory condition of the udder in bovine and other species caused by bacterial infection. It reduces milk production, with consequent economic losses for the dairy industry. However, approximately 10–40% of clinical mastitis cases yield “no significant growth” in routine clinical culture assays, although the reason for this is currently unknown (Östensson et al., 2013; OldeRiekerink et al., 2008). This may be due to infection that has been bacteria present in low numbers, even though the SCC has not yet decreased. Other considerations include sampling procedure, treatment of milk samples, methods, and media used in the bacteriological examination, the presence of pathogens below current detection thresholds, the absence of the bacteria at the time culture is initiated, or that the mastitis may be caused by non-bacterial microorganisms (Hogan et al. 1999; Kuehn et al., 2013). Since selection of antibiotics largely depends on the infecting bacterial species, it is important to clarify the reason why the milk was diagnosed as negative for pathogens.
Many kinds of antimicrobial components (one of the innate immune factors) such as lingual antimicrobial peptide (LAP), cathelicidins, lactoferrin (LF), lactoperoxidase (LPO) and S100 protein are produced in mammary epithelial cells and leukocytes and secreted into milk (Swanson et al. 2004; Isobe et al., 2009, 2011; Regenhard et al. 2010; Tetens et al. 2010). Their concentration in milk is increased in mastitic milk compared with that in healthy milk (Isobe et al., 2009; Edwin et al., 1977; Kawai et al., 2013; Morimoto et al., 2012; Zhang et al., 2014). Therefore, the milk from mastitic cows contains a high amount of antimicrobial components.

It takes at least several hours from milking to culturing in medical centers. During this intervening period, it may be possible that pathogens in milk are killed by the antimicrobial components. However, this possibility remains to be elucidated. Therefore, the objective of the present study was to investigate the change of the number of living pathogens during the preservation of milk collected from mastitic udder.

MATERIALS AND METHODS

Sixty-two Holstein Friesian cows were used. California mastitis test (CMT) in the quarter milk was performed before collection and only CMT-positive milk was collected. SCC of milk was measured by fluorescence optics type somatic cell measuring equipment (Somscope series, Milestone-General, KAWASAKI). Milk with SCC of >300,000 cells/ml was considered as subclinical mastitis. Other parts of the mastitic milk were kept at room temperature for 0, 0.5, 1, 2, 3, 4 and 5 h. Then, 50 μl of the milk was plated onto 5% sheep blood agar, and cultured at 37°C for 18 to 48 h to count colony forming unit (CFU). The identification of the pathogen was conducted using the usual method.

RESULTS AND DISCUSSION

Streptococci was detected in 40% of milk and 10 % of them contained Streptococcus uberis. Coliform and Staphylococcus aureus were observed in less than 20% and 10% of milk, respectively. Coagulase negative Staphylococci, Yeast-like fungus and Corynebacterium bovis were detected in less than 10% of milk. The number of Staphylococcus aureus in milk has not changed significantly during 5-h cultivation. The number of Streptococcus uberis in milk decreased slightly at 0.5 and 1 h compared with that at 0 h, but there was no significant difference. In the milk with Coliform, number ratio was significantly decreased to under 50% at 4 h compared with that at 0 h. Number ratio was significantly decreased at only 0.5 h of culture in milk with Coagulase negative Staphylococci, Yeast-like fungus and Corynebacterium bovis and their ratio further declined at 5 h of culture to under 20% in Coagulase negative Staphylococci or under 10% in Yeast-like fungus and Corynebacterium bovis.

These results suggest that some pathogens in high-somatic cell count milk decreased during preservation at room temperature. Therefore, reduction of microbes from the time of collection to examination should be taken into consideration to evaluate milk contamination.

REFERENCES


Diacylglycerol Acyltransferase1 (DGAT1) Gene Polymorphism in New Zealand Holstein Friesian Cattle under Dairy Breeding Station and Its Correlation with Milk Quality

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ABSTRACT: Functional single nucleotide polymorphism (SNPs) in major genes can be potential to be used genetic assisted selection (GAS) to improve considered traits. Using GAS into breeding program could give more accurate and efficient results. Diacylglycerol acyltransferase1 (DGAT1) gene is one of potential candidate major genes to improve milk components. The occurrence of dinucleotide substitution of AA to GC at exon 8 in the DGAT1 gene causes the change of lysine to alanine in amino acid (K232A). The aims of the study were to study Diacylglycerol Acyltransferase1 K232A (DGAT1 K232A) gene polymorphism and its association with milk quality components (fat, protein, SNF, lactose, DM) in Holstein Friesian (HF) dairy cattle imported from New Zealand. A total of 72 cows were investigated from Baturraden Excellent Dairy Cattle Breeding Station (Baturraden EDCBS). Genotyping of the DGAT1 gene by PCR-RFLP technique using EaeI restriction enzyme resulted in a fragment length by 411 bp. Genotype frequencies of KK, KA and AA were respectively 0.24, 0.76 and 0.00; while allele frequencies of K and A were 0.61 and 0.39. The result showed that the DGAT1 was polymorphic but its genotypes (KK and KA) were not significantly associated with individual milk components. Effect of DGAT1 polymorphism on milk quality should further be confirmed in a wider investigation.

Keywords: DGAT1 gene, Holstein Friesian, PCR-RFLP, milk quality.

INTRODUCTION

DGAT1 (diacylglycerol acyltransferase) gene is located in the centromic region of chromosome 14 (BTA14) consist of seventeen exons and sixteen introns. Recently, a quantitative trait locus (QTL) mapping study in dairy cattle resulted the identification of DGAT1 gene which is a enzyme in triglyceride synthesis and has strong effect in milk fat percentage and other milk production characteristic (Grisart et al. 2002). Studies led to discovery of a non-conservative dinucleotide substitution in exon 8 at positions of 10433 and 10434. The substitution is a change from AA to GC at amino acid number 232, therefore this polymorphism is commonly K232A (Grisart et al. 2002 a). Since its identification, the K2323A substitution has been associated with milk fatty acids and milk yield and composition in various dairy cattle breeds, such as German Holstein Friesian, Dutch Holstein Friesian, New Zealand Holstein Friesian, Brasilian Holstein and Polish Holstein Friesian (Grisart et al. 2002); Spelman et al. 2002 a; Thaller et al. 2003; Gautier et al. 2007; Schennink et al. 2007). The lysine encoding allele (K) has been shown to increase milk fat synthesis and to some extent and protein content (Grisart et al. 2002 a; Winter et al. 2002; Thaller et al. 2003; Schennink et al. 2007). The lysine allele (K) has also been reported to cause a decrease in protein and milk yield. Thus, both functional and positional data made DGAT1 a promising candidate gene for milk fat percentage and milk production in cattle. The effect of the DGAT1 mutations in fatty acids profile had been reported (Asmarasari, 2014), so in this paper, the authors will report the results of the research on the correlation of DGAT1 gene in milk quality traits of dairy cattle in dairy breeding station. The use of the DGAT1 gene as a marker gene needs to be verified mainly on HF breeding dairy cattle under environment in Indonesia.
The objective of this research was to examine genetic polymorphism that have been identified and associated with milk production and milk quality traits of the DGAT1 gene of New Zealand Holstein Friesian dairy cattle in Central Java, Indonesia.

MATERIALS AND METHODS

Genotypes

The study was conducted in excellent national dairy cattle breeding stations (Baturraden EDCBS) in Central Java from March-April 2012. Blood samples for DNA isolation were collected from 72 cows New Zealand Friesian Holstein. Extraction procedure followed the phenol-chloroform method that was modified by Andreas et al. (2010). Genotyping of the DAT1 polymorphism was performed using PCR-RFLP (Applied Byosistem 9700). The primers were designed based on the DGAT1 sequence (AY065621); forward 5’-GCACCATCCTCTCCTCAAG-3’ and reverse 5’-GGAAGCGCTTTCGGATG-3’ (Cardoso et al. 2011; Winter et al. 2002). PCR cycling conditions were 95°C for 5 min, followed by 40 cycles of 95°C for 30 s, annealing at 60°C for 1 min and extension at 72°C for 1 min and the final extension at 72°C for 5 min. The amplified product or amplicon had the length of 411 bp. Restriction enzyme used was EaeI which recognized restriction sites *GGCA.

Phenotypes

Data of milk yields and milk quality in their first lactation were collected from 72 HF cows to which blood samples were collected. A 0.5 liter milk was sampled from each cow twice a day, in the morning and the evening milking time from March - April 2012. Milk quality (protein percentage, fat percentage and lactose) were analyzed using MilkoScan Minor (Australia).

The Analysis Data

DGAT1/EaeI locus were allele frequency, genotype frequency, degrees of heterozygosity observation (H₀) and heterozygosity expectation (Hₑ) were tested using PopGene32 software ver. 1.31 (Yeh and Boyle 1997). The associations were analyzed by the General Linear Model (GLM) using SAS software ver 9.1 (2002).

RESULT AND DISCUSSION

Result of polymorphism of DGAT1 gene were not significantly effect on every trait measured (Table 1).

Table 1. Effects of DGAT1 polymorphism on milk production and milk quality traits

<table>
<thead>
<tr>
<th>Trait</th>
<th>Genotype</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily milk yield (liter)</td>
<td>KK (n=20)</td>
<td>11.32±6.50*</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>KA (52)</td>
<td>3.12±0.28a</td>
</tr>
<tr>
<td>Fat (%)</td>
<td></td>
<td>3.32±0.44a</td>
</tr>
<tr>
<td>Lactose (%)</td>
<td></td>
<td>4.63±0.46a</td>
</tr>
</tbody>
</table>

ns = non significant  s = significant

Daily milk production of New Zealand FH cow that maintained in under Indonesian environment much different from FH cows reared in New Zealand, native country as well as when compared to other breed (Table 2). Milk production is one of quantitative traits that are controlled by polygenes and also influenced by environment and generally controlled by external factors (external) and internal factors. External factors are factors that come from outside the body of livestock such as climate, the amount and quality of feed, diseases and parasites (Indrijani, 2001),
poor management practices and may be improved simply through better nutrition (Smaragdov 2006). Whilst internal factors are genetic factors, the period of lactation, milking frequency, age and body size of livestock, dry period, the estrous cycle and pregnancy, ketosys and milk fever (Sudono et al., 2005).

Table 2. Mean values and standard deviation of the analysed traits.

<table>
<thead>
<tr>
<th>Breed</th>
<th>Daily milk yield (kg)</th>
<th>Fat (%)</th>
<th>Protein (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friesian</td>
<td>30.01 ± 2.81</td>
<td>3.63 ± 0.53</td>
<td>3.26 ± 0.15</td>
</tr>
<tr>
<td>Jersey</td>
<td>23.03 ± 4.50</td>
<td>4.52 ± 0.73</td>
<td>3.26 ± 0.15</td>
</tr>
<tr>
<td>Piedmontese</td>
<td>10.86 ± 2.58</td>
<td>3.81 ± 0.72</td>
<td>3.64 ± 0.41</td>
</tr>
<tr>
<td>Valdostana</td>
<td>12.04 ± 5.00</td>
<td>3.57 ± 0.31</td>
<td>3.28 ± 0.34</td>
</tr>
</tbody>
</table>

Testing the effect of DGAT1 gene variant genotypes on milk production was done on Baturraden Excellent Dairy Cattle Breeding Station (Baturraden EDCBS), where the station is to implement an intensive maintenance management. Objective observations made at this station are to minimize the influence of the environment and maintenance management to milk production. Genetic variation occurring between the K allele and the A allele was due to a mutation at exon 8 by the existing dinucleotide substitution AA→GC that was identified for causing K232A (lysine K to Alanine A).

The association of variant genotype DGAT1 gene to the average protein content of milk was not statistically significantly different. Cows with KK genotype produce milk protein content of 3.12% and cows with KA genotype produce milk protein content of 3.06%. Milk protein is formed by three main sources, namely peptides derived from blood, plasma proteins and free amino acids. Milk protein content is relatively fixed during lactation, because these proteins are synthesized in the udder glandular epithelial cells is controlled by the genes.

Table 3. The K232A polymorphism in the DGAT1 gene of various cattle breeds and its association with milk production traits (N: number of individuals, FY: Fat yield, MY: Milk yield, PY: Protein yield, F%: Fat percentage, P%: Protein percentage).

<table>
<thead>
<tr>
<th>Population (N)</th>
<th>Allele Frequency</th>
<th>Association</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Zealand Holstein-</td>
<td>K:0.60 A:0.40</td>
<td>K: Increases FY, F% and P%;</td>
<td>Spelman et al., 2002</td>
</tr>
<tr>
<td>Friesian bulls (1527)</td>
<td></td>
<td>decreases MY and PY</td>
<td></td>
</tr>
<tr>
<td>Fleckviech bulls (833)</td>
<td>K:0.07 A:0.93</td>
<td>K: Increases FY, F% and P%;</td>
<td>Thaller et al., 2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>decreases MY and PY</td>
<td></td>
</tr>
<tr>
<td>German Holstein bulls</td>
<td>K:0.55 A:0.45</td>
<td>K: Increases FY, F% and P%;</td>
<td>Thaller et al., 2003</td>
</tr>
<tr>
<td>(858)</td>
<td></td>
<td>decreases MY and PY</td>
<td></td>
</tr>
<tr>
<td>Montbeliarde bulls</td>
<td>K:0.04 A:0.96</td>
<td>K: Increases FY, F% and P%;</td>
<td>Gautier et al., 2007</td>
</tr>
<tr>
<td></td>
<td></td>
<td>decreases MY and PY</td>
<td></td>
</tr>
</tbody>
</table>
Dutch Holstein Friesian (1762)  
K: 0.40  
A: 0.60  
K: Increases FY, F% and P%; decreases MY and PY  
Schennink et al., 2007

Polish Holstein Friesian (177)  
K: 0.40  
A: 0.60  
-  
Strzalkowska et al., 2005

This study (New Zealand under dairy breeding station (72))  
K: 0.61  
A: 0.39  
K: insignificant MY, P%, F%  
Asmarasari et al., 2014

CONCLUSION

Research on DGAT1 gene polymorphism does not affect the production and milk quality traits. Verification could do more with increasing the number of samples and genotype association studies to provide information early in the selection program.

ACKNOWLEDGEMENT

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REFERENCES


ABSTRACT: Since mastitis causes a great economic loss for dairy farmers, its prevention and treatment are essential for milk production. Escherichia coli (E.coli) is one of the main bacteria causing mastitis, and its cell membrane component, lipopolysaccharide (LPS), induces mammary inflammation through the recognition by Toll-like receptors (TLR)-4. In human, there are some reports that Cathelicidin (Cath), one of the antimicrobial peptides, could prevent LPS-induced inflammation by neutralization of LPS. The objective of the present study was to examine whether the goat Cath-2 bound to and neutralized LPS. Leukocytes derived from goat milk were cultured for 0, 1, 3, 6, 12, 24 h. Then the concentration of Cath-2 in the medium was measured. The binding ability of synthetic Cath-2 (0~100 ng/ml) to LPS was analyzed. Mammary epithelial cells (MEC) isolated from milk were cultured with LPS and/or Cath-2. Then mRNA expression of cytokines (IL-1β, IL-6, IL-8 and TNF-α) in the cells and concentration of lactoferrin (LF) in the medium were examined. The concentration of Cath-2 in the cultured medium increased significantly with the time of culture. It was confirmed that Cath-2 bound to LPS. The mRNA expression of IL-8 was increased significantly in MEC challenged with LPS. No significant effect of LPS on the expressions of other cytokines was found. The expressions of all cytokines were not changed by the addition of Cath-2 in MEC challenged with LPS. However, the expression of IL-1β, IL-6 and TNF-α tended to increase in association with the increase of Cath-2 concentration in the absence of LPS. The addition of Cath-2 together with LPS did not cause significant change in LF concentration in the medium. These results suggest that goat Cath-2 was secreted from leukocytes in milk and it has an ability to bind to LPS.

Keywords: Mastitis, Cathelicidin, LPS, Neutralization
and sepsis, such ability of Cath is important. Therefore, the objective of the present study is to examine whether the goat Cath-2 can bind to and neutralize LPS.

**MATERIALS AND METHODS**

Four crossbred female goats were kept in Hiroshima University farm under the Guideline for Animal Experimentation, Hiroshima University, Japan. Leukocytes were isolated from goats milk by centrifuging at 1,800 ×g at 4°C for 10 min and resulting precipitate was used. Leukocytes were cultured for 0, 1, 3, 6, 12, 24 h at the concentration of 1.0 ×10^8 cell/ml. After cultivation, Cath-2 concentration in the medium was measured using ELISA as reported previously (Zhang et al., 2014).

To determine whether Cath-2 can bind to LPS, synthetic Cath-2 (0 ~ 100 ng/ml) was added to the LPS-coated 96-well plate followed by additions of anti-Cath-2 antibody and HRP-labeled anti-rabbit IgG antibody. Then the absorbance of each well was measured.

To examine whether Cath-2 can neutralize LPS reaction, goat mammary epithelial cells (gMEC) was used. Goat milk was centrifuged and precipitated MEC were cultured at a concentration of 1.0 ×10^8 cell/ml for 24 h. Attached cells were cultured to be confluent. MEC was cultured in the medium supplemented with LPS (0 or 10 μg/ml) and/or Cath-2 (0-10 μg/ml) for 6 h. After cultivation, total RNA of MEC and cultured medium were collected to examine the mRNA expression of cytokines (IL-1β, IL-6, IL-8, TNF-α) and the concentration of LF, respectively.

The significance of differences was analyzed by using Kruskal-Wallis multiple comparison test and Tukey multiple comparison test. A probability of P < 0.05 was considered to be significant.

**RESULTS AND DISCUSSION**

The concentration of Cath-2 in the cultured medium increased significantly at 3-24 h compared with that at 0 h. When leukocytes were cultured for different time and immunostained for Cath-2, positive immuno-reaction was observed in the cytoplasm of leukocytes cultured for 0-24 h, suggesting that Cath-2 was synthesized and secreted from leukocytes into milk.

When binding ability of Cath-2 to LPS was examined, the absorbance of the wells added with Cath-2 was significantly higher than that without Cath-2 in the LPS-coated plate. This result suggests that Cath-2 can bind to LPS.

The mRNA expression of IL-8 was increased significantly in MEC cultured with LPS compared with that without LPS. However, no significant differences in the expressions of IL-1β, IL-6 and TNF-α were found in MEC cultured between with and without LPS. The expressions of all cytokines were not changed by the addition of Cath-2 in MEC challenged with, or without, LPS. The addition of Cath-2 and/or LPS did not cause significant change in LF concentration in the medium.

In conclusion, these results suggest that goat Cath-2 is synthesized by leukocytes and secreted into milk and it has an ability to bind to LPS. But we cannot say that Cath-2 has the ability to neutralize LPS.

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Identification of Pure Breed Bali Cattle by Using Molecular Approach

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ABSTRACT: Bali cattle are well known as local beef cattle from Indonesia and recognized as one of beef cattle gene pools in South East Asia. The Bali cattle now are distributed almost throughout of Indonesia and most of them are in the status of either inbreeding or crossed breed. This recent research was intended to identify the pure breed of Bali cattle by using molecular marker approach. DNA Bali cattle samples collected from several locations in Indonesia were investigated. Amount of 24 DNA samples (23 males, 1 female) were used. Those 23 male DNAs consisted of male Bali cattle from NTB/West Nusa Tenggara (10), Riau (5), Bali (5), Kalimantan (2), and 1 male Brahman as breed control collected from Sembawa (Palembang) while one (1) DNA female was Bali cattle as sex control. An UTY gene was used in this study. All 24 DNA samples were amplified with UTY (F and R) primer for 35 cycles. Visualization of all PCR products on 1% agarose gel showed bands at 484 bp. as a right size for UTY gene, and none UTY fragment for female DNA sample (Bali cattle). Six UTY fragments were sequenced as representative of each region. The molecular analysis by ClustalW Alignment of the sequence results with reference of Genbank-NCBI showed that there was not found nucleotide different between sequenced samples to UTY reference, however there found 16 nucleotide different of sequenced samples to UTY gene reference. Similarity of UTY sequence was found 100% for sequence samples to UTY Bos Taurus and Bos indicus. This study concluded that UTY gen exists in all male Bali and male Brahman cattle. This early finding suggests that purity identification of Bali cattle needs more specific genetic marker in the Y-chromosome.

Keywords: Pure breed, Bali cattle, molecular analysis, UTY gene

INTRODUCTION

Bali cattle is one of local beef cattle breed in Indonesia and one of the four existing indigenous cattle breeds (Aceh, Pesisir, Madura and Bali) and Ongole breed was also considered as a local beef cattle since already adapted in a very long time in Indonesia (Martojo, 2012). The Bali cattle is well known as one of gene pools of beef cattle breed in Southeast Asia. In the past of a colonial era, distribution of Bali cattle was restricted only in Bali island in order to keep their breed purity. Up to now, however the Bali cattle almost distributes throughout of Indonesia and suspected in the status of not pure breed anymore.

Characteristics of Bali cattle are signed specifically with white rump patches and white stocking of four beneath legs, black hairs of the back, black color in male and brown in female and in juvenile. In the field, out site of Bali island, Bali cattle is sometime observed with white spotted and even almost all white color. It seems that inbreeding and crossing with other breeds were happened among Bali population. As consequence of inbreeding among Bali cattle, weight performance of Bali cattle now decreases as reported by Talib et al. (2000). A higher rate of inbreeding of Bali cattle might be happened in Bali since Bali cattle has been conserved for decades during colonial era. Purity of Bali cattle is believed conserved at Nusa Penida of Bali island. However, the average of their body weight performance is recently smaller (± 300-350 kg) compared to during colonial era (700-800kg).

There are some concerns about the breed purity because of intensive crossbreeding programs using natural mating and AI using exotic breeds that may cause extinction because of
indiscriminate crossing (Martojo, 2012). Conservation of Bali cattle purity needs to be prevented in order to develop breeding programs. Breeding of Bali cattle as well as other domestic local cattle in Indonesia is important to support a sustainable livestock production. In addition, Bali cattle has some advantageous of adapted at arid area, easy to be reared by smallholder farmers, better in reproduction, carcass and meat quality traits.

Recent molecular studies have reported the advantageous of applying molecular technology approaches. Applying of Single Nucleotide Polymorphism (SNP) in the intron of Y-chromosomal gene UTY 19 was used for cattle domestication (Götherström, et al., 2005; Svensson and Götherström, 2008). Genetic markers from Y-chromosome have been used for tracing the origin of Bali cattle (Kusdiantoro et al., 2009). Purity assessment of Bali cattle has been conducted by applying specific microsatellite marker of HEL9 and INRA035 (Handiwirawan et al., 2003). Breeding value estimation and genetic tendency can also be used for evaluation of Bali cattle purity (Sukmawati et al., 2002). Genotyping by applying microsatellite genetic markers can be used for parentage checking (Margawati et al., 2002).

This research was therefore designed to apply molecular marker to define the purity of Bali cattle. As early study, a genetic primer of UTY was applied for this research purpose in male Bali cattle from several locations in Indonesia and female Bali cattle as sex control and Brahman cattle as breed control.

**MATERIALS AND METHODS**

Samples and DNA Isolation. Amount of 24 sample animals was applied in this research and one of them was female Bali cattle as a control. The remain of 23 male animals consisted of 10 Bali cattle from NTB/West Nusa Tenggara, 5 Bali cattle from Riau, 6 Bali cattle from Bali, 2 Bali cattle from Kalimantan and 1 Brahman as breed control collected from Sembawa, Palembang of south Sumatera. All DNA samples were collected from their fresh blood. Detail of material samples was summarized in Table 1.

<table>
<thead>
<tr>
<th>No</th>
<th>Breed</th>
<th>No. Animal</th>
<th>Material</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bali cattle</td>
<td>23</td>
<td>blood</td>
<td>Lombok, West Nusa Tenggara (10)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Riau, Sumatera (5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pulukan, Bali (6*)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pelaihari, South Kalimantan (2)</td>
</tr>
<tr>
<td>2</td>
<td>Brahman</td>
<td>1</td>
<td>blood</td>
<td>Sembawa, Palembang</td>
</tr>
</tbody>
</table>

*5 male and 1 female

DNA was extracted by using a method of a high concentrated salt (Montgomery and Sise, 1990; Mohammadi and Saberiva, 2009) while the small volume of blood samples was collected by using DNeasy Blood and Tissue Extraction kit (Qiagen).

**UTY Primer**. Primer targeting was re-designed from the reference sequence of AY936542.1 with full length target 484 bp of UTY 19 starting from nucleotide position 1 of the reference (AY936542.1).

**Amplification and Sequencing**. All DNA samples were amplified using designed primer UTY 19 F-5’ TAA GTT GAA AGT TCT TCT ACT GTC 3’ (24 bases) and R-5’ CAA CGT TCA AAG TTA TAC ACA AAA 3´ (24 bases) with targeting 484 bp of UTY-19. PCR reagent of AccuPower PCR Mix (Bioneer) was used with annealing temperature of 52°C and run for 35 cycles. PCR products were visualized on 1% agarose gel using UV transilluminator exposure.

Amount of 6 selected PCR product samples of UTY gene fragments were sequenced through
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a private company services. Those 6 samples represented 5 Bali cattle and 1 Brahman cattle, all samples were male cattle.

**Sequence Analysis.** The UTY gene sequence was aligned with the reference of UTY gene sequence *Bos gaurus* (AY936539.1), *Bison bison* (AY936540.1), *Bubalus bubalis* (AY936541.1), *Bos taurus* (AY936542.1), *Bos indicus* (Ginja *et al.* 2009) by ClustalW multiple alignment software. The UTY gene sequence was then analyzed with nBLAST from NCBI (http://blast.ncbi.nlm.nih.gov/Blast.cgi) to see the similarity percentage (%) of UTY gene.

**RESULTS AND DISCUSSION**

**UTY Gene and Purity Detection**

All male samples showed a right size of the targeting UTY gene intron 19 of the Y-chromosome. Representative of targeting UTY fragment is presented in Figure 1.

![Figure 1](image)

**Figure 1.** Representative PCR products of male animal samples bear UTY gene (484bp.) (M= 100bp. DNA Ladder; Lane 1 to 12= Bali cattle; Lane 13= Brahman)

The UTY gene exists in all male samples (Bali and Brahman male cattle) with fragment size of 484 bp. (Figure 1). This UTY gene was used for detecting the ancestor of modern cattle (Svensson and Götherström, 2008) and domestication (Götherström, *et al.*, 2005). This UTY gene is obtained only in male or exists only in Y-chromosome (Svensson, 2010; Liu and de Leon, 2007). Therefore, the UTY gene was not found in female Bali cattle (not presented in the Figure).

In the Figure 1 showed differences band pattern performance where lane 1, 2 and 6 got more than 1 band. This finding of ladder-like bands (or smear) is similar to the previous study of Liu *et al.* (2003) where the unique band pattern was found in 17 bulls both individually and in other breeds. This ladder-like bands or multi-copy MS are unique for individuals or breeds. These multi copies features loci numbers. This multi-copy male specific sequence (MSY) can be used in Y-chromosome polymorphism analysis. In addition, individual bull got a unique haplotype Y (BTAY14) than can be used to identify individuals, breed or crossbreed (Liu and de Leon, 2007).

In the case of identifying purity of Bali cattle, we may need to explore with more specific genetic markers on the Y-chromosome. There are approximately 260 DNA markers, including ~50 MS,10 genes/ESTs, and ~200 BES, on the Bovine Y Chromosome (BTAY) map (Liu and de Leon, 2007). In addition, the future research might need to involve wild Banteng since it is believed that Bali cattle are originated from wild Banteng (Kusdiantoro *et al.*, 2009; Purwantara *et al.*, 2012).

**Nucleotide Variation**

Nucleotide analysis of the Bali cattle and Brahman compared with UTY gene reference from genbank-NCBI by ClustalW Multiple Alignment is summarized in Table 2. The UTY gene references for the comparison were, *Bos gaurus, Bison bison, Bubalus bubalis* and *Bos taurus.*
### Table 2. Summary of Sequence Alignment Analysis of UTY Gene in Male Bali Cattle Samples collected from Several Locations in Indonesia Compared to other Breeds from GenBank NCBI

<table>
<thead>
<tr>
<th>No</th>
<th>Breed</th>
<th>Sample Location</th>
<th>Nucleotide Position</th>
<th>Similarity</th>
<th>Gaps</th>
<th>Bases change</th>
<th>Length of sequence (bp)</th>
<th>Acc. number</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>01_Bima</td>
<td></td>
<td>C C C A T T C C - C A G A A</td>
<td>100%</td>
<td>-</td>
<td>None</td>
<td>415</td>
<td>AY936542.1</td>
<td>Gotherstrom et al., 2005</td>
</tr>
<tr>
<td>2</td>
<td>04_Mataram</td>
<td></td>
<td>- - - - - - - - - -</td>
<td>97%</td>
<td>10 bp</td>
<td>at 247</td>
<td>494</td>
<td>AY936540.1</td>
<td>Gotherstrom et al., 2005</td>
</tr>
<tr>
<td>3</td>
<td>05_Pulukan</td>
<td></td>
<td>- - - - - - - - - -</td>
<td>95%</td>
<td>10 bp</td>
<td>at 247</td>
<td>494</td>
<td>AY936541.1</td>
<td>Gotherstrom et al., 2005</td>
</tr>
<tr>
<td>4</td>
<td>06_Riau</td>
<td></td>
<td>- - - - - - - - - -</td>
<td>97%</td>
<td>10 bp</td>
<td>at 247</td>
<td>494</td>
<td>AY936540.1</td>
<td>Gotherstrom et al., 2005</td>
</tr>
<tr>
<td>5</td>
<td>07_Kalsel</td>
<td></td>
<td>- - - - - - - - - -</td>
<td>95%</td>
<td>10 bp</td>
<td>at 247</td>
<td>494</td>
<td>AY936541.1</td>
<td>Gotherstrom et al., 2005</td>
</tr>
<tr>
<td>6</td>
<td>B. gaurus</td>
<td>(AY.936539.1)</td>
<td>- - - - - - - - C -</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>B. bison</td>
<td>(AY.936540.1)</td>
<td>- - - - - - - - - -</td>
<td>97%</td>
<td>10 bp</td>
<td>at 247</td>
<td>494</td>
<td>AY936540.1</td>
<td>Gotherstrom et al., 2005</td>
</tr>
<tr>
<td>8</td>
<td>B. bubalis</td>
<td>(AY.936541.1)</td>
<td>A T T A G - C T C A</td>
<td>95%</td>
<td>10 bp</td>
<td>at 247</td>
<td>494</td>
<td>AY936541.1</td>
<td>Gotherstrom et al., 2005</td>
</tr>
<tr>
<td>9</td>
<td>B. taurus</td>
<td>(AY.936542.1)</td>
<td>- - - - - - - - - -</td>
<td>95%</td>
<td>10 bp</td>
<td>at 247</td>
<td>494</td>
<td>AY936542.1</td>
<td>Gotherstrom et al., 2005</td>
</tr>
<tr>
<td>10</td>
<td>Brahman</td>
<td></td>
<td>- - - - - - - - - -</td>
<td>95%</td>
<td>10 bp</td>
<td>at 247</td>
<td>494</td>
<td>AY936541.1</td>
<td>Gotherstrom et al., 2005</td>
</tr>
</tbody>
</table>

Remarks: * Insert Mutation= 10 bp. (AATACCAAT); dots (…) = nucleotides not different among cattle breeds.

Based on the Table 2, there were 16-nucleotide point differences between the five Bali cattle origin samples and other cattle breeds on the UTY 19. There were not found nucleotide base differences on the UTY 19 when Bali and Brahman cattle compared with reference UTY 19 of Bos taurus (AY 936542.1). It might be the origin of Bali cattle and Brahman cattle are from tropical area while Bos taurus is typically origin cattle breed from Europe with cold weather. The Y-Chromosome is paternally inherited it has been used to study the evolution and migration patterns of modern humans by using Y-Chromosome haplotypes (Quintana-murci et al., 2001).

Similarity analysis of the sequenced cattle samples to the reference UTY gene is presented in Table 3. Those references used for comparison were Bos taurus, Bison bison, Bubalus bubalis and B. indicus.

### Table 3. Similarity UTY Sequence of Bali Cattle Samples from different locations Compared to other Breeds

<table>
<thead>
<tr>
<th>Breed</th>
<th>Sample Location</th>
<th>Similarity</th>
<th>Gaps</th>
<th>Bases change</th>
<th>Length of sequence (bp)</th>
<th>Acc. number</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>B. taurus clone SUTY</td>
<td></td>
<td>100%</td>
<td>-</td>
<td>None</td>
<td>415</td>
<td>AY936542.1</td>
<td>Gotherstrom et al., 2005</td>
</tr>
<tr>
<td>Bison bison</td>
<td></td>
<td>97%</td>
<td>10 bp</td>
<td>at 247</td>
<td>494</td>
<td>AY936540.1</td>
<td>Gotherstrom et al., 2005</td>
</tr>
<tr>
<td>Bubalus bubalis</td>
<td></td>
<td>95%</td>
<td>10 bp</td>
<td>at 247</td>
<td>494</td>
<td>AY936541.1</td>
<td>Gotherstrom et al., 2005</td>
</tr>
</tbody>
</table>
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| B.indicus (Brahman) | 100% | Short base | 280 | Brahman | Ginja et al., 2009
| B.indicus (Brahman) | 100% | None | 420 | - | This research

In the Table 3 showed 100% similarity when Bali cattle (from 5 locations) compared to Bos taurus (AY936542.1; Gotherstorm et al. 2005), 100% when compared to Bos indicus (Ginja et al. 2009) and 100% compared to Brahman (Bos indicus) of this research. However, the similarity to UTY gene was 97% when the Bali samples compared to Bison bison (AY936540.1; Gotherstorm et al. 2005) and 95% when compared to Bubalus bubalis (AY936541.1; Gotherstorm et al. 2005). There was insertion of 10 nucleotides at the position of 247 in Bison bison and Bubalus bubalis. Therefore the nucleotide numbers of those breeds are longer 10 nucleotides compared to the UTY of Bali cattle samples, Bos taurus, Bos gaurus and Bos indicus. All references belong to order Artiodactyla, suborder Ruminantia, family Bovidae (Prusak et al., 2004), however still had small difference of UTY gene similarity in Bison bison (97%) and Bubalus bubalis (95%).

CONCLUSIONS

All male DNA samples bear UTY gene intron 19 of Y-chromosome. There is not found nucleotide variation in the UTY gene fragment of Bali cattle and Brahman males compared to the reference of Bos taurus (AY936542.1). There is found 16 points of nucleotide variation in the UTY gene fragment of Bali cattle compared with reference of Bos gaurus (AY936539.1), Bison bison (AY936540.1) and Bubalus bubalis (AY936541.1). The existing UTY gene in the intron 19 of Y-chromosome could not be used to determine the purity of Bali cattle breed. In coming research, the study will focus on the specific marker in the Y-chromosome for identifying individual breed and the crossbreed of possibility introgression of other breed in Bali cattle. So, it might be can explain clearly the breed purity.

REFERENCES


Mohammadi, G. and A. Saberivand, 2009. Simple method to extract DNA from Mammalian whole
Milk Transmitting Ability of Saanen Bucks under Intensive Management

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Research Institute for Animal Production, PO Box 221, Bogor, Indonesia
Corresponding email: ria.anneke@yahoo.co.id

ABSTRACT: Saanen goats have been maintained intensively for their good milk production in some parts of West Java, Indonesia. Genetic evaluation is required for dairy bucks to be used as breeding stocks. Milk transmitting ability of 18 Saanen bucks, whose female offspring for 1-27 hd, were evaluated at Fajar Taurus Dairy Farm, Cicurug, West Java. Data of daily milk yield were evaluated only for lactation lengths ≥120 days at 1st lactation period. Lactation lengths were standardized to complete lactations of 180 days. Heritability of 180-d milk production was estimated by paternal half-sib correlation method. Variant components among bucks were generated from general linear method by considering fix effects of kidding year and kidding month on milk yields of offspring. Contemporary Comparison (CC) method was used to evaluate milk transmitting ability of the bucks. Heritability of milk production was $h^2 = 0.301$. The values of estimated transmitting ability (ETA) of Saanen bucks varied with the highest ETA being 9.3 (CC = 114.3 and EBV = 18.6). Bucks at the 3 highest ranks (ETA = 2.9 to 9.3) could be considered as breeding stocks. However, the accuracy of these best bucks had to be improved as their ETAs were derived from limited female offspring.

Keywords: Saanen Buck, Milk Production, Transmitting Ability.

INTRODUCTION

The commercial business of dairy goat farms recently has grown in some urban areas in Java Island, Indonesia. This dairy goat business has developed due to a growing number of consumers of goat milk, especially in large cities. Consumers believe many functions can be obtained by consuming milk from dairy goat. Goat milk is a source of animal food with a balanced nutrition, containing a high quality of proteins and a great content of minerals and vitamins. Goat milk is also considered as a medical food to address a number of health problems. Moreover, this milk also has better digestibility of lipid fraction and is lower in allergenicity of protein fraction compared to milk of dairy cattle (Brito et al., 2011).

Genetic improvement of dairy goat production of milk, fat, protein and a number of other related lactation traits is considered necessary. Currently milk production is the primary target in dairy goat business in our country as it directly determines income of farmers and farms. A buck had an important role to make genetic improvement of milk production of dairy goat due to its ability to produce a large number of offspring in a relatively short period (Wiggans et al., 1989). However, males do not produce milk, so their ability to pass milk production onto their offspring can only be evaluated by progeny testing. Progeny testing makes possible that the determination of milk transmitting ability of each of bucks.

A number of large dairy goat farms have commercially reared Saanen goats in West Java. One example is Taurus Dairy Farm, Cicurug-Sukabumi, West Java. Saanen goats on this farm were originally imported from Perth and New South Wales in 1996. Twenty young females (eight months old) and 4 young males (one year old) were initially imported. In 1999, 33 Saanen ewes were brought from Central Java. Mating was performed between the existing males and females,
later followed by the mating among their offspring. Animals were reared intensively under a good feeding and management.

The purpose of this study was to evaluate milk transmitting ability of saanen bucks reared under an intensive management at PT Taurus Dairy Farm, Sukabumi, West Java.

MATERIALS AND METHOD

Secondary data were collected from Saanen bucks consisting of identity, date of mating and date of kidding of their offspring. Milk production of female offsprings were also collected during 2000 - 2011. Twenty Saanen bucks were identified that had a wide ranged number of female offspring (1-31 hd). For the purpose of this study, 18 Saanen bucks with 1-27 female offspring were considered in evaluation. Some bucks (10 bucks) for the evaluation had only one female offspring; while anothers had either 2-5 offspring (4 bucks) or 6-11 offspring (4 bucks). However, 2 bucks had female offspring of 16 hd and 27 hd, respectively.

Milk production of female offspring evaluated in progeny test of their bucks were summarized as monthly cumulative milk productions for lactation lengths of more than 120 days in 1st lactation. Differences in lactation lengths were standardized to complete lactation to 180 days (Anggraeeni, 2014). Correction factors of lactation length of milk production at the first lactation of 120d, 150d, 180d, 210d, 240d, 270d, 300d, 330d and 360d were successively 1.40, 1.16, 1.00, 1.16, 1.30, 1.41, 1.58, 1.64 and 1.79. Heritability of this 180-d milk production was estimated by paternal half-sib correlation method. Variant components among bucks were generated from general linear method by considering fix effects of kidding year and kidding month.

Estimated breeding value (EBV) for an individual buck was analyzed by Contemporary Comparision (CC) method (Dalton, 1985), following this formula:

\[\text{CC}_i: \frac{\sum_i wij dij}{\sum_i wij}\]

\[\text{EBV}: 2b \text{CC}_i\]

\[b: \frac{wi}{(wi + k)}; k: \frac{(4 - h^2)}{h^2}.\]

\[nD: \text{number of female offspring of a certain buck as participant in progeny test.}\]

\[nM: \text{number of herdmates (M) in a same herd.}\]

\[dij: \text{production difference between female offspring of a tested buck against contemporary.}\]

\[w: \frac{(nD \times nM)}{(nD + nM)}.\]

\[wi = \sum wij\] was as a weighting factor of female offspring of ith buck in jth herd.

RESULTS AND DISCUSSION

The Use of Bucks in Natural Mating

Distribution of Saanen bucks in natural mating services on female Saanen population in this study were identified based on kidding year of their offspring as shown in Table 1. However, Saanen bucks having only one offspring in the evaluation (8 hd) were not presented.

Saanen bucks were used for natural mating services over a long period. This was especially true for those having female offspring in relatively large numbers (TDF13, Thunder, TDF 14, TDF 17 and Maralinda P). They were used as natural service sires for 4-7 years. TDF 13 had the largest number of offspring (27 hds); distributed between 2005 - 2010.
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Table 1. Number of female offspring of Saanen bucks used in natural mating services from 2000-2010

<table>
<thead>
<tr>
<th>Buck Identity</th>
<th>Kidding year of sire’s offspring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2000</td>
</tr>
<tr>
<td>Komuta TP</td>
<td>5</td>
</tr>
<tr>
<td>Drazell</td>
<td>2</td>
</tr>
<tr>
<td>TDF 13</td>
<td></td>
</tr>
<tr>
<td>Thunder</td>
<td>2</td>
</tr>
<tr>
<td>TDF 14</td>
<td>1</td>
</tr>
<tr>
<td>Maralinda P</td>
<td>6</td>
</tr>
<tr>
<td>TDF 48</td>
<td></td>
</tr>
<tr>
<td>Keynote</td>
<td>1</td>
</tr>
<tr>
<td>TDF 17</td>
<td>1</td>
</tr>
<tr>
<td>Komuta B</td>
<td>2</td>
</tr>
</tbody>
</table>

Milk Production

Standardized milk production for a 180-day lactation of female offspring for Saanen bucks in the study are shown in Table 2.

Table 2. Description of standardized 180-d milk production of female offspring of Saanen bucks.

<table>
<thead>
<tr>
<th>Buck ID</th>
<th>∑ Offspring (hd.)</th>
<th>Mean±SD (lt.)</th>
<th>Buck ID</th>
<th>∑ Offspring (hd.)</th>
<th>Mean±SD (lt.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pamona J</td>
<td>1</td>
<td>421</td>
<td>Maralinda P</td>
<td>16</td>
<td>223 ± 71</td>
</tr>
<tr>
<td>Komuta T</td>
<td>1</td>
<td>353</td>
<td>TDF 48</td>
<td>5</td>
<td>203 ± 14</td>
</tr>
<tr>
<td>TDF 46</td>
<td>1</td>
<td>271</td>
<td>Keynote</td>
<td>3</td>
<td>176 ± 21</td>
</tr>
<tr>
<td>Komuta TP</td>
<td>6</td>
<td>332 ± 71</td>
<td>TDF 17</td>
<td>9</td>
<td>262 ± 82</td>
</tr>
<tr>
<td>Drazell</td>
<td>6</td>
<td>185 ± 75</td>
<td>TDF 5</td>
<td>1</td>
<td>185</td>
</tr>
<tr>
<td>TDF 28</td>
<td>1</td>
<td>236</td>
<td>SP</td>
<td>1</td>
<td>129</td>
</tr>
<tr>
<td>TDF 13</td>
<td>27</td>
<td>214 ± 100</td>
<td>Jaloe</td>
<td>1</td>
<td>117</td>
</tr>
<tr>
<td>Thunder</td>
<td>11</td>
<td>212 ± 94</td>
<td>Komuta B</td>
<td>2</td>
<td>282 ± 19</td>
</tr>
<tr>
<td>TDF 14</td>
<td>9</td>
<td>232 ± 62</td>
<td>TP</td>
<td>1</td>
<td>105</td>
</tr>
</tbody>
</table>

Milk production showed a wide variation, either among the offspring within buck or between bucks. Milk production ranged from 421 lt (Pamona J), to 105 lt (TP). However, both productions were from one offspring.

The average milk production for a standardized 180-d lactation for first lactation was 227±88 lt. Average milk production of complete lactations for 1-5 lactation of Saanen goats in tropical regions of Sudan were between 206-369 kg (Ishaq et al., 2012). Higher milk production of a previous study was due to longer lactation lengths (vs standardized 180-d), namely 194 - 212 days.
Heritability

Heritability of milk production that was estimated based on a standardized 180-d milk production in 1st lactation was \( h^2 = 0.301 \). Heritability showed additive genetic variation passed from parent to offspring. Estimated value of heritability in a population depends on population condition such as number of sires evaluated and method used (Warwick et al., 1995). Heritability of milk production in this study was estimated from Saanen bucks having an average number of female offspring of 5.7 hd per buck. Nevertheless, some bucks had only one offspring.

Heritability values can be estimated fairly accurate if a males had a minimal number of female offspring of 10 hd (Dalton 1985). Higher values of heritability were obtained from a study of five exotic dairy goat breeds, namely Saanen, Alpine, LaMancha, Nubian and Toggenburg (\( h^2 = 0.44, 0.42, 0.38, 0.45, \) and 0.41, respectively) (Grossman et al., 1986). A high value of heritability showed genetic improvement can be made effectively through genetic selection.

Milk Transmitting Ability

To determine genetic potential of Saanen bucks to transmit milking production to their female offspring, it is necessary to estimate breeding value for milk production. This can be calculated by using the Contemporary Comparison (CC) method. The CC method is based on calculation of breeding value and milk transmitting ability by comparing the average of the first lactation milk production of female offspring of a certain sire to those of other males that produce milk in the same herd, season, and year.

Table 3. Estimated values of CC, EBV and ETA of Saanen bucks, ranked high to low of ETA

<table>
<thead>
<tr>
<th>BUCK</th>
<th>Offs.</th>
<th>Wi</th>
<th>Dij</th>
<th>( \sum Wi )</th>
<th>( \sum Wi Dij )</th>
<th>b</th>
<th>CC</th>
<th>EBV</th>
<th>ETA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pamona J</td>
<td>1</td>
<td>1.09</td>
<td>114.99</td>
<td>1.09</td>
<td>124.68</td>
<td>0.08</td>
<td>114.29</td>
<td>18.4</td>
<td>9.32</td>
</tr>
<tr>
<td>Komuta T</td>
<td>1</td>
<td>1.09</td>
<td>46.09</td>
<td>1.09</td>
<td>50.28</td>
<td>0.08</td>
<td>46.09</td>
<td>7.52</td>
<td>3.76</td>
</tr>
<tr>
<td>TDF 46</td>
<td>1</td>
<td>1.03</td>
<td>37.14</td>
<td>1.03</td>
<td>38.4</td>
<td>0.08</td>
<td>37.14</td>
<td>5.76</td>
<td>2.88</td>
</tr>
<tr>
<td>Komuta TP</td>
<td>6</td>
<td>0.34</td>
<td>9.77</td>
<td>1.43</td>
<td>118.78</td>
<td>0.03</td>
<td>82.84</td>
<td>4.50</td>
<td>2.25</td>
</tr>
<tr>
<td>Drazeil</td>
<td>6</td>
<td>1.17</td>
<td>39.81</td>
<td>2.74</td>
<td>43.84</td>
<td>0.09</td>
<td>16.02</td>
<td>2.78</td>
<td>1.39</td>
</tr>
<tr>
<td>TDF 28</td>
<td>1</td>
<td>1.03</td>
<td>2.34</td>
<td>1.03</td>
<td>2.41</td>
<td>0.08</td>
<td>2.34</td>
<td>0.36</td>
<td>0.18</td>
</tr>
<tr>
<td>TDF 13</td>
<td>27</td>
<td>0.11</td>
<td>-50.25</td>
<td>1.3</td>
<td>11.77</td>
<td>0.01</td>
<td>10.44</td>
<td>0.18</td>
<td>0.09</td>
</tr>
<tr>
<td>Thunder</td>
<td>11</td>
<td>0.50</td>
<td>21.47</td>
<td>2.75</td>
<td>2.86</td>
<td>0.04</td>
<td>1.04</td>
<td>0.08</td>
<td>0.04</td>
</tr>
<tr>
<td>TDF 14</td>
<td>9</td>
<td>0.37</td>
<td>20.87</td>
<td>2.60</td>
<td>0.3</td>
<td>0.03</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Maralinda</td>
<td>16</td>
<td>0.29</td>
<td>-43.00</td>
<td>2.73</td>
<td>-15.06</td>
<td>0.03</td>
<td>-5.52</td>
<td>-0.26</td>
<td>-0.13</td>
</tr>
<tr>
<td>TDF 48</td>
<td>5</td>
<td>0.28</td>
<td>-73.45</td>
<td>0.28</td>
<td>-20.64</td>
<td>0.02</td>
<td>-73.14</td>
<td>-3.28</td>
<td>-1.64</td>
</tr>
<tr>
<td>Keynote</td>
<td>3</td>
<td>0.59</td>
<td>-123.06</td>
<td>1.62</td>
<td>-70.06</td>
<td>0.05</td>
<td>-43.16</td>
<td>-3.96</td>
<td>-1.98</td>
</tr>
<tr>
<td>TDF 17</td>
<td>9</td>
<td>1.09</td>
<td>-130.26</td>
<td>3.40</td>
<td>-141.62</td>
<td>0.08</td>
<td>-41.64</td>
<td>-6.79</td>
<td>-3.40</td>
</tr>
<tr>
<td>TDF 5</td>
<td>1</td>
<td>1.03</td>
<td>-48.38</td>
<td>1.03</td>
<td>-49.94</td>
<td>0.08</td>
<td>-48.38</td>
<td>-7.50</td>
<td>-3.75</td>
</tr>
<tr>
<td>SP</td>
<td>1</td>
<td>1.11</td>
<td>-74.00</td>
<td>1.11</td>
<td>-82.2</td>
<td>0.08</td>
<td>-74.00</td>
<td>-12.27</td>
<td>-6.14</td>
</tr>
<tr>
<td>Jaloie</td>
<td>1</td>
<td>1.11</td>
<td>-85.25</td>
<td>1.11</td>
<td>-94.72</td>
<td>0.08</td>
<td>-85.25</td>
<td>-14.14</td>
<td>-7.07</td>
</tr>
<tr>
<td>Komuta B</td>
<td>2</td>
<td>0.64</td>
<td>-24.41</td>
<td>0.64</td>
<td>-141.24</td>
<td>0.05</td>
<td>-219.70</td>
<td>-21.84</td>
<td>-10.92</td>
</tr>
<tr>
<td>TP</td>
<td>1</td>
<td>1.13</td>
<td>-13.33</td>
<td>1.13</td>
<td>-150.00</td>
<td>0.08</td>
<td>-133.33</td>
<td>-22.36</td>
<td>-11.18</td>
</tr>
</tbody>
</table>

Description:
CC : Contemporary Comparison; EBV : Estimated Transmitting Ability; ETA : Estimated Transmitting Ability
Results of estimated breeding values (EBV) for Saanen bucks, by CC method, showed both positive and negative EBV (Table 3). This genetic evaluation was calculated for many bucks that had female offspring in limited numbers. The 3 highest ranking bucks had CC values of 114.3, 46.1 and 37.1 and EBV values of 18.6, 7.5 and 5.8. Estimated transmitting ability is calculated as half of the EBV. Those bucks having negative CC values also had negative values of EBV and ETA.

Contemporary Comparison method has some advantages in estimating EBV and ETA by making corrections for possible differences in the number of offspring. This was because only the first lactation of offspring were evaluated. However, this method is only accurate when the number of female offspring of the evaluated bucks were at least 10 animals. Only three bucks from this study had more than 10 offspring. The average number of female offspring for the evaluated bucks were limited and made estimation of heritability and ETA less accurate and probably affected accuracy for identifying the best bucks in the herd.

**CONCLUSION**

Evaluation on milk transmitting ability of Saanen bucks, based on a standardized 180-d lactation of the 1st lactation of female offspring, identified the top three best Saanen bucks with ETA values of 9.3, 3.8 and 2.9. The accuracy of identification of top Saanen bucks can be improved with more offspring per buck.

**REFERENCES**


Genetic Markers of Twinning Births of Local Beef Cattle and Its Crossbreds in Indonesia

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ABSTRACT: Genetic polymorphisms of Insuline Like Growth Factor 1 (IGF1) gene and Osteopontin (OPN or SPP1) gene were studied in Indonesian local beef cattle and its crossbreds. In regarding to twinning trait, the IGF1 gene is associated to ovulation rates, while the OPN gene is related to maintain fetal growth and pregnancy. Blood samples of local Ongole Grade (OG) cattle of historical twin (T) and non twin (NT) were collected from the Provinces of South Kalimantan (T=17 and NT=3) and East Java (T=28 and NT=12); and for its crossbreds from Central Java (T=28 and NT=9). Genotyping was done by Polymerase Chain Reaction–Restriction Fragment Length Polymorphism (PCR-RFLP) Method, using restriction enzymes of SnaB1 (the IGF1 gene) and Bsr1 (the OPN gene). Genotyping at the intron1 IGF1 gene for all observed cattle was monomorphic, resulting entirely the BB genotype, with a DNA fragment of 249 bp. Genotyping at the intron4 OPN gene was polymorphic, resulting three genotypes, i.e. CC (200 and 90 bp), CT (290, 200, 90 bp) and TT (290 bp). The OG twin cattle was dominated by the TT genotype (97%) than the CT genotype (3%). By contrast, twin crossbreds had almost similar the TT and the CT genotypes. Instead of the monomorphic intron1 IGF1|SnaB1 gene, the intron4 OPN|Bsr1 gene could be considered as a genetic marker in exploring twinning traits in beef cattle observed.

Key Words: Beef Cattle, Twinning Births, IGF1 gene, OPN gene, and FCR-RFLP.

INTRODUCTION

Cattle is considered into a uniporous species, very commonly giving single calf per birth. Twin or multiple births in cattle therefore are very rare. Cows in giving twin (multiple) births factually were found in Indonesian local beef cattle. The occurrence was distributed widely, though its frequency was very low (about 1-4%). Cows calving twin or multiple births were also reported in a local Ongole Grade (OG) cattle and its crossbreds, so it was interesting to study genetic control of twinning trait in our local OG its crossbreds.

Twinning trait in cattle is known of following the pattern of a quantitative trait, controlled by many genes and interacting to environment. A number of genes have been identified possible in controlling twinning births, two of those are insuline Like Growth Factor 1 (IGF1) and Osteopontin (OPN or SPP1) genes. IGF-1 gene in cattle known is located at chromosome five (BTA-5) and known as regions where quantitative trait loci (QTL) controlling twinning or multiple births (Lien et al., 2000). Study Echternkamp et al. (1990) proved that twinning (multiple) births in cattle is associated by the increasing IGF-1 concentrations in both blood serum and follicular fluid. The IGF-1 stimulates mitogenesis of granulosa cells and steroidogenesis of ovarian cell cultures. This gene plays an important role in the regulation of folliculogenesis and may be involved in the process of multiple ovulation in cattle.

IGF1 gene in cattle is located at chromosome 6 (BTA6) close to quantitative trait gene (QTL) for milk production. OPN is generally in the form of a monomer with long ranges of 264-301 amino acids. Ongoing post-translational modification extensively involves phosphorylation, glycosylation and cleavage generating molecular variants ranging from 25-75 kDa. The OPN gene is hypothesized to affect uterine environment through histotrobi components needed in the adhesion and signal transduction processes on the surface of the uterus-placenta. The resulting product is expressed as uterine stromal invasion caused its response to conceptus, products of sac placenta and uterine immune cells that are useful in regulating cytokine production. Regulation and functional implications of conditions involving instantaneous OPN probably result in a common activity to ensure developing and maintaining pregnancy (Johnson et al., 2003).
This research was aimed to study genetic polymorphisms of these two genes by PCR-RFLP method in the local OG and its crossbreds.

MATERIALS AND METHODS

Blood samples
Fresh bloods for DNA extraction were collected from a total number of 117 heads of historical twin (T = 83 hd) and non twin (NT = 24 hd) as control in Indonesian local beef cattle and its crossbreds. Blood samples of local Ongole Grade (OG) cattle were collected from Hulu Sungai Tengah District (T=17; NT=3) in South Kalimantan Province; Probolinggo (T=8; NT=1), Pasuruan (T=9; NT=1), and Tuban (T=21; NT=10) in East Java Province. For its crossbreds (mating by exotic males of Simmental, Brangus, Limousin dan Brahman), fresh bloods were collected from Kendal (T=15; NT=5) and Sragen (T=28; NT=9) in Central Java Province.

DNA extraction
DNA Extraction Mini Kit (Geneaid) was used. Some procedures were by washing the blood from alcohol, 200 µl of blood sample was added 1000 µl of water (±5 min), then centrifuged at 8000 rpm ((±5 min) (2x). Sample was added by 10 µl ProtK 5 mg/ml, 200 µl buffer GT, and 200 µl GB buffer, then incubated at 60 ºC (1 hour) and at 70 ºC (10 minutes).

Polymerase Chain Reaction
Genomic DNAs of both twin and control were used as templates in DNA amplification reactions (PCR reactions), using primer pairs (mix) of nucleotide sequences of the IGF1 (Siadkowska et al., 2006) with F: ATT ACA AAG CTG CCT GCC CC and R: ACC TTA CCC GTA TGA AAG GAA; while those of the OPN gene (Leonard et al., 2005) with F: GCA AAT CAG AAG TGT GAT AGA C, and R: CCA AGC CAA ACG TAT GAG TT.

Genotyping fragments of the IGF1 and OPN genes
Amplification of the fragments of the IGF1 and the OPN genes was genotyped at the thermocycler engine by setting an initial denaturation temperature of 95ºC (5 minutes), while for 35 cycles at 95ºC (45 seconds). Amplicons of the IGF gene were restricted by the SnaBI enzyme while those of the OPN gene were by BsrI enzyme, then they were incubated at a temperature of 65ºC.

Frequencies of allele and genotype
Genotype frequency was calculated by dividing the number of a particular genotype to overall samples, whereas allele frequency was the ratio between a particular allele to all alleles at the observed locus (Nei, 1987):

\[ x_{ii} = \frac{n_{ii}}{N} \]

\[ x_{i} = \frac{2n_{ii} + \sum n_{ij}}{2N} \]

Description:
- \( x_{ii} \) = the ii\textsuperscript{th} genotype frequency;
- \( x_{i} \) = the ith allele frequency;
- \( n_{ii} \) = individual number of the ii\textsuperscript{th} genotype;
- \( n_{ij} \) = individual number of the ij\textsuperscript{th} genotype; and
- \( N \) = total number of individual samples.

RESULTS AND DISCUSSION

Genotyping IGF1|SnaBI Gene
DNA amplicons as the PCR products in Indonesian local OG beef cattle and its crossbreds that were genotyped through RFLP method using the SnaBI enzyme did not showed any point mutations at the intron1 IGF1 gene. Genotyping results at the intron1 IGF1|SnaBI in all of beef cattle observed produced only one DNA fragment with the length of 249 bp as presented in Figure 1. Table 1 showed that the result of the cutting SnaBI enzymes to PCR products at the intron1 IGF1 gene by RFLP method in all of the observed OG cattle and its crossbreds of twin or historical twin cows as well as single calving cows from three provinces of East Kalimantan, East Java and Central Java produced only one fragment with the dna size of 249 bp. This meant that each individual of both historical twin or non twin of the local OG and its crossbreds had only one type of genotype, namely a BB genotype.
Table 1. Frequencies of genotype and allele of the intron4 OPN\|Bsr1 gene in twin and non twin of Local Ongole Grade and its crosses bred.

<table>
<thead>
<tr>
<th>Province/District</th>
<th>Twin Genotype Freq (%)</th>
<th>Twin Allele Freq (%)</th>
<th>Non twin Genotype Freq (%)</th>
<th>Non twin Allele Freq (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CC (Freq)</td>
<td>CT (Freq)</td>
<td>TT (Freq)</td>
<td>C (Freq)</td>
</tr>
<tr>
<td>Ongole Grade</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SK: H.S. Tengah</td>
<td>0 (0)</td>
<td>12 (2)</td>
<td>88 (15)</td>
<td>6</td>
</tr>
<tr>
<td>EJ: Probolinggo</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>100 (8)</td>
<td>0</td>
</tr>
<tr>
<td>Pasuruan</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>100 (9)</td>
<td>0</td>
</tr>
<tr>
<td>Tuban</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>100 (21)</td>
<td>0</td>
</tr>
<tr>
<td>Sub Total</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>100 (38)</td>
<td>0</td>
</tr>
<tr>
<td>Total (OG)</td>
<td>0 (0)</td>
<td>4 (2)</td>
<td>96 (53)</td>
<td>2</td>
</tr>
<tr>
<td>Crossbred</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CJ: Kendal</td>
<td>0 (0)</td>
<td>60 (9)</td>
<td>40 (6)</td>
<td>30</td>
</tr>
<tr>
<td>Sragen</td>
<td>0 (0)</td>
<td>62 (8)</td>
<td>38 (5)</td>
<td>31</td>
</tr>
<tr>
<td>Sub Total</td>
<td>0 (0)</td>
<td>61 (17)</td>
<td>39 (11)</td>
<td>30</td>
</tr>
<tr>
<td>Total (CrossB.)</td>
<td>0 (0)</td>
<td>61 (17)</td>
<td>39 (11)</td>
<td>30</td>
</tr>
<tr>
<td>Overall</td>
<td>0 (0)</td>
<td>23 (19)</td>
<td>77 (64)</td>
<td>11</td>
</tr>
</tbody>
</table>

Description: (...) number in parentheses was number of cattle (head).

SK: South Kalimantan; EJ: East Java; and CJ: Central Java.
OG: Ongole Grade; CrossB: Crossbreds.

No genetic variation or monomorphic nature in the base fragment of the intron1 IGF1\|SnaB1 was likely due to the nucleotides as a cutting site of the SnaBI restriction enzyme without the C/T base transition. Another possibility was that the observed OG cattle had unique nucleotide sequences, especially at the cutting sides of the SnaBI restriction enzyme (no transition C/T), so this enzyme could not cut specific fragments at intron1 of the IGF1 gene.

![Figure 1. RFLP results of the intron1 IGF1 gene. All columns with DNA fragment of 249 bp for BB genotype. M = Marka (300pb).](image-url)
Results from this study however different to the previous study by Siadkowska et al. (2006). By genotyping the intron1 IGF1|SnaB1 gene in Holstein Friesian (HF) Norway (662 head) from that study identified three type of genotypes. In the case of genotyping PCR products resulted two DNA bands (223 and 26 bp) then be identified as a homozygous AA (TT) genotype, three DNA bands (249, 223 and 26 bp) as a heterozygous AB (CT) genotype, and only one DNA band (249 bp) as a homozygous BB (CC) genotype. Frequencies of the AA, AB and BB genotypes were reported successively 29%, 47% and 24%; while the frequencies for A and B alleles were 52% and 48% respectively.

Monomorphic of the intron1 IGF1|SnaB1 gene was also identified in both twin (27 heads) and non twin (15 heads) of Holstein Friesian (HF) cattle by Anggraeni et al., (2012) by resulting only the BB genotype, without the AB and the AA genotypes. It was stated that as no genetic polymorphisms identifying at this fragment gene made unable for the intron1 IGF1|SnaB1 gene to be functioned as a genetic marker in exploring twinning trait in the observed HF cattle.

Genetic polymorphisms of the IGFI gene in Angus cattle previously was identified by Ge et al. (1997) as single strand conformation polymorphism (SSCP), which was known as C/T transition at the position -472 relative to the early transcription (at position 512 bp from the ATG codon, corresponding to the gene bank sequences at AF210383) (Ge et al., 2001).

**Genotyping of the OPN|Bsr1 gene**

Genetic polymorphism of the inton4 OPN gene was identified by examining a base mutation of C/T transition at a non-code area 5' of the OPN gene through the PCR-RFLP method following the study by Leonard et al. (2005) in Bos taurus dairy cattle. According to the previous study, as presented in Figure 2, a homozygous CC genotype was identified if the cutting by Sbrl enzyme to the PCR product (290 bp) resulting two DNA bands (200 bp and 90 bp); a heterozygous CT genotype was for resulting three DNA bands (290 bp, 200 bp and 90 bp); and a homozigous TT genotype was for the obtaining only one DNA band (290 bp) in which the Sbrl enzymes failed in cutting the PCR product.

**Figure 2.** RFLP results of the intron 4 OPN gene. Columns with DNA fragments of 200 and 90 bp for CC; 290, 200 and 90 bp for CT; and 290 bp for TT genotypes. M = Marker (300bp).

Frequencies of genotype and allele of the intron4 OPN|Bsr1 gene of twin and non twin in both local OG and its crossbreds were listed in Table 1. The results explained that the genotyping results at the intron4 OPN|Bsr1 gene in twin (multiple) OG cattle from H.S. Tengah in South Kalimantan Province was polymorphic, resulting two genotypes, namely TT and CT genotypes. Genotyping of this fragment gene hence resulted two type of alleles, namely T and C alleles. For this cattle group, the frequency of the TT genotype was predominantly to that of the CT genotype (88% vs. 12%). Contrastly, monomorphic nature was identified in the twin OG from East Java Province, of which all of observed cattle had the only TT genotype (100%).

While for the twin crossbreds from Central Java Province, the intron4 OPN|Bsr1 gene was polymorphic, resulting also the TT and the CT genotypes. However, the frequency of the CT genotype was higher than that of the TT genotype (61% vs. 39%). Further, the overall of non twin
(as control) cattles neither in OG nor its crossbred were consistently monomorphic. These results informed that by the existing genetic polymorphism at the intron4 OPN|$Bsr1$ gene identifying in historical twinning OG cattle and its crossbreds could be considered as a genetic marker with regarding to explore twinning or multiple births in beef cattle observed.

In a previous study in HF dairy cattle in West Java Province by Anggraeni et al. (2012) also reported that genotyping at the intron4 OPN|$Bsr1$ gene either in historical twin cattle (27 head) and non twin cattle (15 heads) were polymorphic. Both groups resulted three genotypes, i.e. CC, CT and TT genotypes. However, the first group had the frequencies of the CC and the CT genotypes were higher than the second one (30% and 56% vs. 20% and 40%).

By considering the abone results, studies for the association of twinning or multiple births to genetic marker in cattle seemingly have shown a fairly complex process. It is considerably required to exploit marker genes closely associated with various fertility traits, that will give the success of follicle development, fertilization, embryo development and by the ending twinning (multiple) births in cattle.

CONCLUSION

Genotyping the intron1 IGF1|$Snab1$ gene in local OG and its crossbeds was monomorfic resulting solely the BB genotype (249 bp), whilst genotyping the intron4 OPN|$Bsr1$ gene in in twin OG and its crossbeds was polimorfic resulting the CT and the TT genotypes, so this gene could be considered as a genetic marker in exploring twinning births in observed cattle.

REFERENCES


Association of Prolactin Gene with Egg Production in PMp Ducks

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ABSTRACT: A new strain of duck, namely PMp duck as broiler type, has been developed recently in Indonesia. PMp duck was the result of crossbreeding between Pekin and white Mojosari ducks and followed by inter-se mating for 4 generations. A selection program based on the production of eggs was conducted on this PMp duck to prepare it as female parental line that would be crossed with male Muscovies to produce mule ducks. Accuracy of selection can be improved if genes controlling the egg production are known. Although in exon 5 and 3’ flanking region of prolactin gene has been known to play a role in egg production and egg weight of Peking duck, in PMp ducks have not yet been carried out. The study aim was to investigate the relationship between PRL genotypes of single nucleotide polymorphism (SNP) and egg production of PMp ducks. Primer pairs of exon 5 of the prolactin gene were designed based on the duck genomic sequence database. Polymorphisms were detected by the direct sequencing technique. Two SNPs in the 3’ flanking region of prolactin gene were identified, namely T6049- and T6052A. The result of the association analysis between SNPs and egg production showed no significant effect (P > 0.05). It can be concluded that there were SNPs in 3’ flanking region of prolactin gene on PMp duck, but they cannot be used as marker genes for egg production, because all genotypes showed the same level of production. Further investigations on more duck populations with large sample sizes are needed to confirm this finding.

Keywords: Prolactin gene, SNP, PMp duck, egg production

INTRODUCTION

A new strain of duck, namely PMp duck as broiler type, has been developed recently in Indonesia. PMp duck is the result of crossbreeding between Pekin and white Mojosari ducks and followed by inter-se mating for four generations. Pekin duck is a commercial duck from China that specialized as broiler ducks. In two months, body weight of Pekin duck can reach 2-3 kg. Mojosari duck is one of the Indonesian native local duck from East Java. In six months, body weight of Mojosari is only 1.7 kg. A genetic approach to cross Pekin and Mojosari ducks for producing crossbred is one of the methods to improve meat performance of Indonesian local duck. Duck PMp has a body weight of about 2-2.2 kg at the age of 10 weeks. However, its egg production is still relatively low with a coefficient of variation of egg production relatively is high, so the selection is required to increase egg production.

A selection program based on the production of eggs is conducted on this PMp duck to prepare it as a female parental line that would be crossed with male Muscovies to produce mule ducks. The accuracy of selection can be improved if genes controlling the egg production are known. Chang et al. (2012) reported that genetic markers linked to loci influencing economically important traits could be used to enhance the speed and effectiveness of progress in animal breeding. Once an association between DNA polymorphism and a trait is found, the DNA polymorphism can be considered a candidate genetic marker for marker-assisted selection (MAS) programs. One of the
candidate genes that control of importance traits economically in poultry is the prolactin gene. This prediction is based on the function of the hormone prolactin that was crucial in poultry namely to encourage of hatching behavior and regulate of follicular development (Susanti et al., 2012). On chickens, research on prolactin genes that linked to traits production had been widely reported.

Unlike in chickens, research on ducks prolactin gene has not been done yet, especially at the local ducks Indonesia. However, overall prolactin gene of duck has been sequenced as shown in Figure 1.

![Figure 1. Illustrations portions of prolactin gene in ducks (modified from Kansaku et al., 2005)](image)

The duck prolactin gene had length 6.33 kb and were composed of five exons and four introns, encoding 229 amino acids; and the duck prolactin cDNA shares 92.0, 91.7 and 91.4% sequence homology to chicken, turkey and quail prolactin respectively (Kansaku et al., 2005). This prolactin gene sequences could provide the basis for investigating the effect on gene traits based on polymorphisms - trait association. Wang et al. (2011) also had conducted an analysis of prolactin gene in 6 types of ducks that come from China and discovered the existence of 12 single nucleotide polymorphism (SNP) in the 5′flanking region, intron 1, exon 2, intron 2, exon 4, intron 4, exon 5, and 3′flanking region. These studies mostly using peking duck as material research that could be categorized as a stable strain as selection results. While in Indonesia the ducks with phenotypic diversity was still very high. It was necessary to be done own research on the diversity of prolactin gene and its association with the properties of production and reproduction. In this paper would discuss the association of exon 5 of prolactin gene with egg production on PMp ducks.

**MATERIALS DAN METHODS**

The materials in this study were 3 breed ducks that were kept in the Indonesian Research Institute for Animal Production (IRIAP). They consisted of 25 Peking duck, 22 white Mojosari and 47 the crossbred PMp. Peking duck and white Mojosari were kept in a litter cage, so that the records of egg production individually were not available. While the PMp ducks were kept in a cage, so that every individual can be observed their egg production. Feed given equal between Peking duck, white Mojosari and PMp namely the feed for laying ducks with a protein content of 19% and EM 3200 kcal/kg. The drinking water was provided ad libitum. Phenotypic observations consisted of egg production was carried out for 73 weeks and it was be associated with the diversity of exon 5 of the prolactin gene.

The observation of prolactin gene diversity, genomic DNA was extracted from whole blood of the Pekin, Mojosari putih and PMp ducks using Genomic DNA Mini Kit (GeneAidTM DNA Isolation Kit) according to the manufacturer’s protocol. Kit contained RBC lysis buffer, cell lysis buffer, protein removal buffer and DNA hydration buffer. DNA qualities were evaluated by
spectrophotometer (purity and concentration).

Amplification of prolactin gene was carried out using Polymerase Chain Reaction technique. Amplification of exon 5 was done by KAPA®PCR Kit. Composition of the PCR reaction were 25 ml of PCR kit master mix, 23 ml of distilled water, 1 ml of sample DNA and primers 1 ml, so that the final volume were 50 ml. The conditions of PCR was 2 min pre-denaturation at 94°C, 30 s denaturation at 94°C, 20 s annealing at 60°C, elongation of 40 s at 72°C and a final extension stage 10 min at 72°C.

The design of primer was necessary stage prior to the amplification of exon 5 of prolactin gene on ducks. In this study, the primary design was done with the help of a web-based program namely the Integrated DNA Technology (IDT DNA), Primer 3, and the National Center for Biology Information (NCBI). One pair of gene specific primer was designed based upon the published prolactin sequence gene of duck (Genbank accession no: AB158611). The primer information was listed in the Table 1.

**Table 1.** The primer sequences and product size of exon 5 of duck prolactin gene

<table>
<thead>
<tr>
<th>Code</th>
<th>Primer sequences (5’ – 3’)</th>
<th>Product size (bp)</th>
<th>Amplification region</th>
<th>Annealing Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRL - F5</td>
<td>GCATTCCTCAAGGCCAGTAT</td>
<td>343</td>
<td>5844 - 6035</td>
<td>60</td>
</tr>
<tr>
<td>PRL - R5</td>
<td>TGGCAAAGCAACAAGAACAC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Visualization of PCR product was analyzed by gel electrophoresis. Gel electrophoresis contained agarose gel 1.5% in TBE 0.5X with 2μl fluorosave. Universal ladder (KAPPATM) was used as a DNA marker. Gels were run out at 100V for 30-45 min. Individual banding patterns were determined under visible light by using UV transiluminator. A total of 30 μl of PCR product from each PCR samples were sequenced for forward sequence in Macrogene, Korea.

Single nucleotide polymorphisms were identified by comparing individual alignment to current prolactin published sequence for *Anas plathyrynchos* (Code Access GenBank: AB158611.1) using *Molecular Evolutionary Genetics Analysis* (MEGA 5) and chromatograms were individually examined via *BioEdit Sequence Alignment Editor*. Analysis of nucleotide composition was used with BioEdit Sequence Alignment Editor and Molecular Evolutionary Genetics Analysis (Tamura et al., 2007). Polymorphism – trait association analyses was performed with PROC GLM procedur (SAS Institute, 2002). Association between the SNP and egg traits were analyzed according to the following model: \( Y_{ij} = \mu + G_i + e_{ij} \), where \( Y \) is the observed values of egg number traits; \( \mu \) is the population mean, \( G_i \) is genotype and \( e \) is random error.

**RESULT AND DISCUSSION**

DNA purity and concentration from blood method were high, there were 1.81 and 169 μg/ml respectively. DNA extracts from blood showed in light bands (Figure 2). The results of analysis based program MEGA5 have been revealed two SNPs in the 3’ flanking region of prolactin gene of duck PMp namely T6049- and T6052A (Figure 3).

The point mutation of 6049 and 6052 were in the 3’ flanking region and they were also called non-coding regions. SNPs located in non-coding regions have effects on gene expression
Figure 2. The PCR visualization on the part of samples of exon 5 of prolactin gene

Figure 3. The part of samples that show the mutation point at T6049- and T6052A

By affecting regulatory elements and some intronic SNPs activates cryptic splice sites, leading to alternative splicing (Alberobello et al., 2011). The results of the study were virtually identical as that found on local ducks China. Wang et al. (2011) found a mutation point in the 3' flanking region namely T6052A on local ducks in China. The mutation point was exactly the same as those found in ducks PMp as the local ducks in Indonesia. Wang et al. (2011) also found other mutation point in exon 5 namely C5961T and shown to have an influence on the number and weight of eggs produced by the Chinese local ducks. However, the mutation point was not found in ducks PMp.

Based on the current results, all SNPs in non-coding regions were found and the associations of exon 5 of prolactin genotype combinations with egg number were identified. The results of association analysis between the single SNPs and the phenotypic traits in the PMp ducks were presented in Table 2.

Table 2. The average egg production of PMp duck for 73 weeks based on genotype of mutation point T6049- and T6052A

<table>
<thead>
<tr>
<th>The point mutation</th>
<th>Genotype</th>
<th>Egg production (egg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6049-</td>
<td>Delesi T (n = 9)</td>
<td>138.12a</td>
</tr>
<tr>
<td></td>
<td>TT (n = 33)</td>
<td>179.56a</td>
</tr>
<tr>
<td>T6052A</td>
<td>TT (n = 4)</td>
<td>143.9a</td>
</tr>
<tr>
<td></td>
<td>TA (n = 2)</td>
<td>252.0a</td>
</tr>
<tr>
<td></td>
<td>AA (n = 36)</td>
<td>149.8a</td>
</tr>
</tbody>
</table>
Based on Table 2, there is no real relationship between the mutations that occur with egg production in PMp ducks. The absence of relationship is likely due to the number of samples used little or as a result of inbreeding. As it is known that the PMp ducks as material in this study is the fourth generation from crosses inter-se, so that inbreeding was a very high possibility. Genesis inbreeding can result in reduced genetic diversity in a population (Muir and Aggrey, 2003).

CONCLUSION

In the present study has been found two SNPs of exon 5 of prolactin gene namely T6049- and T6052A. The results of analysis, there was no association between the SNPs found with PMp duck egg production. That can be concluded that there were SNPs in 3’ flanking region of prolactin gene on PMp duck, but they cannot be used as marker genes for egg production, because all genotypes showed the same level of production. Further investigations on more duck populations with large sample sizes are needed to confirm this finding.

ACKNOWLEDGMENTS

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REFERENCES


Microsatellite Analysis of Genetic Diversity in Pekin, Alabio, and Their Crossbred Duck Populations

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PO Box 221 Bogor 16002

ABSTRACT: Identification of gene responsible for the molting process in poultry based on microsatellite markers is expected to lead into better control of molting in local breeds of layer ducks in Indonesia. The genetic structure of Pekin, Alabio and their crossbred duck populations were analyzed using nine microsatellite markers. DNA samples from twenty birds of each genotype were extracted and amplified using the microsatellite primers through PCR. The PCR products were then separated using polyacrylamide gel electrophoresis, and stained with silver nitrate. All nine microsatellite markers showed high polymorphism on all populations. AY49 detected 5 alleles (200-250bp), AY50 detected 8 alleles(250-320bp), AY56 detected 4 alleles (130-145bp), AY61 detected 7 alleles (170-210bp), AY64 detected 5 alleles (185-210bp), AY67 detected 3 alleles (130-140bp), AY69 detected 5 alleles (250-300bp), AY71 detected 4 alleles (130-145bp), and AY80 detected 4 alleles (225-240bp). Every allele on parental populations were inherited randomly on their filial. A few alleles such as allele 230bp in AY49, allele 145bp in AY56, allele 205bp in AY64, Allele 270bp in AY69, and allele 225bp in AY80 might be used as identifying markers for Alabio ducks. While for allele 280bp in AY50, allele 260bp in AY69, allele 145bp in AY71, allele 190bp in AY61, dan allele 130bp and 135bp in AY80 might be used as the identifying markers for Pekin ducks.

Keywords: microsatellites, diversity, ducks
Genotypic Profile of Ettawa Grade Goat with Different Head and Neck Color Based on MC1R Gene

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²) Research Center for Biotechnology, Jalan Raya Jakarta-Bogor Km 46, Cibinong, Bogor, Jawa Barat 16911, Indonesia
Corresponding email: d.maharani@ugm.ac.id

ABSTRACT: The exterior characteristic is the main reason for the most farmers in Indonesia to select and keep Ettawa grade goat. The farmers prefer to keep the goats with black head color instead of brown or mixed colors due to the price of black head color is more expensive. In order to indicate the genetic molecular basis of different head and neck color of Ettawa grade goats, a comparative analysis of MC1R gene polymorphism was conducted. The Melanocortin-1-receptor (MC1R) gene is known as an important candidate gene for the coat color trait. Total thirty Ettawa grade goats were divided in three group: CP (brown head and neck color with white body color), RP (brown or black head and neck color with various body color), HP (black head and neck color with white body color) were used in this study. The blood samples from all groups were collected for DNA isolation. The single nucleotide polymorphisms (SNP 676A<G) in exon 1 which located at 676 bp in MC1R gene were obtained by PCR-RFLP methods for genotyping of the goats by using earl restriction enzyme. The results showed all of the goats in CP and RP groups were heterozygote (AG Genotype) which indicated 1.00 for their genotype frequencies. In HP group only had one goat with homozygote animal (GG genotype). Interestingly, none AA genotype found in this study. The A and G allele frequencies were similar 0.5 in both CP and RP group. However, the A allele frequency (0.55) was slightly higher than G allele (0.50) in HP group. These results indicated the spread of both alleles were equal in all groups and seems less genetic variability in the goat population study. In conclusion, the SNP 676A<G of MC1R gene may be regulated genetically in Ettawa grade goat with different head color. Further study need to be conducted in detecting the association of the gene that may affect production traits.

Key words: Genotypic, Phenotypic, Ettawa grade goat, Head and neck color

INTRODUCTION

Ettawa Grade goats are one of potential animals in Indonesia which are widely raised in small farmers. To increase the income, the farmers prefer keep the goat with black head and neck color due to the high price compare to other goats color. Those specific goats are also kept by farmers for goat competition purpose. However, the farmer’s perception believed that color differences will not have impact on the productivity of goats. Initially, this perception needs to be confirmed based on genetic molecular basis which can describe genetic variability of the goat with different head color. In order to detect the genetic variability of goats, a comparative analysis of MC1R gene polymorphism was conducted.

The Melanocortin-1-receptor (MC1R) gene plays a central role in regulation of animal coat color formation. The gene has been widely used to identify the coat color in various ruminants.
such as in sheep, cattle, goat and rabbit. The haplotype AATGT in MC1R was uniquely associated with black coat color in Minxian Black-fur breed (Yang et al., 2013). The coat color extension gene (E) which encoded the transmembrane domain MC1R have been indicated affecting the coat color in French cattle breed (Rouzaud et al., 2000). In goat, the p.267W missense mutation located in coding region of MC1R was present in all Murciano-Granadina black goats, whereas it was never identified in the brown ones (Fontanesi et al., 2009). The c.[124A;125_130del6] was suggested responsible for a MC1R variant determining eumelanin production in the black area of the rabbit (Fontanesi et al., 2010). Moreover, the mutation at the position 676 bp of MC1R gene had been detected in Boer Goat with red head and neck color (Wu et al., 2006). Therefore, the objective of this study was to identify the genetic profile of Ettawa grade goat with different head color based on MC1R gene.

MATERIALS AND METHODS

Animal and sampling. Thirty Ettawa grade goats which divided in three groups: CP (brown head and neck color with white body color), RP (brown or black head and neck color with various body color), HP (black head and neck color with white body color) were reared in the field laboratory in Faculty of Animal Science, Universitas Gadjah Mada (FAS UGM) with the same environments condition. The blood samples were collected for genomic DNA isolation using SDS/ProteinaseK modified method (Sambrook et al., 1989).

Polymerase Chain Reaction (PCR). The primer sequences (according to Wu et al., 2006), annealing temperature for PCR amplification and the restriction enzyme for PCR-RFLP are shown in Table 1.

Table 1. Primers for PCR amplification and restriction enzyme information for genotyping of MC1R gene

<table>
<thead>
<tr>
<th>GenBank Acc. No</th>
<th>Primer</th>
<th>PCR product size</th>
<th>Restriction enzyme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y13958</td>
<td>E1-F : 5’ gtggacgctactcct 3’</td>
<td>416 bp</td>
<td>EarI</td>
</tr>
<tr>
<td></td>
<td>E1-R : 5’ tgaagatgagcag 3’</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Amplifications were performed at 10 min at 94°C, 35 cycles of 30 s at 94°C, 30 s at the annealing temperature (64°C), and 30 s at 72°C, and a final extension of 10 min at 72°C. The PCR products were visualized in 1.5% standard agarose gels stained with ethidium bromide.

PCR-RFLP and Genotyping Determination. PCR products were sequenced using the same primers for PCR by PT Genetics Science Indonesia. The DNA sequences were analyzed with the BioEdit program ver. 7.00 (Tom Hall, Ibis Therapeutics, California, USA) and the SNP676A>G was confirmed based on the electrophoregram results. The SNP G.676A>G was genotyped by the PCR-restriction fragment length polymorphism (PCR-RFLP) method. The restriction enzyme digestion was performed in 20 µl reaction volumes with approximately 5 µl of PCR products and 2 units of each restriction enzyme. The digested products were run on 3% agarose gels.

Statistical Analysis. A chi-square test was performed to test the allele and genotype frequencies for Hardy Weinberg equilibrium. The following mathematical model was:
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Integrated Approach in Developing Sustainable Tropical Animal Production
October 20-22, 2015, Yogyakarta, Indonesia

\[
\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)}{E_i}
\]

Where, \( \chi^2 \) is Chi-square value, \( O_i \) is observed frequency, \( E_i \) is expected frequency, \( n \) is the number of possible outcomes of each event.

**RESULTS AND DISCUSSION**

SNP g.676A>G in MC1R gene was initially identified by direct sequencing using PCR product pool. The SNP was confirmed by BioEdit program and used for genotyping the goats (Fig.1a). Homozygote AA and GG were defined when the fragments size being recognized at 162 and 254 bp, and 416 bp, respectively. The heterozygote AG existed by PCR-RFLP method at the same position of the homologous chromosome with 162, 254 and 416 bp of fragments size (Fig.1b). As the results, most of animals in three groups have heterozygote (AG) genotype. Only one animal have GG genotype in HP group and no AA genotype detected in the study. The allele and genotype frequencies are shown at Table 2.

![Figure 1 (a). Electrophoregram result for the identified SNP g.676A>G in MC1R gene with G & A peaks. (b) PCR-RFLP patterns of SNP g.676A>G (digested with EarI restriction enzyme).](image)

**Table 2.** Frequencies allele and genotype of three groups Ettawa Grade Goats based on PCR-RFLP results using SNP g.676A>G

<table>
<thead>
<tr>
<th>Group</th>
<th>Allele Frequency</th>
<th>Genotype Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A ( (0.50) )</td>
<td>G ( (0.50) )</td>
</tr>
<tr>
<td>CP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HP</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on Table 2, the results indicated the spread of both alleles A and G were equal in all groups. The A and G allele frequencies were similar 0.5 in both CP and RP group. However, the A allele frequency (0.55) was slightly higher than G allele (0.50) in HP group. The AG genotype frequencies were similar 1.00 in both CP and RP group. However, no AA genotype was identified in the study. The results of Pearson’s Chi-square test indicated that the genotypes of the goats were deviated from the Hardy-Weinberg equilibrium (HWE). The deviation may due to variation of causes. Mutation, gene flow, non-random mating (assortative mating), genetic drift and selection.
may lead to deviate from HWE (Falcorner and Mackay, 1996). In case of this study, non-random mating and small sample size may due to the deviation.

CONCLUSIONS

In conclusion, the Ettawa Grade goats with different head and neck color have same AG genotypes based on MC1R gene. Our results suggest that the SNP 676A<G of MC1R gene may associate with hair color and can be used to determine the genotype profile of Ettawa Grade goats.

REFERENCES


ABSTRACT: Prolactin (PRL) is a synthesized peptide hormone which is one of the important reproductive hormones involves in incubation and brooding behavior of birds. KUB chicken genetically has broodiness trait which negative correlation with egg production. The objective of the current research was to investigate the association of polymorphisms in the KUB’s PRL promoter region with egg production. As much as 60 KUB chickens were divided into groups of 20 KUB chickens with high egg production (118,15±18,99 eggs/hen), 20 KUB chickens with low egg production (25,74±12,31 eggs/hen), 20 cocks KUB chickens and 20 White Leghorn (WL) chickens as non broody behavior as a control group. Genotyping of 80 individual samples were objected to PCR-PAGE (Polymerase Chain Reaction-Polyacrylamide Gel Electrophoresis) method with prolactin Primers of P4 and P5. The result showed that in P4, three genotypes (AA, AB and BB) were found in KUB chickens, while only one genotypes (AA) was detected in White Leghorn chickens (WL). Similarly with Primers P5, three genotypes (CC, CD and DD) were found in KUB chickens, while only one genotypes (CC) was detected in White Leghorn chickens (WL). The allel frequencies of A and B (Primer P4) in all groups of KUB chicken was the same of proportion allel frequency, but in WL chicken was significantly diferent. Frequency of A and B allel in KUB chicken were 15,83% and 84,17% respectively, while for WL chicken had allel of A was 100%. For Primer P5, detected predominant of allel C in KUB and WL chickens. The frequency of C and D allel in KUB chicken were 69,17 and 30.83% respectively. In WL chicken was found allel of C of 100%. Association between genotypes and egg production in the both of primers was statistically not significantly.

Keywords: KUB chicken, Prolactin Gene, genotyping
Qualitative And Quantitative Traits of Kokok Balenggek Chicken, the Rare Indigenous Chicken in West Sumatera

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ABSTRACT: Kokok Balenggek chicken is one of the rare indigenous chickens in West Sumatera are unique as they have a very nice song with multilevel sound. An experiment was conducted to identify the qualitative and quantitative traits of Kokok Balenggek chicken in West Sumatera. A total of 111 Kokok Balenggek chicken were characterized for qualitative and quantitative traits. The qualitative traits base on color of feather, plumage, flick feather, feather pattern, shank colour, and comb types. The quantitative traits studied were body weight and body size of Kokok Balenggek chicken. The result indicated that the predominant of qualitative traits of Kokok Balenggek chicken are coloured (ii), wild type pattern (e+), plain feather (ss), golden flick feather (ss), yellow shank coloured (Id_) and single comb (pp). Based on the type of plumage color of Kokok Balenggek chicken have shown predominantly on Biriang (52.25%). Variations were found on quantitative traits such as body weight, number of crow, shank diameter and neck length.

Keywords: Kokok Balenggek chicken, nice song, qualitative, quantitative trait

INTRODUCTION

The Indonesian native chicken apparently have species physical characteristic which differentiate them into at least 31 breeds or distinct groups of local chicken (Nataamijaya, 2000). Two breeds of chicken are known as ornamental chickens because their voice are Kokok Balenggek and Pelung chicken. Kokok Balenggek chicken are unique because they produce a melodious song like crow, Have syllabic diversity, as each portion of the call can be composed with different pitches and vocalizations. They deserve to be conserved and developed as an indigenous germ plasm (Arlina et.al., 2014).

Local chickens are kept in many parts of the world irrespectively of the climate, traditions, life standard, or religious taboos relating to consumption of eggs and chicken meat (Tadelle, 2003). Unquestionably, the native breeds are valuable genetic resources for each country due to their adaptability to harsh conditions and their resistance against local diseases. There is little information about existing or potential productivity and production characteristics of indigenous chickens (Hoffman, 2005).

In the poultry field, identification and characterization efforts are prerequisites in utilization of genetic resources (Utoy et al., 1996; Weigend and Romanov, 2001). Characterization of indigenous livestock can be done in several ways, namely descriptions of phenotypic, genetic evaluation, DNA fingerprinting and karyiotipe (Khumnirdpetch, 2002). The qualitative traits of the chickens also have important economic, cultural and religious function. Their specific characteristics must be carefully identified and considered in developing and breeding programs.

From the breeding point of view, the main qualitative traits in chicken are plumage color, comb type, shank feather, shank color, ear lobe present and color. On the other hand, the quantitative traits or polygenic traits such as body weight, body measurements (body weight, shank length, body depth and keel length) are the most important economic traits in poultry production. To study the existence and genetic improvement program in Indonesia, identification and characterization
of Kokok Balenggek are required. Therefore, the aim of this study was to characterize the Kokok Balenggek chicken based on some qualitative and quantitative trait.

**MATERIALS AND METHODS**

A total number of 111 male of Kokok Balenggek were used in this research. These chickens were raised by small holders in the Tigo Lurah Regency, Solok District of West Sumatera Province, Indonesia. This research utilized the survey method and intensive direct examination. In sample selection, mature sex the purposive sampling method was utilized. The variety on base color of feather, color of the plumage, flick feather, feather pattern, shank color and comb types of the chickens were identified based on Hutt (1949) and Somes (1988). Data were analyzed using descriptive statistic analysis to compute means and their standard errors and coefficients of variation for quantitative traits.

**RESULTS AND DISCUSSION**

**Qualitative Trait of Kokok Balenggek Chicken**

Qualitative traits of Kokok Balenggek chicken including plumage color, shank color, comb type of Kokok Balenggek chicken are presented in Table 1.

**Table 1.** Percentage of qualitative traits of Kokok Balenggek chicken in West Sumatra

<table>
<thead>
<tr>
<th>Qualitative Trait</th>
<th>Locus</th>
<th>Genotype</th>
<th>Phenotype</th>
<th>Total Sample (head)</th>
<th>Percentage of Phenotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feather color</td>
<td>I-i</td>
<td>I-</td>
<td>white</td>
<td>10</td>
<td>9.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii</td>
<td>colored</td>
<td>91</td>
<td>81.99</td>
</tr>
<tr>
<td>Plumage color</td>
<td>E-e+-e</td>
<td>E-</td>
<td>black</td>
<td>12</td>
<td>10.81</td>
</tr>
<tr>
<td></td>
<td></td>
<td>e+-</td>
<td>wild type</td>
<td>78</td>
<td>70.27</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ee</td>
<td>colombian</td>
<td>21</td>
<td>18.92</td>
</tr>
<tr>
<td>Feather pattern</td>
<td>B-b</td>
<td>B-</td>
<td>strip</td>
<td>41</td>
<td>36.94</td>
</tr>
<tr>
<td></td>
<td></td>
<td>bb</td>
<td>plain</td>
<td>70</td>
<td>63.06</td>
</tr>
<tr>
<td>Feather flick</td>
<td>S-s</td>
<td>S-</td>
<td>silver</td>
<td>36</td>
<td>32.43</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ss</td>
<td>gold</td>
<td>75</td>
<td>67.57</td>
</tr>
<tr>
<td>Shank color</td>
<td>Id-id</td>
<td>Id-</td>
<td>Yellow/white</td>
<td>87</td>
<td>78.38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>idid</td>
<td>black/grey</td>
<td>24</td>
<td>21.62</td>
</tr>
<tr>
<td>Comb type</td>
<td>P-p</td>
<td>P-</td>
<td>pea</td>
<td>-</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pp</td>
<td>single</td>
<td>111</td>
<td>100</td>
</tr>
</tbody>
</table>

Based on the result of this research, the qualitative traits of Kokok Balenggek chicken were determined by color (ii) 81.99%, wild type pattern (e+) 70.27%, plain feather (ss) 63.06%, golden flick feather (ss) 67.57%, yellow shank coloured (Id_) 78.38% and single comb (pp) 100%. Similar observation by Sartika et al. (2008) also discovered that in the Kampung (village), the chickens were colourfull (ii), had wild type pattern (e+), plain feather (ss) and golden flick feather (ss), with yellow shank color (Id_) and single comb (pp). The presence of such large variations in plumage colours revealed that much genetic dilutions have occurred with native chickens which is about 60% (Bhuiyan et al., 2005). No variations were observed in comb type. The comb type of Kokok Balenggek chicken was 100% single. The higher frequency of white/yellow shank color (78.38%)
to black/green color. This result is in line with the report of Sartika & Iskandar (2007) who found the white/yellow skin was dominant in the indigenous chickens in Indonesia. Large variation in plumage colour on the indigenous chicken population is indicative of unconscious selection effort (Arlina et al., 2014).

**Types of Kokok Balenggek (AKB) Based on the Plumage Color**

The types of Kokok Balenggek (AKB) based on the plumage color that has been recognized by farmers in Tigo Lurah district can be seen in Table 2.

**Table 2.** Total and percentage of Kokok Balenggek chicken based on plumage color

<table>
<thead>
<tr>
<th>Types of AKB</th>
<th>Dominant plumage color</th>
<th>Village Batu Bajanjang</th>
<th>Village Tanjung Balik Sumiso</th>
<th>Village Rangkiang Luluih</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biriang</td>
<td>Redish</td>
<td>23(65.72%)</td>
<td>13(50.00%)</td>
<td>22(44.00%)</td>
<td>58(52.25%)</td>
</tr>
<tr>
<td>Taduang</td>
<td>Black</td>
<td>2 (5.71)</td>
<td>8(30.77%)</td>
<td>2(4.00%)</td>
<td>12(10.81%)</td>
</tr>
<tr>
<td>Jalak</td>
<td>Greenish/black</td>
<td>2(5.71%)</td>
<td>4(15.38%)</td>
<td>14(28.00%)</td>
<td>20(18.02%)</td>
</tr>
<tr>
<td>Pileh/Bangkeh</td>
<td>Mix color</td>
<td>4 (11.43%)</td>
<td>1(3.85%)</td>
<td>6 (12.00%)</td>
<td>11(9.91%)</td>
</tr>
<tr>
<td>Kinantan</td>
<td>White</td>
<td>4(11.43%)</td>
<td>-</td>
<td>6(12.00%)</td>
<td>10(9.01%)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>35</td>
<td>26</td>
<td>50</td>
<td>111</td>
</tr>
</tbody>
</table>

These result indicated that the predominant the type of Kokok Balenggek chicken was Biriang (52.25%) followed by Jalak (18.02%), Taduang (10.81%), and Kinantan (9.01%). The plumage color of Biriang is dominant with red color while on the chest, wings and tail are black colored. Balenggek chicken is thought to be a derivative crosses the red jungle fowl (*Gallus gallus G*) with central areas of local chicken in the shifting cultivation area. Romanov and Weigend (2001) states that *Gallus gallus* is the ancestor of all domestic chickens that developed nations now. Hillel et al. (2003) states that the red jungle fowl is a single common ancestor (single ancestor) and a major contributor to the gene pool all domestic chicken nation in the world.

**Quantitative Trait of Kokok Balenggek Chicken**

Body weight and body measurements of Kokok Balenggek chicken are listed in Table 3.

**Table 3.** Mean, standard deviation (SD) and coefficient of variation (CV %) for quantitative trait of Kokok Balenggek chicken

<table>
<thead>
<tr>
<th>Quantitative Trait</th>
<th>Mean</th>
<th>SD</th>
<th>CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body weight (kg)</td>
<td>1.59</td>
<td>0.33</td>
<td>20.85</td>
</tr>
<tr>
<td>Tibia lenght (cm)</td>
<td>13.80</td>
<td>1.19</td>
<td>8.61</td>
</tr>
<tr>
<td>Femur lenght (cm)</td>
<td>10.67</td>
<td>1.79</td>
<td>16.72</td>
</tr>
<tr>
<td>Comb height (cm)</td>
<td>4.58</td>
<td>1.10</td>
<td>23.93</td>
</tr>
<tr>
<td>Shank lenght (cm)</td>
<td>9.54</td>
<td>1.13</td>
<td>11.87</td>
</tr>
<tr>
<td>Wing lenght (cm)</td>
<td>22.10</td>
<td>2.62</td>
<td>11.78</td>
</tr>
<tr>
<td>Beak lenght (cm)</td>
<td>1.83</td>
<td>0.59</td>
<td>31.85</td>
</tr>
<tr>
<td>Shank circumference (cm)</td>
<td>1.60</td>
<td>0.34</td>
<td>21.47</td>
</tr>
<tr>
<td>Neck lenght (cm)</td>
<td>17.66</td>
<td>3.57</td>
<td>19.82</td>
</tr>
<tr>
<td>Total crown</td>
<td>4.99</td>
<td>1.42</td>
<td>28.39</td>
</tr>
</tbody>
</table>
The mean body weight of Kokok Balenggek chicken was 1.59 kg while the body measurements were tibia length 13.80 cm, femur length 10.67 cm, shank length 9.54 cm, wing length 22.10 cm and Shank circumference 1.60 mm, respectively. Beak length varied more (coefficient of variation = 1.85 %) while tibia length (coefficient of variation = 8.61 %) varied the least. The number of crow was ranging 3 to 9 crows with an average 4.99. These results were less as compared to the finding Abbas et al., (1997) 11 crows and Rusfidra 6.7 crows (2004).

CONCLUSIONS

The Kokok Balenggek chickens showed heterogeneity in the qualitative and quantitative traits considered. The result indicated that the predominant of qualitative traits of Kokok Balenggek chicken are coloured (ii), wild type pattern (e+_), plain feather (ss), golden flick feather (ss), yellow shank coloured (Id_) and single comb (pp). Quantitative traits of Kokok Balenggek chicken was varied. The number of crow was ranging 3 to 9 crows with an average 4.99 crow. High diversity was founded in body weight, number of crow, shank circumference and neck length. Therefore, further investigation is required to search the diversity of Kokok Balenggek chicken through molecular research. In addition, it is important to take into account the uniformity of qualitative characters to make local strains are similar in their morphological and productive characteristics.

ACKNOWLEDGMENT

We are very grateful to Directorate General of Higher Education, Ministry of National Education of the Republic of Indonesia which has provided the funding in conducting research in “Research Competitive Grant”. Special thanks to the small farmer in Tigo Lurah Subdistrict who gave full efforts in supporting this research and for providing his chickens used in this study.

REFERENCES


**ABSTRACT:** Bali cattle is an important breed for Indonesian farmers. However, the breed is threatened by isolation of populations and cross breeding with exotic breeds. Here we aim to increase the knowledge of Bali cattle phenotypic diversity and management. Based on this information we suggest breeding strategies suitable for small scale farmers that can help to maintain diversity and also lead to improved animal health and welfare. Animals from Bali, Sumatra, Lombok and Kalimantan were phenotyped for; body length, withers height, chest girth, body weight, pelvic height, pelvic width and horn length. Furthermore, stature, coat color, fur and horns were described. In total 94 animals >2 years of age were phenotyped. The gathered data will be critical for selection of individuals for future genomic studies aimed at identification of genetic factors. A total of 68 farmers were interviewed focusing on management and breeding. The interviews revealed a willingness to learn about breeding and how to breed for certain traits such as size and appearance. ANOVA analysis of the phenotypic measurements showed significant differences between females on Sumatra compared to those on Lombok and Kalimantan. Females on Sumatra were significantly lighter (P<0.0001) compared to females on Lombok and Kalimantan. Females on Sumatra also had significantly narrower pelvic width and shorter horns (P<0.001) compared to females from Nusa Tenggara Barat (NTB). For males, management could explain many of the observed differences. Abnormal colored, white spotted animals were sighted and comparisons were made with the standard colored. These spotted cattle were smaller in all phenotypic measurements and significantly lighter in body weight (P<0.0001) compared to standard cattle and regardless of origin. The phenotypic recordings may provide a realistic estimate of the Bali cattle on the locations investigated. The results from interviews and phenotyping can be used when developing breeding programs for Bali cattle.

**Keywords:** Bali cattle, Phenotyping, ANOVA, Breeding

**INTRODUCTION**

For small domestic animal holders in Indonesia, the world’s 4th most densely populated country, Bali cattle (*Bos javanicus*) constitute the most important breed. Due to their high feed efficiency these cattle can live and produce well on very low-quality feed. They also have good fertility and show resistance against many occurring diseases (Mohamad *et al*, 2009). These features makes Bali cattle the economically most important cattle breed used for meat production out of the four indigenous cattle breeds in Indonesia (Martojo, 2012). Bali cattle constitute about 27% of Indonesia’s total cattle population and are most common on the eastern islands. In 2004, the population of Bali cattle was estimated to be approximately 11 million heads (Purwantara *et
al., 2012). Genetic analysis of Bali cattle revealed low rates of heterozygosity, which is a sign of inbreeding (Mohamad et al., 2009) which is a well-known problem for domesticated animals (Barker, 2001; Talib et al., 2003).

Here we aim to increase the knowledge of how Bali cattle are managed by collecting phenotypic recordings and investigate how to approach the problem with a decreased genetic diversity.

MATERIALS AND METHODS

Phenotypic recordings

The field study and phenotyping were conducted during February and March 2015, which is at the end of the rain season.

Phenotype measurements were recorded for each individual according to guidelines from the Food and Agriculture Organization of the United Nations (FAO) (FAO, 2012). The measurements taken on each individual were: body length (BL), height at withers (HW), chest girth (CG), horn length (HL), body weight (BW), pelvic height (PH) and pelvic width (PW). Qualitative variables noted were: gender, age, dewlap size (DS), rump profile (RP), backline profile (BP) and facial profile (FP).

In order to minimize the risk that difference in phenotype was due to age the comparisons in the study were made on adult animals >2 years of age. All individuals were photographed in order to keep track of which animal that had been sampled and to be able to connect phenotypic measurements to the ID. There was also a description of the color of: eyelid, hoof, horn, skin, muzzle and coat. The coat color pattern and type of the fur were also recorded.

The measurements were performed with folding-rulers and a measuring-tape. A calibrated European weight measuring-tape for cattle was used to record weight. Animals were sampled at four different locations - Bogor on Java, Kampar on Sumatra, Paremas on Lombok and Pleihari on Kalimantan. The number of animals >2 years of age sampled at each location is shown in Table 1.

Table 1. Locations and numbers of phenotyped animals at each location

<table>
<thead>
<tr>
<th>Location</th>
<th>Bulls</th>
<th>Cows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedlot Gunung Sindur, Java (Originating from Bali)</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Sumatra, Kampar</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>Kalimantan, Pleihari (originating from Lombok)</td>
<td>1</td>
<td>40</td>
</tr>
<tr>
<td>Lombok, Paremas</td>
<td>2</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>85</td>
</tr>
</tbody>
</table>

Interviews

Interview questions were composed using a standardized questionnaire and guidelines from Bell (1999). The questionnaire considered desired traits, the farmer’s prior knowledge about breeding, management and problems with for instance calf mortality and health. The answers to the questions were analyzed and compared between locations. A total of 68 farmers were interviewed on the same four different locations as was used for the phenotype recordings; Bogor on Java, Kampar on Sumatra, Pleihari on Kalimantan and Paremas on Lombok.

Statistical analysis

Statistical analysis were performed using Graph pad Prism version 6.00 for Windows and
Microsoft Office Excel 2010. Mean values, max/min values, standard deviations, and variance for mean values were calculated for linear measurements and age. Correlations were estimated for males and females and for white spotted animals compared to standard colored individuals. ANOVA was used to determine if there were significant differences for the phenotypic values between the individuals depending on origin and location. The null hypothesis ($H_0$) stated that the difference was equal to zero and the alternative hypothesis ($H_1$) stated that there was a difference ($\alpha = 0.05$). A P-value <0.05 indicated a significant difference. Animals were divided by gender and tested depending on location and origin.

**RESULTS AND DISCUSSION**

**Interviews**

A total of 68 farmers were interviewed on the four locations. None of the farmers used planned mating but mated their cows throughout the year regardless of season. By recommending farmers to perform planned matings animal welfare effects are possible. The possibility to plan the gestation with regards to the season could have beneficial effects since it would minimize heat stress and optimize access of feedstuff.

The majority of the farmers preferred to use artificial insemination (AI) and to use crossbreeding between Bali cattle cows and bulls from other cattle breeds. Limousin and Simmental were the preferred breeds to mate with, due to their large size and good growth. Size was also mentioned as the most desired trait to improve. The posture and conformation was also mentioned as important. The popularity of crossbreeding and desire for large animals might pose a threat for the purity of the Bali cattle breed and may also increase the risk of calving difficulties since crosses with the exotic breeds result in much greater birth weights compared to Bali cattle. Taylor and Murray (1988) stated that smaller individuals tended to cope better with heat-stress. The heavier beef cattle have much higher energy requirements compared to the Bali cattle and are not suited for the Indonesian small-scale farmer conditions. This might result in malnourishment and increased disease prevalence, thus leading to loss of income and animal welfare problems.

On Kalimantan, all the 31 interviewed farmers responded that they had a breeding strategy and all of them answered that the goal with the strategy was to breed for getting larger animals. The fact that farmers also stated that they sold the largest animals since they brought in the best pay, contradicts with this breeding goal and may result in that the largest animals are excluded from breeding. The most common health problems were caused by infections and resulted in fever and diarrhea. On Sumatra, 13.3 % of the farmers stated that they had problems with Jembrana disease. Close to all farmers, 98.6 %, wanted to learn more about breeding and the fact that they were eager to learn more opens future possibilities for further education and collaborations.

**Phenotypic recordings**

A total of 93 animals >2 years of age were phenotyped, 8 males and 85 females. For all mean values, see Table 2.

| Table 2. Descriptive statistics of phenotypic measurements from all males and female |
|-------------------------------|-------------------------------|-------------------------------|
| Age (years)                  | Min/Max                       | sd   |
| All males N=8                | Mean                          | sd   |
| 2.00                         | 2                             | 0    |
| BL (cm)                      | 123.25                        | 13.97|
| All females N=85             | Mean                          | sd   |
| 5.55                         | 2/7                           | 2.79 |
| 110.66                       | 95/130                        | 7.09 |
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Integrated Approach in Developing Sustainable Tropical Animal Production
October 20-22, 2015, Yogyakarta, Indonesia

<table>
<thead>
<tr>
<th></th>
<th>120.38</th>
<th>110/129</th>
<th>6.7</th>
<th>110.42</th>
<th>100/125</th>
<th>4.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW (cm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CG (cm)</td>
<td>165.75</td>
<td>133/181</td>
<td>16.02</td>
<td>150.32</td>
<td>130/166</td>
<td>8.13</td>
</tr>
<tr>
<td>BW (kg)</td>
<td>389.13</td>
<td>205/492</td>
<td>99.96</td>
<td>285.00</td>
<td>192/381</td>
<td>41.9</td>
</tr>
<tr>
<td>PH (cm)</td>
<td>119.13</td>
<td>112/131</td>
<td>6.73</td>
<td>111.27</td>
<td>101/128</td>
<td>4.67</td>
</tr>
<tr>
<td>PW (cm)</td>
<td>33.00</td>
<td>18/40</td>
<td>7.62</td>
<td>23.96</td>
<td>10/36</td>
<td>7.8</td>
</tr>
<tr>
<td>HL (cm)</td>
<td>23.75</td>
<td>19/28</td>
<td>2.96</td>
<td>21.26</td>
<td>8/35</td>
<td>8.76</td>
</tr>
</tbody>
</table>

BL=Body length, HW=Height at whithers, CG=Chest girth, BW=Body Weight, PH=Pelvic height, 
PW=Pelvic width, HL=Horn length. sd= standard deviation and var=variance

Abnormally colored, white spotted animals were sighted on all the locations on Bali, Lombok, Sumatra and Kalimantan. According to information given in the present study, white color or spotted color pattern appeared mostly on inbred animals. Since all the white spotted individuals were females they were compared to standard colored females to avoid differences depending on gender.

Statistical analysis

The ANOVA-test comparing phenotypic measurements for males originating from Bali and males originating from NTB showed that the ones from Bali were larger in all phenotypic measurements except from HL. These differences could probably be explained by differences in management because the males originating from Bali were housed in a feedlot. Comparing females on Sumatra with the females located on Lombok showed significant (P<0.0001) differences in the BW where the females on Sumatra on average weighed 45.6 kg less compared to the ones located on Lombok. Comparing females from Sumatra with the ones located on Kalimantan (originating from NTB) showed significant differences for BW where the ones on Sumatra weighed 25.3 kg less, had significantly (P<0.01) narrower PW and also got significantly (P<0.001) shorter HL.

Comparisons between the females located on Lombok and Kalimantan showed significant (P<0.001) differences in HL where the average difference was 15.4 cm shorter on Lombok. Significant differences were also found for PW (P<0.01) and BW (P<0.0001) where the females on Lombok were heavier and having wider hips. When comparing females from Sumatra with all females originating from NTB, significant (P<0.0001) differences were found for the BW where females from Sumatra on average weighed 33.6 kg less.

Analyses of the white spotted animals

The performed ANOVA comparing white spotted cows with the standard colored cows showed that the white spotted cows were smaller in all measurements and significantly (p<0.0001) differed in BW where the white spotted cattle on average weighed 48.0 kg less compared to the individuals with standard color, regardless of the origin and location. Since inbreeding results in smaller phenotypical measurements this could be the explanation to the smaller measurements. According to Sponenberg (2015) the spotted coat color is most likely not a result of inbreeding and this type of spots have been recorded on horses that are cross bred and also in out-bred horse breeds. However, if white spotting is a recessive trait in Bali cattle, it could be used as a marker for inbreeding since it would occur more frequently due to increased homozygosity. Perhaps the inbreeding is not the reason for the spotted color as such, but the reason to an increased frequency of the color appearing in an inbred stock.

No literature could be found about the genetics behind the white spotting and according to Sponenberg (2015) the genetic background to the color pattern is still unknown. The information from the farmers stating that it was due to inbreeding did not indicate at what degree of inbreeding the white color appears. Since the degree of inbreeding of the white spotted animals in this study
was unknown, this theory could not be studied further. The dataset of white spotted individuals was small and thus not large enough to draw reliable conclusions from, further data from white spotted and white individuals is thus needed.

CONCLUSIONS

This study may be a first step in developing tools suitable for improved breeding of Bali cattle at the small scale farm level. Thus helping to preserve the genetic integrity of this important cattle breed.

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Investigating The Genetic Status of Bali Cattle in Indonesia Using Large Scale Genotyping

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ABSTRACT: Bali cattle belong to the family Bovidae, where also European (Bos taurus) and Zebu (Bos indicus) cattle belong. Mitochondrial data has shown that Bali cattle had a different ancestor than European and Zebu cattle. Today the breed has become widely distributed all over Indonesia and has also been introduced to Australia and Malaysia. In a first survey of genetic variation in Bali cattle 154 animals were genotyped on the Bovine HD SNP chip consisting of 750 000 SNPs. The SNPs have been ascertained in Bos taurus and Bos indicus, therefore Bos javanicus display lower levels of genetic diversity when compared to taurine and indicine cattle and in order to correct for the bias extensive filtering needs to be done. In comparison to taurine and indicine cattle Bali cattle are genetically distinct, and the HD chip can thus be used for screening for pure Bos javanicus animals and also to investigate population structure within the breed. The animals analysed here were part of a phenotypic study of animals from Kalimantan, Sumatra, Lombok and Bali. Our investigation indicate that there are differences in size between females from Kalimantan, Sumatra, Lombok and Bali. Our investigation indicate that there are differences in size between females from Kalimantan, Sumatra, and Lombok, the genetic data suggest that these differences most likely are the result of management, whereas size differences between males from Bali and Lombok may well be the results of both management and genetics. Interviews revealed some problems with inbreeding and lack of knowledge regarding breeding and breeding strategies in all villages which could pose a threat to the genetic diversity of the Bali cattle breed. In a village in Lombok where the awareness of inbreeding was lower the animals also displayed lower genetic variation. We show that the HD SNP chip is a fast and relatively cheap way to assess the genetic status of the breed.

Keywords: Bali cattle, Genetic diversity, Single Nucleotide Polymorphism, Population structure
Genetic Variation and Phylogenetic Tree of Indonesian domestic Goat

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Corresponding email: tety@ugm.ac.id

ABSTRACT: Indonesia has native domestic goat breeds as genetics resources, however so far there were limited informations of genetic diversity, population demographic history, and origin of Indonesian goats. The aim of this study was to examine the genetic diversity and phylogenetic tree of Indonesian domestic goats which compared with available data in Genbank. Polymerase Chain reaction from 20 individuals representing 4 indigenous breeds was performed to determine a 464-bp fragment of mitochondrial DNA (mtDNA) cytochrome b. Restriction fragment length polymorphism of 464 bp using Hinf and HaeIII show the similar fragment result in 2% Agarose gel. Two representative products PCR were sequenced for further analysis. The sequence results then aligned with 37 data genbank by using BioEdit version 7.0. These results pattern of genetic variation in goat’s mtDNA sequences indicated 79 SNP contains substitution G → A (25 SNP), T → C (46 SNP), A → T (4 SNP) and 5 SNP of insertions/deletions. Phylogenetic tree analysis shows the distinct group of Indonesian goats compare with 37 individual data form genbank which clustered into two larger lineages. The genetic variation of domestic goats in Indonesia gives more contribution to the genetic diversity of animal in the world.

Keywords: Domestic goats; mtDNA; genetic variation, Phylogenetic tree

INTRODUCTION

The domestic goat (Capra hircus) is classified as Capra, Caprovinae, Bovidae, Ruminatia, Artiodactyle. Indonesia raises the number of goats (Bligon, Ettawa Grade, Kejobong, Gembong, Marica, Samosir, Kosta, Muara, Benggala) and has a specific breed of goat breeds, called Kacang (Hartatik, 2014). There are around 300 breeds of goats identified in tropic and sub-tropic territory (Devendra and Burns, 1994). Mitochondrial DNA (mtDNA) is maternally inherited and changes in the nucleotide sequence occur faster than DNA (Brown, 1980) so mtDNA is ideally suited as a tool for studying population genetics (Bailey et al., 2000). Mitochondrial DNA (mtDNA) is a useful genetic marker for both intra- and interspecies studies (Brown et al., 1979; Kikkawa et al., 1995). Several studies on mtDNA RFLP of cattle have been reported. Cyt b gene is a gene that is often used to compare multiple phylogenetic species in the same genus or family, the diversity of the cyt b gene has been used to detect the source of milk derived from cattle (Bos), sheep (Ovis) and goats (Capra) and buffalo (Bubalus) (Lanzilao et al., 2005). Pfeiffer et al. (2004) has identified the diversity of the cyt b gene in the species of cattle (Bos taurus), sheep (Ovis aries), goats (Capra hircus), roe buck (Capreolus capreolus) and red deer (Cervus elaphus) (Wolf et al., 1999). Various molecular markers have been explored and commonly utilized in the studies of genetic diversity and phylogenetics of domestic goats based on studies of RFLP and the mtDNA genome. Li et al. (1999) deduced that the origin and evolution of modern Chinese goat breeds were independent of those of exotic goats and that the indigenous goats could be grouped into two main types, the North type and the South type. Since Indonesia has large amount of domestic goats, it is very interesting to understand the genetic variation and the origin of goats in Indonesia base on molecular marker.

The aims of this study were to identify the genetic variation and phylogenetic tree of indonesian domestic goat compare with other goats in another country. Therefore we understand the contribution of Indonesia to promote the genetic diversity of animal in the world.
MATERIALS AND METHODS

Samples

Twenty Indonesia local goats consist of Bligon, Etawa Grade, Kacang and Kejobong were used in the study. Blood samples were collected from all animals by jugular vein that was saved in tubes containing ethylene diamine tetra-acetic acid (K2EDTA). Blood samples were stored at -20°C until DNA extraction.

DNA extraction and Polimerase Chain Reaction

Genomic DNA was isolated from whole blood by using Isolation DNA Kit (Genesync, 2015). The extracted DNA samples were stored at -20°C and used later as a substrate for PCR reaction. The 464-bp fragment of cytochrome b (cyt b) gene was amplified using primers: forward primer of L14735 (5’-AAA AAC CAC CGT TGT TAT TCA ACT-3’) and reverse primer of H15149 (5’-GCC CCT CAG AAT GAT ATT TGT CCT CA-3’) (Wolf et al., 1999). DNA was amplified in a total volume of 20 µl containing 1 µl genomic DNA (10-100 ng), 1 µl each primers, 10 µl PCR KIT (KAPPA2GTM Fast, KAPABIOSYSTEMS, USA) and 7 µl aquabidest steril. PCR conditions were 2 min at 94°C, 36 sec at 95°C, 73 sec at 51°C, 84 sec at 72°C, 35 cycles and 3 min at 72°C (Prado et al., 2005). The PCR was carried out in Primus-25 Advanced (Germany) Thermal Cycler. The PCR products were visualized on 1% agarose gel buffered with 1X Tris-Boric-EDTA buffer (1XTBE), stained with ethidium bromide and visualized under UV light.

Polymerase Chain Reaction - Restriction Fragment Length Polimorphism (PCR-RFLP)

The PCR-amplified DNA fragment of the cytochrome b was digested using HinfI and HaeIII restriction enzyme to identify of genetic pattern. Total volume of digestion was 15 µl containing 6 µl PCR product, 0,2 µl HinfI and HaeIII enzyme (1U), 1,5 µl Tango buffer and 7,3 µl aquabidest steril. The PCR product was digested at 37°C for three. The digestion products were separated on 2,5% agarose gels in 1XTBE buffer and run with 50 V for an hour for separation of the DNA fragments. The bands were stained with ethidium bromide to visualization by UV light. The size of DNA marker φX174 DNA/BsuRI (HaeIII) (Fermentas). The predicted size of PCR-RFLP product as follows:

<table>
<thead>
<tr>
<th>Restricted Enzyme</th>
<th>Product size</th>
</tr>
</thead>
<tbody>
<tr>
<td>HinfI</td>
<td>266 dan 198 bp</td>
</tr>
<tr>
<td>HaeIII</td>
<td>230, 179 dan 35 bp</td>
</tr>
</tbody>
</table>

Sequencing

Two representative products PCR were sequenced for further analysis. DNA sequencing was performed by PT Genetika Science. The sequence results then aligned with 37 data genbank by using BioEdit version 7.0 in order to identify the single nucleotide polymorphism (SNP) and to construct the phylogenetic tree.

RESULTS AND DISCUSSION

The visualization of the PCR product of mt-DNA cytochrome b was performed by 1% agarose gel electrophoresis. Twenty samples of local goat show the same product size of PCR 464 bp. Restriction fragment length polymorphisms of 464 bp PCR product size using HinfI and HaeIII in 2% agarose gel electrophoresis show the similar fragment result for all samples. The same DNA fragments from PCR-RFLP restricted by HinfI restriction enzyme produce 266 and 198 bp. Restriction enzyme Hae III produce DNA fragments 230,179 dan 35 bp. Two or three samples of each indigenous breed of local goats were sequenced to clarify the result of PCR-RFLP
and to detect the SNPs in sequence product of mtDNA cytochrome b. The sequence result can be used to simulate the restriction mapping by using HinfI and HaeIII enzyme, as shown in Figure 1. The restriction site of HinfI restriction enzyme was take place in nucleotide number 266. The restriction site of HaeIII restriction enzyme was take place in nucleotide number 179 and 409.

A. HinfI

B. HaeIII

Figure 1. Restriction mapping of enzyme HinfI (A) dan HaeIII (B) with BioEdit program

As shown in the Figure 1, the result from sequencing was firm with the result from PCR-RFLP. When the restriction sit take place in the position 266, the PCR-RFLP will produce 266 and 198 bp (Figure 1 A). On the other result of restriction mapping, HaeIII restriction enzyme was found in the position 179 and 409. Therefore, the DNA product size of PCR-RFLP were 230,179 and 35 bp. Genetic variation of animal can be identified both using PCR-RFLP and sequencing. However sequencing gives more evidence if there is SNP in the position which cannot be recognized by restriction enzyme.

Two representative products PCR of each breed of local goat were sequenced by Genetika Science. The results of sequences were then analyzed by ClustalW in BioEdit. The totals of 9 samples (PE1, PE2, BG2, BG3, KAC1, KAC3, KEC2, KEC3 dan KJ4) were used in this study. The results indicate the same sequence order. Figure 4 shows the using BioEdit Sequence Alignment
Editor. Dot mark indicates the same sequence. The difference letters show the single nucleotide polymorphisms (SNPs). There are 18 SNPs between goat (9 samples) and cattle (J2). The same sequence order base on mtDNA cytochrome b indicate that the same origin of four breed of local goat. In mammalian, mitochondrial DNA is only passed down through the mother (maternal) without recombination (Manceau et al., 1999).

Since Kacang goat is the indigenous goat in Indonesia, the author suggest that all domestic breed of goat in Indonesia have the same maternaly origin from Kacang goat. Animals which were inherited from the same maternal breed will have similar type of mitochondrial DNA.

![Figure 2. Sequence Alignment using BioEdit program](image)

Phylogenetic analysis at Figure 3 shows the specific sequences of mtDNA cytochrome b of local goat in Indonesia. Separate groups of local goat appear at above site of phylogenetic tree. It seems clearly the differences of local goat of Indonesia compare with other goat from another country. The goat which was clustered within one branch of phylogeny was caused by the low sequence substitutions in Cytochrome b gene (Sultana et al., 2003). Oka et al. (2011) study about the three types of goat (Gembrong, Kacang and KacangxEtawah crossbred) had a very close genetic relationship base on mt DNA D-loop. The analysis of Cytochrome b gene of Kejobong goats originated from different area showed the high similarity and a close genetic relationship (Jiyanto et al, 2014). The registered mtNA in genbank give the evidence that domestic goat of Indonesia has the specific source of genetic. Therefore, the conservation of Kacang goat is very important as the local resources of genetic for the future study.
ACKNOWLEDGMENT

The author would like to thank the Ministry of National Education Republic of Indonesia, which has funded some of these research activities through Penelitian Unggulan Perguruan Tinggi (Contract No. 025/SP2H/PL/Dit.Litabmas/II/2015, SP3 No. 63/LPPM/2015). Thanks also submitted to the Head of the Laboratory of Animal Breeding and Genetics, Department of Animal Production, Faculty of Animal Science Universitas Gadjah Mada for the facilities to use the laboratory.

REFERENCES


Figure 3. Phylogenetic tree


Identification of Gh|Alu-I Gene Polymorphisms in Indonesian Simeulue Buffalo

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ABSTRACT: The purpose of this study was to identify the GH/AluI gene polymorphism in Indonesian Simeulue buffalo. To the best of our knowledge this is the first published data on the polymorphism of growth hormone (GH) gene in Simeulue buffalo. The 178 DNA samples buffalo were collected from three districts in Simeulue Island, Teupah Selatan (71), Teupah Barat (59), and Salang (48). Result shows that a gene fragment of the GH|AluI gene at 432 bp located on exon 3 were successfully amplified by using the techniques of PCR (polymerase chain reaction) and genotyped by PCR-RFLP (restriction fragment length polymorphism). Based on that results showed no polymorphisms were detected in these genes. All buffaloes tested had LL genotype for locus GH|AluI.

Keywords: Simeulue Buffalo, Growth Hormone Gene, Polymorphism

INTRODUCTION

Buffalo is one of the importance domestic animals in Indonesia. They are also regarded as the excellent meat producer. To increasing demand for its products, attention has been focused on the genetic improvement of these species. The local buffalo is a source of germplasm that can be used in order to increase food availability, to improve public welfare, to create employment and to generate foreign exchange. Animals that are genetically adapted to specific environmental conditions would be more productive because it can be developed using low cost, supporting the diversity of food, agriculture and culture, as well as effective in achieving the objectives of food security (FAO, 2000).

Growth hormone (GH) is an anabolic hormone synthesized and secreted by cells of lobe somatotropin in anterior pituitary (Ayuk and Sheppard, 2006). GH has an important role in the growth and postnatal development, growth tissue, lactation, reproduction, and proteins, lipids and carbohydrates metabolism (Akers, 2006; ThidarMyint et al., 2008). The study of GH gene MspI and AluI loci have been reported in Hereford and Composite cattle (Sutarno et al., 1996; Sutarno 1998), Ongole Grade (PO) cattle (Sutarno et al., 2005), Pesisir cattle (Jakaria et al., 2007), Aceh cattle (Sari et al., 2013), Indonesia local buffalo (Andreas et al., 2010; Sumantri et al., 2013). but the use of GH gene as molecular marker in Simeulue buffalo has never done. The aim of this research was conducted in order to identify the polymorphism of growth hormone (GH) gene of AluI loci in Indonesian Simeulue buffalo.

MATERIAL AND METHODS

DNA Sample
DNA samples obtained from blood buffalo. The blood samples were used as a source of as much as 178 DNA samples originating from three different regions, namely 59 samples from Teupah Barat, 71 samples from Teupah Selatan, and 48 samples from Salang.

**Primer**

Primers to amplify gene segments of GH followed Balogh *et al.* (2009), with forward primer 5’-CGGACCGTGTCGTATGAGAACCAGCTGAG-3’ and reverse primer 5’-GTTCTTTGACACCCAGCTCGTCA-3’. The amplified product length was 432 bp.

**DNA Extraction**

DNA was extracted from blood buffalo. Extraction procedure followed the phenol chloroform method (Sambrook and Russell, 2001) was modified with the following procedure:

**Sample preparation**

The blood in the alcohol were as much as 200 µl. Sample was inserted to a 1.5 ml tube. Alcohol was eliminated from the sample by adding distilled water until 1000 µl, and left in room temperature for 20 minutes. Then it was precipitated by centrifugation at a speed of 8,000 rpm for 5 minutes.

**Protein degradation**

The samples were cleared from alcohol and added by 200 µL 1x STE (sodium tris EDTA), 40 µL sodium dosesil sulfate 10%, and 20 µl proteinase K (5 mg/ml). The mixture were incubated overnight at 55 °C temperature while shaken gently.

**Organic material degradation**

After incubated, samples were added by 400 µl phenol solution, 400 µL chloroform/isoamyl alcohol (24:1), and 40 µL 5M NaCl. Then, the mixture was shaken at room temperature for one hour.

**DNA precipitation**

Samples were centrifuged at a speed of 5,000 rpm for 10 minutes to separate the water phase with phenol phase. Water phase was transferred in a new tube with the volume measured. DNA molecules deposited by adding a 2x volume of alcohol absolute and 0.1 x volume of 5M NaCl. Then the mixture was incubated at a temperature of -20 °C over night. Subsequent DNA was precipitated by centrifugation at a speed of 12,000 rpm for 10 minutes. Obtained DNA precipitate was washed by 70% alcohol, and then precipitated again. Precipitated DNA clean from alcohol restored by adding 100 µl TE (Tris EDTA). DNA samples were stored at -20 °C and ready for use.

**Amplification of GH Gene**

Amplification of GH fragment was done by using PCR (polymerase chain reaction) methods. Reagents used for amplification of both target fragment were a 2 µL sample DNA, each primer 25 pmol, 200 µM dNTPs mixture, 1 mM MgCl₂, and 0.5 units of DreamTaq™ DNA Polymerase and 1X buffer (Fermentas) in total solution 25 µL. Amplification in vitro within Gene Amp® PCR System 9,700 (Applied Bio systems™) done with the condition of pra-denaturation at 94°C for 5 minutes, 35 cycles consisting of denaturation at 94°C for 45 seconds, annealing primers at 62°C for 45 seconds and extension of new DNA at 72°C for 1 minute, and the final extension at 72°C for 5 minutes.

**Genotyping by using RFLP Method**

Determination of genotypes of each individual was done by using restriction fragment length polymorphism (RFLP), follow by visualized on 2% agarose gel with 0.5 x TBE buffer (tris borate
EDTA) at 100 V for 40 minutes. Gel was stained by ethidium bromide, and visualized on UV transiluminator. Cutting enzyme that is used for both sides of the target gene was AluI.

**Genotype and Allele Frequency**

Genotype frequency represents the ratio of a genotype to total population. Allele frequency is a ratio of an allele to the overall allele at a locus in the population. Mathematical model genotype and allele frequency (Nei and Kumar, 2000) is represented as follows:

\[ x_i = \frac{n_i}{N} \times 100\% \]

\[ x_a = \frac{G_a + \sum n_j}{2N} \]

where:
- \( x_i \) = \( i \)th genotype frequency
- \( n_i \) = number sample of a genotype
- \( n_j \) = number sample of \( j \)th genotype
- \( N \) = total sample
- \( x_a \) = \( a \)th allele frequency

**RESULTS AND DISCUSSION**

**Amplification of Buffalo GH Gene**

Amplification of GH gene fragment was carried on Gene Amp® PCR System 9700 (Applied Biosystems™) with temperature of 62°C. The amplified gene fragments were visualized on 1.5% agarose gel. The amplified product length GH gene fragment was 432 bp, including 55 bp of 4th exon, 4th intron, and 99 bp of 5th exon (Balogh et al., 2009).

**Identification of GH Gene by Using PCR-RFLP Method**

Determination of GH gene genotypes in this study was done by PCR-RFLP method using AluI which have cutting site AG|CT. Based on DNA sequences of GH genes amplified segment there were three sites AluI cutting, which produced fragments of length 20, 51, 96, and 265 bp, known as the leucine allele (L). This results also supported by Andreas et al. (2010) and Sumantri et al. (2013). There was a substitution from C to G at position 1758 (Lucy et al., 1993), so the produces fragments of length 20, 147, and 265 bp, known as the valine allele (V) (Balogh et al., 2009). Visualization on 2% agarose gel showed that the GH|AluI locus the three buffalo population was monomorphic. The LL genotype was found in a total sample (Figure 1).

**Figure 1.** Visualization of the GH|AluI locus on 2% Agarose Gel. M: DNA Ladder 100 bp, 1-16: Buffalo Samples Genotype LL
Genetic Diversity of GH/AluI Genes within Indonesian Simeulue Buffalo

Level of diversity within populations can be drawn from the allele frequency. Allele frequency is a ratio of one allele relative to the overall allele found in one population. Information on genetic diversity of a population using multiple loci can be described by the value of heterozygosity (Nei and Kumar, 2000).

Genetic diversity based on molecular marker

GH/AluI loci in buffalo were very low. This was indicated by the value of one genotype frequency and allele which had a value of 1, which marks the fixation process. Low diversity in buffalo can be caused by a limited number of males in the population.

CONCLUSION

Based on this research, it can be identified that the use of GH/AluI only resulted in LL genotype and monomorphic, so that it cannot be used as a marker. This phenomenon is likely due to the limited number of samples and the existence of natural selection towards LV and VV genotype as the consequence of Simeulue buffalo adaption’s to the local environment. Thus, a further research is still necessary, by using more samples and if diversity is found, sequencing needs to be done so that the results are more accurate.

ACKNOWLEDGMENTS

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REFERENCES


Reproduction Performance of Bali Cow at Three Areas of Bali Province

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ABSTRACT: Reproduction traits of Bali cattle such as service per conception, calving rate and calving interval and fertility of semen are as successful parameter on breeding program (natural or artificial). Data of Bali cattle reproduction like breeding season, birth season, services per conception, calving interval, and days open were used to study reproduction ability of the dam. Result of research showed that service per conception was 1.23±0.31; 1.02±0.09; 1.2 ±0.27; calving interval was 12.53±0.83; 12.53±0.83; 13.33 ±1.86; days open was 106±25.01; 130.24±38.31; 110±32.33 for the herd from Karang Asem, Tabanan and Pulukan, respectively. Breeding season and birth season were happened along the year. Breeding season was on July to December and it reached the peak on September. Birth of calves was on April to October and it reached the peak on July.

Keywords: Bali cattle, reproduction traits, breeding season, birth season.

INTRODUCTION

Beef cattle were grown to produce meat and other products which were utilized by human beings. Meat is an important food source to fulfill the need of protein of human. Meat demand in Indonesia was increased by 6%~8% each year, especially in densely populated areas such as Java. The fulfillment of the meat is partially supplied by local beef cattle such as Bali, Ongole, Madura, and some other breeds. Bali cattle represent the greatest percentage (26.92 percent) among all cattle breeds, which means that the contribution of Bali cattle to meeting the needs for the meat is very significant. However, the performance of Bali cattle in producing meat has not yet reached a maximum so that efforts are still needed to optimize it.

The advantages characteristics of the Bali cattle breed are its high fertility, high meat quality, low fat percentage (Bugiwati, 2007), its survival and capacity to perform under poor environmental and climatic conditions in harsh dry land areas such as in eastern Indonesia (Toelihere, 2002). In beef cattle production such as Bali cattle, selective breeding mainly has been purposed to improve production trait such as average daily gain (ADG), growth rate and very rare in reproduction trait. However, reproduction traits appear most economically important in meat production whatever the production system. Economic losses from impaired reproductive traits such as fertility are main cause of the production loss as a result of prolonged calving interval, increased insemination costs, reduced return from calves born and higher replacement costs (Bagnato and Oltenacu, 1994).

In fact, reproductive traits dramatically affect productivity. Reproduction traits such as service per conception, calving rate and calving interval of cow and fertility of bulls were as successful parameter in breeding program. Some studies refer to reproduction traits noted that service per conception of Bali cow was 1.8 – 2.0 (Mastika, 2002); calving rate was about 64 – 78% (Bamuailim dan Wirdahayati, 2002). Study in reproduction traits of Bali cattle is still needed to improve productivity of them. The aim of the research is to study reproduction performance of Bali cow in term of service per conception, calving interval and days open. Breeding season and birth season are also investigated to determine the peak of breeding and birth season of Bali cattle in certain area.
MATERIALS AND METHODS

Data

138 Bali cows were used as samples to study service per conception, calving interval and days open. Data were gathered from the farmers who lived in three districts namely Karang Asem, Tabanan and Pulukan. The total number of recording of Bali cows which from Karang Asem, Tabanan and Pulukan were about 61, 47, and 30, respectively. A summary of data structure for each district is presented in Table 1.

Table 1. The number of data for each district at certain age

<table>
<thead>
<tr>
<th>Age</th>
<th>Karang Asem</th>
<th>Tabanan</th>
<th>Pulukan</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI0</td>
<td>22</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>PI2</td>
<td>7</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>PI4</td>
<td>13</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>PI6</td>
<td>2</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>PI8</td>
<td>17</td>
<td>14</td>
<td>7</td>
</tr>
</tbody>
</table>

Note: PI= Permanent Incicy; PI0=1.5 years old; PI2= >1.5 – 2 years old; PI4= >2 – 3 years old; PI6= >3 – 4 years old; PI8= > 4 years old.

Management of animals

The data was from the database of the Bali breeding center of the Animal Husbandry Organization of Bali Province. For the genetic improvement of Bali breed in its growth performance, the project was started in 1976 by the Agriculture Ministry of Indonesia. In this project, bulls were selected at 1 year of age from village breeding center (Tabanan and Karang Asem). Then, the bulls were assigned to flocks in Pulukan to participate in performance test under supervision of Bali Breeding Center. In these flocks pedigree information and other information related to growth traits were recorded carefully. This information was collected from flocks and recorded in the database of Bali Breeding Center for investigating the amount of success of the Bali project. In the Bali breed, the mating period was from July to December by artificial insemination and natural mating. Calving was commenced in April to October. During the calving season, the calves were outdoors together with the dams until weaning.

The calves were weighed and ear tagged within 12 hours of birth. The identities of newborns and of their parents, date of birth, sex, and birth weight were recorded. The length of the suckling period was not the same for all calves. During the suckling period, calves were additionally fed with king grass and concentrate from industry. Most of calves were weaned in May. After weaned, calves were put in different flocks separated to their dams. At 18 months of age animals were treated the same way to test their performance.

Data Analysis

Based on the data, some variables were calculated as follows:
1. Service per conception. Royal et al. (2000) stated that service per conception (S/C) is a measure of the fertility of a herd; the number of services required to affect a pregnancy.
2. Days Open (DO) is the period between calving and conception in cows. Called also calving-to-conception interval (Atabany et al., 2011).
3. Calving interval (CI) is the average time interval between successive calvings (Iskandar and
All variables were analyzed to describe reproduction performance through general average and standard deviation of each area.

RESULTS AND DISCUSSION

Reproduction performance of Bali Cow

Table 2 showed reproduction performance of Bali cow such as service per conception, calving interval and days open.

Tabel 2. Reproduction performance of Bali cow

<table>
<thead>
<tr>
<th>No</th>
<th>Parameter</th>
<th>Karang Asem</th>
<th>Tabanan</th>
<th>Pulukan</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Service per conception</td>
<td>1.23 ± 0.31</td>
<td>1.02 ± 0.09</td>
<td>1.2 ± 0.27</td>
</tr>
<tr>
<td>2.</td>
<td>Calving interval (months)</td>
<td>12.53 ± 0.83</td>
<td>13.34 ± 1.28</td>
<td>13.33 ± 1.86</td>
</tr>
<tr>
<td>3.</td>
<td>Days open (days)</td>
<td>106 ± 25.01</td>
<td>130.24 ± 38.31</td>
<td>110 ± 32.33</td>
</tr>
</tbody>
</table>

It could be noted from Table 2 that service per conception, calving interval and days open of Bali cow at three area (Karang Asem, Tabanan and Pulukan) were in ideal condition. Detailed information for every year of service per conception (S/C), life birth (%) and calving interval (days) at village breeding center (Tabanan and Karang Asem) in last ten years was summarized in Table 3. Other important information like breeding season and birth season was graphically in figure 1.

Tabel 3. Reproduction performance of Bali cow at village breeding center in last ten years

<table>
<thead>
<tr>
<th>Year</th>
<th>S/C</th>
<th>Life birth (%)</th>
<th>Calving interval (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.13</td>
<td>80.60</td>
<td>400.00</td>
</tr>
<tr>
<td>2</td>
<td>1.19</td>
<td>80.75</td>
<td>396.00</td>
</tr>
<tr>
<td>3</td>
<td>1.30</td>
<td>80.76</td>
<td>396.00</td>
</tr>
<tr>
<td>4</td>
<td>1.18</td>
<td>78.80</td>
<td>385.78</td>
</tr>
<tr>
<td>5</td>
<td>1.30</td>
<td>*</td>
<td>396.00</td>
</tr>
<tr>
<td>6</td>
<td>1.18</td>
<td>79.80</td>
<td>385.78</td>
</tr>
<tr>
<td>7</td>
<td>*</td>
<td>75.80</td>
<td>395.78</td>
</tr>
<tr>
<td>8</td>
<td>1.20</td>
<td>79.95</td>
<td>388.00</td>
</tr>
<tr>
<td>9</td>
<td>*</td>
<td>75.26</td>
<td>385.98</td>
</tr>
<tr>
<td>10</td>
<td>1.15</td>
<td>79.75</td>
<td>386.83</td>
</tr>
</tbody>
</table>

Mean: 1.2 ± 0.06, 78.11 ± 2.37, 391.62 ± 5.59

Noted: * data not available

Table 3 showed that the mean of S/C in last ten years was about 1.2 ± 0.06, it meant that the cow had good fertility. The mean of life birth and calving interval was about 78.11 ± 2.37 and 391.62 ± 5.59, respectively. From figure 1 it could be concluded that the evident of breeding and birth was along the year. Breeding season was on July to December and reached the peak on September. Birth season was on April to October and reached the peak on July.
High fertility of Bali cow at Tabanan and Karang Asem as village breeding center (with considering of S/C, calving interval dan days open) due to Bali cow have been adapted to tropical environment for long time ago. Feeding of Bali cow also played role important for basic live and reproduction need. It was correlated to successfully of pregnancy. The high fertility of Bali cow was also supported by shorter calving interval which almost every year calve were born.

High breeding season on July to December related to rainy season at Tabanan. According to Anonymous (1997) the rainy season at Tabanan was started on October and reached the peak on January and hot season was started on April and reached the peak on August. The breeding season on those months was correspondence to highly rainfall which resulted on high quality and quantity of grass. The effect of tropical climate was indirectly on productivity of livestock through feeding, healthy and management (Keman, 1986). On the hot season, cattle which raised in Tabanan were fed by low quality and quantity of grass due to difficulties to get grass in a good quality and quantity.

Instinctively livestock will adapt to environment in order to get the most kind and helpful to them. Livestock adapt to the environment depends on the needs of the water and food they get (Critchfield, 1979). Rainfall, either directly or indirectly is important to the effects on plant growth and disease (Lawlor, 1997). Calf births are on May to September is about 60.52%. It is different to sub tropical area which is 50% calf births are on March to May. By looking at the rainy season and hot season in Tabanan, it appears that the higher rainfall the lower percentage of births. As with any other living creature, Bali cattle instinctively looks adjust and adapt to the environment. In the high rainfall the disease from insects, ticks and mites will grow faster than the low rainfall (Lawlor, 1997).

The percentage of births is the number of offspring born along year divided by the number of cow multiplied by 100. The average of the percentage of births during the 10 years is about 78.11 ± 2.37%. This figure is still within the limits of reproductive efficiency which are considered good for cow. Reproductive efficiency of cattle is considered good when the pregnancy rate may reach 65-75%, calving interval is no more than 12 months (365 days), the time of birth to re-pregnancy is about 60-90 days, service per conception (S/C) is 1.65 and the birth rate is 45-65% (Hardjopranyoto, 1995). The average of birth percentage in this study is in accordance to those reported by Pane (1990) in South Sulawesi, NTT, NTB and Bali is about 76%, 70%, 72% and 69%, respectively; Sumbung et al. (1978) in South Sulawesi is about 79-85%; Djagra and Arka (1994) in Bali is about 83-85%.

Calving interval over the last 10 years also indicates that the reproductive efficiency of cows in village breeding center is good. The calving interval is shorter than those reported by Komariah et al. (1982) in Bali (1.32 years); Darmadja (1980) in Bali and South Sulawesi is about 555 days and 388 days; but it is longer than that reported by Sumbung et al. (1978). Shorter calving interval is related to the guidance conducted by field personnel, the availability of both male for mating natural or semen for artificial insemination and the issuance of unproductive barren cow. Hafez
(2000) states that calving interval depends on the efficiency of estrus detection and fertility of sire and dam. In addition weaning age, days open, body condition, estrus detection, diagnosis of pregnancy and disease control are some of the factors that can affect calving interval.

REFERENCES

Blood Lipid Profile of Hypercholesterolemia *Rattus norvegicus* L. Fed with Sausages Containing Omega 3 and Omega 6 Fatty Acids

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**ABSTRACT:** The experiment was conducted to investigate blood lipid profile of hypercholesterolemia *Rattus norvegicus* L. fed with sausages containing omega 3 and omega 6 fatty acids. Twenty four male *Sprague-dawley* breed rats of two months old were used in this experiment and placed in individual cage. They were grouped into four groups consisted of six rats and fed with basal ration, and drinking water ad lib. The rats were given sausages with different level of omega 3 and omega 6 fatty acids with ratio of 1 : 5.29. The levels were 1.78 g/rat/day (low level); 3.56 g/rat/day (medium level); and 7.11 g/rat/day (high level); and control. Blood was taken at the venous sinus retro-orbital of rats for the lipid profile analysis (cholesterol, triglyceride, low density lipoprotein, and high density lipoprotein). The data of lipid profile were analyzed statistically using analysis of variance and the differences between means were tested by Duncan’s new multiple range test. The feeding of sausages containing omega 3 and omega 6 influenced significantly on the blood lipid profile of rats (P<0.05). The blood of rats fed with sausages containing omega 3 and omega 6 fatty acids at the level of 7.11 g/rat/day (high level) had lower cholesterol 113.77±5.65 mg/dl, triglyceride 81.55±7.35 mg/dl, and low density lipoprotein 50.56±6.41 mg/dl, and had higher high density lipoprotein 64.51±3.43 mg/dl compared to control that contained cholesterol 218.54±6.51 mg/dl, triglyceride 142.71±9.27 mg/dl, and low density lipoprotein 100.41±5.97 mg/dl, and high density lipoprotein 20.98±2.36 mg/dl (P<0.05). In conclusion, the rats fed with sausages containing omega 3 and omega 6 fatty acids at low, medium, and high levels improve the blood profile of rats in term of decrease of cholesterol, triglyceride, and low density lipoprotein and of increase of high density lipoprotein.

**Keywords:** Sausages, Lipid profile, Blood, *Rattus norvegicus* L., Hypercholesterolemia

**INTRODUCTION**

The degenerative diseases such as coronary heart disease and stroke were increased. The increasing of degenerative diseases mostly caused by consuming fast food or foodstuffs from animal origin. Meat derived from livestock slaughtered in Indonesia has low quality. This is due to the origin of livestock that used as draught cattle, so that the meat yielded contains a lot of saturated fatty acid and cholesterol (Setiyono, 2008). The consumption of meat containing a lot of saturated fatty acids and cholesterol is related to negative impact on health or significant health problems, including coronary heart disease and stroke (Krummel, 2008). Setiyono, (2008) reported that the Ongole cross breed meat fattening by feedlots contained fat 5.98% (Longissimus dorsi muscle) and 5.87% (Biceps femoris muscle) and contained cholesterol 81.39 mg/100 g of meat (Longissimus dorsi muscle) and 83.09 mg/100 g of meat (Biceps femoris muscle). According to Singapore General Hospital in Muharrami (2011) and Anonymous (2015) the normal blood lipid profile contained cholesterol < 200 mg/dl, low density lipoprotein (LDL) < 130 mg/dl, high-
density lipoprotein (HDL) > 40 mg/dl, and triglycerides < 200 mg/dl. The bloods which contain cholesterol higher than 200 mg/dl is called hypercholesterolemia and related to atherosclerosis.

There are various prevention efforts of hypercholesterolemia. One of the prevention effort could be conducted by consuming healthy meat product such as sausages that contained omega 3 and omega 6 fatty acids. The food containing omega 3 and omega 6 fatty acids with the ideal ratio could overcome the cholesterol problems in the blood (Setiyono, 2008; Elmadfa and Kornsteiner, 2009; Anonymous, 2015). The feeding of sausages containing omega 3 and omega 6 fatty acids from animal and plant such as cod liver oil and corn oil could reduce the cholesterol content in the blood. Therefore, the biological test on Rattus norvegicus L. needs to be conducted to prove that the sausages could reduce the cholesterol content in the blood of rats. The experiment was conducted to investigate the blood lipid profile of hypercholesterolemia Rattus norvegicus L. fed with sausages containing omega 3 and omega 6 fatty acids with ratio of 1 : 5.29.

**MATERIALS AND METHODS**

The materials used in the experiment consisted of twenty four male Sprague dawley breed rats of two months old (we used the Sprague dawley breed rats in this experiment because of the rats have a good responses when used as a subject in the experiment using cholesterol as an indicator (Fox et al., 1984)), individual cage, basal ration/AIN-93-M (Reeves, 1997), lard/pork fat, sausages containing omega 3 and omega 6 fatty acids with ratio of 1: 5.29 at 11.37% fat content of sausages), reagents and kits used for analysis of total cholesterol and triglycerides, and reagents and kits used for analysis of HDL cholesterol. Reagent to measure total cholesterol containing phosphate buffer, 4-aminophenazone, phenol, peroxidase, cholesterol esterase, and cholesterol oxidase. Reagent to measure triglycerides containing phosphate buffer, 4-chlorophenol, ATP, Mg2+, glycerokinase, peroxidase, lipoprotein lipase, 4-aminophenazone, and glycerol-3-phosphate oxidase, while the reagents used to measure HDL cholesterol containing N,N-bis (4-sulfobutyl)-m-toluidine disodium salt (DSBmT), cholesterol oxidase, peroxidase, 4-aminoantipyrine, cholesterol esterase, and detergents.

This experiment was conducted for 35 days and divided into three stages of experiment. In the first stage, twenty four male Sprague dawley breed rats of two months old were fed with basal ration/AIN-93-M and drinking water ad lib for 7 days. In the second stage, they were fed with lard 4 g/rat/day until hypercholesterolemia/blood cholesterol > 200 mg/dl for 14 days. In the third stage, they were grouped into four groups consisted of six rats. The groups were: P1(control); P2 (basal ration/AIN-93-M + sausages 1.78 g/rat/day); P3 (basal ration/AIN-93-M + sausages 3.56 g/rat/day); and P4 (basal ration/AIN-93-M + sausages 7.11 g/rat/day). The treatment was conducted for 14 days. Blood was taken at the end of each stage for the lipid profile analysis including cholesterol, triglyceride, low density lipoprotein (LDL), and high density lipoprotein (HDL). Blood was taken by using microcapiler hematocrit at the venous sinus retro-orbital of rats (Hrapkiewicz et al., 1998). Total cholesterol and HDL cholesterol were analyzed by using CHOD-PAP (cholesterol oxidase-p-aminophenazone) method. Triglyceride were analyzed using GPO-PAP (glycerol-3-phosphate oxidase-p-aminophenazone) method (Rodriguez et al., 2000). LDL cholesterol were calculated mathematically (LDL cholesterol (mg/dl) = (total cholesterol (mg/dl) – HDL cholesterol (mg/dl)) – (triglycerides (mg/dl) / 5) (Ginsberg et al., 1998). The data of lipid profile were analyzed statistically using analysis of variance and the differences between means were tested by Duncan’s new multiple range test (Steel and Torrie, 1993).
RESULTS AND DISCUSSION

Table 1. Blood lipid profile of *Rattus norvegicus* L. fed with sausages containing omega 3 and omega 6 fatty acids with ratio 1 : 5.29 at low, medium, and high levels

<table>
<thead>
<tr>
<th>Variable</th>
<th>Feeding sausages/sausages levels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
</tr>
<tr>
<td>Cholesterol (mg/dl)</td>
<td></td>
</tr>
<tr>
<td>First stagens</td>
<td>103.83±2.61</td>
</tr>
<tr>
<td>Second stagens</td>
<td>218.87±6.26</td>
</tr>
<tr>
<td>Third stage</td>
<td>218.54±6.51d</td>
</tr>
<tr>
<td>LDL (mg/dl)</td>
<td></td>
</tr>
<tr>
<td>First stage</td>
<td>42.63±4.19b</td>
</tr>
<tr>
<td>Second stagens</td>
<td>100.30±5.86</td>
</tr>
<tr>
<td>Third stage</td>
<td>100.41±5.97d</td>
</tr>
<tr>
<td>HDL (mg/dl)</td>
<td></td>
</tr>
<tr>
<td>First stagens</td>
<td>75.73±3.14</td>
</tr>
<tr>
<td>Second stagens</td>
<td>23.29±2.69</td>
</tr>
<tr>
<td>Third stage</td>
<td>20.98±2.36a</td>
</tr>
<tr>
<td>Triglycerides (mg/dl)</td>
<td></td>
</tr>
<tr>
<td>First stage</td>
<td>72.08±5.91b</td>
</tr>
<tr>
<td>Second stagens</td>
<td>141.33±9.33</td>
</tr>
<tr>
<td>Third stage</td>
<td>142.71±9.27a</td>
</tr>
</tbody>
</table>

abcd Superscripts at the same row indicate significant differences (P<0.05)

The data of blood lipid profile were shown at Table 1. The feeding of sausages containing omega 3 and omega 6 influenced significantly on the blood lipid profile of rats (P<0.05). The feeding of sausages containing omega 3 and omega 6 fatty acids with ratio of 1 : 5.29 at low, medium, and high levels decreased cholesterol, triglyceride, and low density lipoprotein (LDL) but it increased high density lipoprotein (HDL). The blood of rats fed with sausages containing omega 3 and omega 6 fatty acids at the level of 1.78 g/rat/day (low level) contained cholesterol 159.16±4.45 mg/dl, triglyceride 108.33±5.35 mg/dl, LDL 76.93±4.17 mg/dl, and HDL 35.20±4.02 mg/dl. The blood of rats fed with sausages containing omega 3 and omega 6 fatty acids at the level of 3.56 g/rat/day (medium level) contained cholesterol 128.67±5.23 mg/dl, triglyceride 98.07±6.69 mg/dl, LDL 64.31±4.98 mg/dl, and HDL 48.85±4.21 mg/dl. The blood of rats fed with sausages containing omega 3 and omega 6 fatty acids at the level of 7.11 g/rat/day (high level) contained cholesterol 113.77±5.65 mg/dl, triglyceride 81.55±7.35 mg/dl, LDL 50.56±6.41 mg/dl, and HDL 64.51±3.43 mg/dl. The blood of rats fed with sausages containing omega 3 and omega 6 fatty acids at the level of 1.78 g/rat/day (low level); 3.56 g/rat/day (medium level); and 7.11 g/rat/day (high level) had lower cholesterol, triglyceride, and LDL, and had higher HDL compared to control that contained cholesterol 218.54±6.51 mg/dl, triglyceride 142.71±9.27 mg/dl, LDL 100.41±5.97 mg/dl, and HDL 20.98±2.36 mg/dl. The blood lipid profile of rats fed with sausages containing omega 3 and omega 6 fatty acids was in agreement with the Singapore General Hospital in Muharrami (2011) and Anonymous (2015) regarding to their blood lipid profile which contained cholesterol < 200 mg/dl, low density lipoprotein (LDL) < 130 mg/dl, high-density lipoprotein (HDL) > 40 mg/dl, and triglycerides < 200 mg/dl.
Omega 3 and omega 6 fatty acids with the ideal ratio affected low density lipoprotein (LDL) receptors, decreased very low density lipoprotein (VLDL), decreased apolipoprotein B as the component of low density lipoprotein (LDL), and increased apolipoprotein A1 as the component of high density lipoprotein (HDL) therefore blood LDL of rats decreased while blood HDL of rats increased. HDL could decrease blood cholesterol because of the HDL function in the blood which pick up cholesterol from tissues to the liver then degraded or converted to bile acids (Assmann and Schulte, 1992; Mayes, 1996; Pastore, 2003; Setiyono, 2008; Elmadfa and Kornsteiner, 2009; Siri-Tarino et al., 2010) therefore the feeding of sausages containing omega 3 and omega 6 with the ideal ratio on rats decreased blood cholesterol of rats because the cholesterol was used as the component of bile acids production. Omega 3 and omega 6 fatty acids with the ideal ratio also affected the activity of the lipoprotein lipase enzyme. The lipoprotein lipase enzyme degraded triglycerides in chylomicrons and VLDL into glycerol and fatty acids (Assmann and Schulte, 1992; Mayes, 1996; Pastore, 2003; Setiyono, 2008; Elmadfa and Kornsteiner, 2009; Siri-Tarino et al., 2010) therefore the increase of lipoprotein lipase enzyme activity could decrease blood triglycerides of rats. LDL is the metabolic products of VLDL, therefore decrease of the VLDL because the feeding of sausages containing omega 3 and omega 6 with the ideal ratio on rats could decrease blood LDL of rats. Linolenic/α-linolenic fatty acid (omega 3 fatty acid) converted into eicosa pentanoic acid (EPA) and docosa hexanoic acid (DHA) and linoleic fatty acid (omega 6 fatty acid) converted into arachidonic fatty acid (Anonymous, 2013). EPA and DHA could reduce VLDL, inhibit thromboxane production, increase prostacyclin, lowering blood viscosity, and prevents thrombosis (Soerjodibroto, 2005). EPA and DHA also could be lowering blood triglycerides in individuals with hypertriglycerider and prevent blood platelets.

CONCLUSION

The rats fed with sausages containing omega 3 and omega 6 fatty acids with ratio 1 : 5.29 at low, medium, and high levels improve the blood profile of rats in term of decrease of cholesterol, triglyceride, and low density lipoprotein (LDL) and of increase of high density lipoprotein (HDL).

REFERENCES


The Effect of Kayu Akway (Drymis sp) Extract on The Number of Leukocyte of The Male Mice (Mus musculus L)

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ABSTRACT: Kayu Akway (Drymis sp) is an endemic herb plant in West Papua. Akway plant is a plant traditionally used by Papua citizen for various benefits, such as increasing endurance and durability, vitality, controlling birth range, and also curing kudis. The objective of this research was to determine the effect of Kayu Akway extract on the number of leukocyte of male mice (Mus musculus L). The experimental method used in this research is randomized complete design with 3 blocks of treatments and 4 times repetition with given orally for two weeks. The block of treatments are control (K), dose of oral 1.3 ml/kg body weight (K1), and dose of oral 3.3 ml/kg body weight (K2). The data of leukocyte number is analyzed by Analysis of Variance (ANOVA) and then continued by Duncan Multiple Range Test at 95% confidence interval. The result showed that statistically insignificant number of leukocyte in K1 and K2 treatment when compared with control. In the contrary, the lowest leukocyte number was found in the control treatment that was untreated with oral extract. While increased the number of leukocyte was found in the K1 treatment and the highest leukocyte number was found in the K2 treatment. It concluded that seen a trend increase in the number of leukocyte on the second dose compared to control.

Keywords: Drymis sp extract, Leukocyte number, Male mice

INTRODUCTION

Haemotological study both humans and in animal sciences is regarded to be an important index of the physiological state of the individual. Blood is one of the most important specimen studied during parasitic infections and diseases in mice as experimental models. The total leukocyte count (TLC) is one of an important diagnostic tool to assess the host immune status and resistance to disease or infection (Astavief, 1966; Garside and Behnke, 1989). The differential leukocyte count (DLC) is a significant parameter in the blood picture of an animal, especially during any kind of stress from disease, trauma, and infection. The leukocytes of most strains of mice mainly contain neutrophils, lymphocytes, monocytes and eosinophils, while basophils are almost absent (Hardy, 1941). Most of the routine haematological tests described by Dacie (Dacie, 1964) for humans and by Schalm (Schalm et al., 1961) for larger animals are applicable to rats and mice, using electronic cell counters.

The balance between free radical and antioxidant in the body is one of that affects health. It is caused by a deficiency of the antioxidant inputs enough food consumption. One of an antioxidant source that come from outside the body can be obtained from plants. One of the anti oxidant is believed to be the potential akway (Drymis sp). It is based on studies (Santoso et al., 2004), which he also informed that simplisia the bark of a plant Akway high alkaloid, saponin and tannin.

Akway plants (Drymis sp) is defined as of herbaceous plants from the family winterceae with high 1 to 4 m, part the edge of a leaf shaped and oblong leaves somewhat slippery (Anon, 2005). In Indonesia, these plants only in the regions Papua, especially in hilly areas Manokwari. Akway including rare plants growing in the Arafak Mountains natural heritage, the Regency of Manokwari at an altitude of 2500 m (Parubak, 2007). The classification of plants Akway in taxonomic kingdom plantae is a phylum of tracheophyta, subfilum tracheophytina, magnoliopsida.
class, subclass magnoliidae, winterales the ordo, winteraceae family, subfamily winteroideae, the genus drymis, and species drymis sp (Heywood 1993 in Santoso et al., 2004).

Akway used as traditional medicine herbs Sough tribe in the District of Sururey Papua. This plant used to treat malaria and to increase endurance in do servile work, as well as for increase vitality of the body (Paliling, 2004). So far not yet never reported the influence of treatment extract kayu Akway (Drymis sp) to the number of leukocytes in physiology of the body normal. Therefore to discover the potential kayu Akway as one of the traditional herbs done study on the effect of extract kayu Akway (Drymis sp) to the number of leukocytes using male mice (Mus musculus L) as animal models.

The general goal of this study is to interpret the status of the blood profile during treatment extract kayu Akway (Drymis sp) in male mice (Mus musculus L) in comparison to control treatment and then look at the normal physiological conditions. It has already been proved that the blood picture may undergo huge changes during the life time (Khan and Zafar, 2005). The blood profile can undergo drastic changes with certain conditions such as, stress, infections and intoxications. The objective of this research was to determine the effect of kayu Akway (Drymis sp) extract on the number of leukocyte of male mice (Mus musculus L).

**MATERIALS AND METHODS**

**Plant material**
Kayu Akway (Drymis sp) were collected from the traditional market in the Regency of Manokwari, West Papua. The semidyry material (5 g) was dried in air under shade, and crushed to get a fine powder, then it was boiled in a soxhalate apparatus with 50 mL of aquadest for 15 minute in 90°C temperature. After that the crude extract was obtained after removal of the solvent, the extract poured in a beaker glass and closed an aluminum foil paper than stored in low temperature.

**Animal models**
Twelve adults male mice (Mus musculus L) weighting (18-25 g) were obtained from the Genetics Laboratory, Animal Husbandry Faculty, University of Papua. They were kept in plastic cages with free access to water and food, with a 12 h dark and 12 h light cycle.

**Experimental Design**
The experimental method used in this research is randomized complete design with 3 blocks of treatments and 4 times repetition with given orally for two weeks. Mice were divided into three groups, each group consisting of 4 animals. Mice of group-I (K) as a control received food and distilled water ad libitum, group-II (K1) received orally a daily dose of kayu Akway (Drymis sp) at 1.3 ml/Kg b. wt. for two weeks, group-III (K3) received orally a daily dose of kayu Akway (Drymis sp) at 3.3 ml/Kg b. wt. for two weeks.

**Hematological tests**
Blood sample (1 ml) was obtained after two weeks of orally from each of the animals. Blood samples were collected by orbital sinus puncture from different experimental groups use microhematocrit blood tube into the corner of the eye then poured in EDTA rinsed vials (Hoff, 2000) for analyzing hematological parameters including total leukocyte count (TLC) were estimated by using the hemocytometer methods.

**Statistical analysis**
Data were analyzed by using SPSS version 16. The results were expressed as the mean ± SD. The data of leukocyte number is analyzed by Analysis of Variance (ANOVA). The significance
of the mean difference between the control group and each of treatment groups was determined by Duncan Multiple Range Test at 95% confidence interval. P<0.05 was considered statistically significant.

**RESULTS AND DISCUSSION**

The kayu Akway (*Drymis* sp) extract resulted in statistically insignificant number of leukocyte in group-II (K1) and group-III (K2) treatment when compared with control (K). It concluded that seen a trend increase in the number of leukocyte on the second dose compared to control (Table 1).

**Table 1.** Total leukocyte count (TLC) (/mm$^3$) of *Mus musculus* Luring treatment with kayu Akway (*Drymis* sp) extract

<table>
<thead>
<tr>
<th>Batch</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (K)</td>
<td>6750 ± 957.43</td>
</tr>
<tr>
<td>Treatment 1 (K1)</td>
<td>8100 ± 2289.11</td>
</tr>
<tr>
<td>Treatment 2 (K2)</td>
<td>8600 ± 432.05</td>
</tr>
</tbody>
</table>

In the contrary, the lowest leukocyte number was found in the control treatment that was untreated with orally extract. While increased the number of leukocyte was found in the K1 treatment and the highest leukocyte number was found in the K2 treatment. Leukocyte is a defense system to foreign objects which could result in inflammation and infection in the body. According to Arrington (1972) of normal leukocytes mice ranged between 6000 to 12600/mm$^3$. Observations showed that the number of leukocytes of treatment mice is at the normal range.

This has resulted in the high defense of the mice body to foreign matter who enters into the body which can damage tissue. The role of antioxidant is by means of binding free radicals and molecules that very reactive. The high antioxidant consumption could increase system body for immunity foreign matter or antigen.

An orally kayu Akway extract treatment no significant in percentage of lymphocytes compared with the control group. This is because the experiments were not long time. It looks a tendency of instability the percentage of lymphocytes in the extracts kayu Akway group treatment. This is an increase in the percentage of lymphocytes in the group – II (K1) and a decrease in the percentage of lymphocytes in the group - III (K2) (Table 2). According to Arrington (1972) the percentage of lymphocytes in the normal mice ranging from 55 to 85 %. The observation shows that the percentage of lymphocytes mice because extract kayu Akway treatment be in the range of normal.

**Table 2.** Percentage lymphocytes (%) of *Mus musculus* L during treatment with kayu Akway (*Drymis* sp) extract

<table>
<thead>
<tr>
<th>Batch</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (K)</td>
<td>56.25 ± 2.50</td>
</tr>
<tr>
<td>Treatment 1 (K1)</td>
<td>57.75 ± 3.30</td>
</tr>
<tr>
<td>Treatment 2 (K2)</td>
<td>55.75 ± 1.89</td>
</tr>
</tbody>
</table>

Lymphocytes, the immunocompetent cells, are responsible for the immune response of the
host. The present increase in the percentage of lymphocyte, Lymphocytosis, reflects the host's immune response to overcome parasitic stress, after the phagocytic neutrophils failed in checking the invading parasites.

Lymphocytes is agranulosit leukocytes which has the size and form of which vary. In general, lymphocytes enter the circulatory system through the lymhatic vessels. Lymphocyte cells have the ability to conduct a recirculation in blood circulation so that the number of lymphocytes cells that enter and exit or leave blood circulation is relatively constant (Meyer et al., 1975).

The ability of the recirculation lymphocytes very important especially in the process of the mechanism of the distribution of lymphoid cells. It is associated with the immune system response is accumulation a number of lymphocytes in the location of antigens in tissues and can relocated to another place in the network to perform an immune response (Jain, 1993).

In immune response, lymphocyte consisting of B and T cells which are the controllers in the immune system. B cells that differentiate into plasma cells will produce antibodies, whereas the T-cells can release a range of materials that have biological effects that are called limfokin (Medicastore, 2009).

The role of a lymphocyte very important in the activity of the production of humoral antibodies and the formation of cellular defense, as well as responsibility for the antibody diversity. The increase in cell lymphocytes can usually be found on the condition of stress, both physical and emotional, chronic infection, and chronic inflammation. While decrease the number of lymphocytes can be found in the incident a viral infection (decreasing temporary and will rise again the number of lymphocyte) (Meyer et al., 1975).

CONCLUSIONS

To extract a kayu Akway in the dosage produce count of leukocyte and the percentage of lymphocytes mice in the range of normal. Invisible differences in the number of mice lymphocytes to extract kayu Akway treatment in the dosage to control. Observe this trend for increased the number of leukocytes and reducing the percentage of mice lymphocytes to extract kayu Akway are on the dosage compared to controls.

REFERENCES


In Vitro Maturation Rate of Bligon Goat Oocytes Supplemented With Gonadotropin

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ABSTRACT: Research to determine in vitro maturation rate of Bligon Goat supplemented with gonadotrophin (human chorionic gonadotrophin = hCG) in maturation medium. Cumulus-oocyte complexes of Bligon Goat were in vitro matured for 24 h in TCM 199 supplemented with 10 IU and without hCG. Oocytes were then stained with 1\% aceto orcein to examine changes in the configuration of chromosomes and nuclear membrane. Oocytes were considered mature when reached metaphase II (MII), characterized by first polar body (PB1) extrusion and arrangement chromosome similar to first metaphase stage I (M1). The results demonstrated that oocytes will efficiently undergo IVM under hCG supplementation. hCG supplementation significantly increased proportion oocyte underwent maturation (69.1±1.471 versus 44.2±2.5 \% ) as also indicated by nuclear maturation and MII. Also lower rate of oocytes degeneration were observed in the medium with hCG supplementation (2.1±0.3. versus 10.7±2.3 \%). It could be concluded that gonadotrophin supplementation was effective to improve oocytes maturation in vitro and yielding more mature oocytes for future in vitro fertilization.

Keywords: Bligon Goat Oocytes, Human Chorionic Gonadotrophin, In vitro maturation rate, metaphase II

INTRODUCTION

Bligon goat is a natively adapted goat in Indonesia. This goat breed is an established crossbreed between Etawah and local goat. The use of assisted reproductive technology to improve its reproductive efficiency is important. In vitro embryo production is alternatives technologies that need to be developed to increase its population. Obtaining oocyte from ovaries followed by in vitro maturation prior to fertilization is the initial steps of ART. A study is required to determine efficacy of ART in Bligon goat.

Ovaries were by-products of slaughterhouses were used as a source of oocytes. Oocytes obtained from those ovaries have diverse and immature stages, and required to be matured in vitro. However, the results of in vitro oocyte maturation were not always satisfactory. Follicle size, hormone, serum and growth factors in vitro maturation medium and culture conditions greatly affect the success of oocyte maturation (Velilla et al., 2002 cit. Rahman et al., 2008; Widayati et al., 2014). Improvement of developmental competence of mammalian oocytes by supplementation of in vitro maturation (IVM) media with hormone and serum supplements has been the subject of many investigations. Supplementation of the IVM media with gonadotropins and estradiol has been found to be essential for acquisition of developmental capacity of oocytes in cattle (Fukushima and Fukui, 1985; Brackett et al., 1989). The successful of oocytes to achieve metaphase II were
absolutely necessary for successful fertilization and pregnancy. The ability of oocytes to reach metaphase II also influenced by internal factors such as the quality of the oocyte itself and genetic. This study was conducted to determine the effect of gonadotropins on different oocyte quality of Bligon goat on their ability to reach metaphase II.

**MATERIAL AND METHODS**

The research was conducted in October 2014 until March 2015 at the Laboratory of Animal Physiology and Reproduction, Faculty of Animal Husbandry, Gadjah Mada University, Yogyakarta. Materials used in this study were obtained from ovarian goat abattoir (slaughterhouse) specialized sheep and goats New Babadan, located on Jl. Kaliurang KM. 7, Sleman, Yogyakarta; tissue culture medium (TCM) -199 (Gibco, USA) supplemented with penicillin, streptomycin, and bovine serum albumin (BSA); Dulbeccos’ phosphate buffered saline (DPBS) (Gibco, USA); fetal calf serum (FCS); human chorionic gonadothropin (Teikoku Zouki, Japan), mineral oil; penicillin (Meiji, Indonesia); streptomycin (Meiji, Indonesia); distilled water; ; and 70% alcohol. Research equipment for IVF such as CO2 incubator (Cole Parmer, USA), stereo microscope (Cole Parmer, USA), disposable tissue culture dish (TCD) (Falcon, USA), tube micro hematocrit non-heparin (Brand, Wertheim).

**Aspiration of oocytes.** Goat ovaries obtained from slaughterhouses immediately after being taken from the body and put into 31-34°C normal saline solution then taken to the laboratory. Goat oocytes were collected by aspiration of follicles using 18 G needle attached to 3 mL disposable syringe. Only cumulus-oocyte complexes grade A, B and C were used in this research.

**In vitro maturation.** Oocytes were cultured for 24 h in TCM 199 with hCG, 20 IU/10 mL (treatment group) or without (0 IU or control group) in an incubator at 39°C and 5% CO2 with humidified air. In vitro maturation rate were determined using staining with 1% aceto orcein to examine stage of oocytes maturation by changes in chromosome configuration and nuclear membrane (Karja et al., 2010). Maturation oocytes status was determined based on changes in the configuration of chromosomes and nuclear membrane. Germinal vesicle (GV) characterized by nuclear membrane and nucleus clearly visible on the edges; germinal vesicle break down (GVBD) characterized by nuclear membrane rupture and nucleolus were not clearly visible; metaphase I (MI) characterized by homologous chromosome pairing and lined in equator, anaphase I (AI) characterized by the centromere toward the opposite pole and attracted homologous chromosomes into two parts, telophase I (TI) characterized by homologous chromosomes perfectly collected on each pole, and metaphase II (MII) characterized by polar body I and arrangement chromosome similar to metaphase stage I.

**Statistical analysis.** Data were analyzed using one way analysis of variance (ANOVA) with one way randomized completely design.

**RESULT AND DISCUSSION**

The cumulus-oocytes complexes recoveries were distributed in micro drops of petri dishes with maturation media (TCM 199 without (0IU/10mL) and with 20IU/10mL hCG). After 24 hours of oocytes maturation in incubator with a 5% CO2 humidified air atmosphere, the oocytes were evaluated on the basis of cytological and morphological criteria. The mature oocytes characterized expansion of cumulus cells surrounding oocytes and the extrusion of first polar body. Gordon (2003) reported that mature oocytes indicated the expansion of cumulus cells, the germinal
vesicle breaks down and the first polar body extrusion. Expansion of cumulus cells was the most easily seen as a sign of mature oocytes. Expansion of cumulus cells was essential for successful fertilization because it can help the migration of spermatozoa between cumulus cells (Widayati et al., 2013). The presence of this gonadotropin in the in vitro maturation medium enhances expansion of the cumulus cells surrounding the oocyte, which in terms enhances sperm capacitation and the fertilization process. Abdoon et al. (2001) found that FSH or eCG supplementation to the IVM medium significantly increased cleavage rate and development of buffalo embryos up to the blastocyst stage when compared with negative control medium.

After 24 hours IVM, control (0IU) showed 10.7±2.3 % degeneration and 2.1±0.3 % in treatment group (20IU/10mL). The rate of oocytes reached metaphase II in control and treatment group were 44.2±2.5 and 69.1±1.4 % respectively (Table 1).

<table>
<thead>
<tr>
<th>Stage of oocytes</th>
<th>Control group (hCG 0IU/10 ml)</th>
<th>Treatment group (hCG 20IU/10 ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germinal vesicle (GV)</td>
<td>8.0 ± 1.1</td>
<td>6.0 ± 0.3</td>
</tr>
<tr>
<td>Germinal vesicle break down (GVBD)</td>
<td>4.8 ± 0.7</td>
<td>3.3 ± 0.5</td>
</tr>
<tr>
<td>Metaphase I (MI)</td>
<td>20.3 ± 2.6</td>
<td>14.5 ± 2.0</td>
</tr>
<tr>
<td>Metaphase II (MII)</td>
<td>44.2 ± 2.5a</td>
<td>69.1 ± 1.4b</td>
</tr>
<tr>
<td>Degenerate</td>
<td>10.7± 2.3 a</td>
<td>2.1 ± 0.3 b</td>
</tr>
</tbody>
</table>

Supplementation gonadotrophin into IVM medium was effective in stimulating the development of oocytes to mature in vitro. More MII oocytes were collected from treatment group than controls ($P < 0.05$). This finding was similar with the previous research that canine oocytes reached metaphase II after culture in 10 IU/mL hCG (De Los Reyes et al., 2005). Enhanced cytoplasmic maturation of oocytes was obtained in some studies when gonadotropins were included in IVM media. Akçay et al. (2008) reported that addition of gonadotropins and E2 to a maturation medium would be necessary to improve developmental and fertilization ability of bovine oocytes in vitro. An increase of gonadotropin concentration in the culture medium resulted in an increase in the the percentage of oocytes reaching metaphase II, normal configuration of the spindle, normal chromosomal alignment, cortical granule migration, and mitochondrial aggregation (Sha et al., 2010).

The less oocytes degeneration presented in the oocytes with hCG supplementation. The development of oocytes strongly influenced by the activity of hormone gonadotropin, namely FSH and LH (Hafez, 2000; Wattimena et al., 2006). Absence of hormones resulted failure of oocytes to develop further and degenerates.

Human chorionic gonadotropin is a hormones secreted by human placenta during its pregnancy and have similarity or contains Luteinizing hormones (LH). Balasch et al. (1995) observed the role of luteinizing hormone in human follicle development and oocyte fertility in a woman with long-standing hypogonadotropic hypogonadism and using recombinant human follicle stimulating hormone. The results showed a direct primary role of LH in complete maturation of the follicle. In vivo administration prior to oocyte pick up on IVF patient showed that administration of r-LH produce more oocyte that yielded in grade 1 and grade 2 embryos. Meanwhile recombinant FSH only injection produce higher number oocyte, also when its combined with r-LH, but all treatments
produce similar number of embryos available for embryo transfer (Lisi et al., 2012).

Animal study by Lu et al. (2014) showed that gonadotropin was widely used in in vitro oocyte maturation. Their group used bovine as model and showed no difference by adding 7.5 IU/mL and 75 IU/mL. It showed that the dose does not improve maturation rate but the presence of gonadotropin is required. In human clinical practices, gonadotropin also been used in clinical in vitro maturation a dose of 0.5 IU/mL human Chorionic Gonatropin combined with 75mIU/mL FSH in TCM-199 supplemented with 20% FBS give a better maturation rate compare to the absence of hCG in the media (Ge, et al., 2008). Sha et al. (2010) studied the effect of FSH and LH and hCG on porcine oocyte. The results showed that FSH and LH also hCG can significantly improve cytoplasmic and nuclear maturation in procine oocyte, but there was a dose dependency among those hormones. The results showed combining two gonadotropin vary the maturation and ration LH:hCG may play important role.

CONCLUSION

It could be concluded that gonadotrophin supplementation was effective to improve oocytes maturation in vitro and yielding more mature oocytes for future in vitro fertilization.

REFERENCE


A Preliminary Study of the Use of Hormones on the Reproductive Performance of some Breeds of Rabbits

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Jl. Raya Veteran III Ciawi-Bogor
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ABSTRACT: Reproductive hormones are often used in the animal production, including in rabbits to increase the rate of production, e.g. in the AI practices. Rabbit is a prolific animal, yet its reproductive rate in Indonesia is slow. A preliminary study on reproductive performance of rabbits with or without injection of hCG was carried out at Balai Penelitian Ternak, Ciawi-Bogor in 2014. Five breeds of rabbits, i.e. Rex, Reza, Hybrid NZW Hyla and Hycole and NZW x Local cross were treated with or without injection of 0.2 cc of hCG. Each treatment, depended on the breed, consisted of 15 – 57 individual replications. A randomized complete block design was applied with SPSS IBM 20. Measurement were made on changes of bodyweight of does and kits, receptivity and conception rate of the does, gestation period, litter size (LS) at birth, 21 days and 35 days, stillbirth and kit mortalities during lactation. Results indicated that the use of hormones significantly increased the oestrus rate (61-86% vs 26-29 %), receptivity and conception rate (48-56 % vs 17-36 %) in all treated breeds although the rate was different between breeds. The use of hormones also increased litter size at birth of Rex (7.0 vs 5.8), Reza (6.8 vs 5.8) and Hycole (8.2 vs 5.8). It’s interesting to note that NZW x Local cross produced rather high LS at birth, 8.9 ± 2.2 kits alive. Gestation period was not different among treatments, ranged from 31.4 – 32.5 days.

Keywords: hormone, reproduction, rabbit.

INTRODUCTION

Rabbit is a potential livestock to be developed in Indonesia as it has a biologic and economic potency (Hutasuhut, 2005 and Raharjo, 2005). One of biologic potency of rabbit and has ecomonic trait is their reproductive performance. Rabbit has high of litter size and fast in kiddling interval of rabbit. In rabbit, litter size trait becomes one of reproduction performance that need to be increased because it has economic value (Bolet et al, 2007). Litter size is effected by ovulation rate which depends on LH (luteinizing hormone) level in blood (El-Darawany and Slam, 1996).

Reproductive hormones are often used in the animal production, including in rabbits to increase the rate of production, e.g. in the AI practices. Zanagnolo et al (1996) had studied reproductive hormone was that hCG hormone. They used it undertook to elucidate he effects of GnRH analaog on rabbit ovulation. Based on their research found that it was significanly decreased in ovulatory efficiency and an increase in degeneration rate of preimplantation efficiency. hCG, is one of GnRH (Gonadotrophin Relaxing Hormone) family, is hormone that is included in thyrotopic hormones group and it has pricipal function like LH. The effect of Hormones used were hCG and LH for induced of the ovulation (Bearden et al., 2004, Bosco et al., 2011 and William, 1974). Based on Bosco et al (2011) that rabbit ovulation is induced by coitus and LH and hCG can increase induced of ovulation in rabbit does. The purpose of this studies is a preliminary study to identify that effected hormones hCG to reproduction performance of more breeds rabbit does.
MATERIAL AND METHOD

The research of a preliminary study on reproductive performance of rabbits with or without injection of hCG was carried out at Balai Penelitian Ternak, Ciawi-Bogor in 2014. Five breeds of rabbits, i.e. Rex, Reza, Hybrid NZW Hyla and Hycole and NZWxLocal cross were treated with or without injection of 0.2 cc of hCG at 2 days before mating. Each treatment, depended on the breed, consisted of 15 – 57 individual replications.

Statistic: A randomized complete block design was applied with SPSS IBM 20. Measurement were made on changes of body weight of does and kits, receptivity and conception rate of the does, gestation period, litter size (LS) at birth, 21 days and 35 days, still birth and kit mortalities during lactation.

RESULT AND DISCUSSION

Table 1 and table 2 suggested that the effects of hCG hormone on more breed of does reproductive performances. The result of this studies was hCG that significantly effected estrus (E), percent of pregnant (PP), litter born alive (LBA), pregnant periode (PPr) and male receptivity (MR) traits in does. In the case, the hCG didn't effect to more traits like litter alive within 21 days (LA21) and litter alive within 35 days (LA35).

Table 1. The more breeds of does reproduction performances used hCG hormone

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>NL</th>
<th>Rex</th>
<th>Reza</th>
<th>Hycole</th>
<th>Hyla</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>15</td>
<td>22</td>
<td>18</td>
<td>27</td>
<td>18</td>
</tr>
<tr>
<td>Estrus</td>
<td>60</td>
<td>86</td>
<td>83</td>
<td>81</td>
<td>61</td>
</tr>
<tr>
<td>Mating</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Percent of Pregnant</td>
<td>67</td>
<td>50</td>
<td>56</td>
<td>48</td>
<td>61</td>
</tr>
<tr>
<td>Litter Born Alive</td>
<td>8.9±2.2</td>
<td>7.0±2.2</td>
<td>6.9±3.6</td>
<td>8.2±3.5</td>
<td>7.6±4.1</td>
</tr>
<tr>
<td>Litter Born Died</td>
<td>1.2</td>
<td>2.5</td>
<td>2.1</td>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td>Pregnant Periode</td>
<td>31.4±1.01</td>
<td>31.7±1.2</td>
<td>32.3±0.5</td>
<td>31.2±0.6</td>
<td>31.9±1.2</td>
</tr>
<tr>
<td>Male Receptivity</td>
<td>93</td>
<td>68</td>
<td>61</td>
<td>81</td>
<td>89</td>
</tr>
<tr>
<td>Litter Alive within 21 days</td>
<td>4.4±1.3</td>
<td>4.0±0.6</td>
<td>4.2±0.8</td>
<td>4.2±1.4</td>
<td>4.0±1.6</td>
</tr>
<tr>
<td>Litter Died within 21 days</td>
<td>4.4</td>
<td>3.0</td>
<td>3.8</td>
<td>4.0</td>
<td>3.6</td>
</tr>
<tr>
<td>Litter Alive within 35 days</td>
<td>3.6±0.8</td>
<td>3.4±1.0</td>
<td>3.5±1.0</td>
<td>3.5±1.4</td>
<td>3.7±1.2</td>
</tr>
<tr>
<td>Litter Died within 35 days</td>
<td>0.9</td>
<td>0.6</td>
<td>0.7</td>
<td>0.7</td>
<td>0.3</td>
</tr>
</tbody>
</table>

FAO (1997) explained that female rabbit had no cycle and can stay in heat for several days running. hCG, which has the role like LH, has the function of promoting development of ovarian follicles (duration = 10 hour) and then of ovulation. According to the function hCG, it can cause LBA significantly for more does breeds. The hormone effected estrus because the hCG had principal action like LH. Bearden et al (2004) stated that the hCG, had chemical class was protein and came from placenta, like LH action.

According to Bosco et al (2011) that The estrogen levels present in circulation and the number of pre-ovulatory follicles could influence the pituitary sensitivity at minumum dose. The function of hCG like LH but hCG has a longer than LH, Bosco et al (2011) stated that although the pharmacological action of hCG and LH are similar, the pharcokinetics and bioavailability of the hormones are
different because LH has a shorter half life than hCG, so it can effect the estrogen level in blood. The effect of estrogen level in blood can continue to the estrus in does. Estrus in does can be shown with vulva colour change. A significant number of does showing red and puple vulva were much numerous. The positive relationship between the intensity of the vulva colour and the male receptivity, fertility and prolificacy has been demonstrated (Maertens et al, 1983; Theau-Clement et al 1990; Bonanno et al, 1990; Maertens and Luzi, 1995 in Maertens et al, 1995).

**Table 2.** The more breeds of does reproduction performances without hCG hormone.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>NL</th>
<th>Rex</th>
<th>Reza</th>
<th>Hycole</th>
<th>Hyla</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>30</td>
<td>39</td>
<td>51</td>
<td>24</td>
<td>57</td>
</tr>
<tr>
<td>Estrus</td>
<td>43</td>
<td>26</td>
<td>53</td>
<td>58</td>
<td>53</td>
</tr>
<tr>
<td>Mating</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Percent of Pregnant</td>
<td>40</td>
<td>33</td>
<td>55</td>
<td>17</td>
<td>42</td>
</tr>
<tr>
<td>Litter Born Alive</td>
<td>6.6±0.7</td>
<td>5.9±2.9</td>
<td>5.0±2.3</td>
<td>5.8±1.5</td>
<td>7.2±2.9</td>
</tr>
<tr>
<td>Litter Born Died</td>
<td>2.0</td>
<td>0</td>
<td>1.5</td>
<td>0</td>
<td>0.7</td>
</tr>
<tr>
<td>Pregnant Periode</td>
<td>32±1.28</td>
<td>32.5±1.0</td>
<td>32.6±1.0</td>
<td>32.3±1.0</td>
<td>32.1±1.0</td>
</tr>
<tr>
<td>Male Receptivity</td>
<td>53</td>
<td>49</td>
<td>49</td>
<td>54</td>
<td>46</td>
</tr>
<tr>
<td>Litter Alive within 21 days</td>
<td>4.8±0.8</td>
<td>4.2±1.1</td>
<td>4.0±1.8</td>
<td>4.3±1.3</td>
<td>4.2±1.7</td>
</tr>
<tr>
<td>Litter Died within 21 days</td>
<td>1.8</td>
<td>1.6</td>
<td>1.0</td>
<td>1.5</td>
<td>3</td>
</tr>
<tr>
<td>Litter Alive within 35 days</td>
<td>4.0±1.0</td>
<td>3.6±0.9</td>
<td>3.1±1.6</td>
<td>3.5±0.6</td>
<td>3.8±1.7</td>
</tr>
<tr>
<td>Litter Died within 35 days</td>
<td>1.5</td>
<td>0.7</td>
<td>0.9</td>
<td>0.8</td>
<td>0.4</td>
</tr>
</tbody>
</table>

The estrogen level effect in blood can continue to the estrus in does. Estrus in does can be shown with vulva colour change. A significant number of does showing red and puple vulva were much numerous. The positive relationship between the intensity of the vulva colour and the receptivity, fertility and prolificacy has been demonstrated (Maertens et al, 1983; Theau-Clement et al 1990; Bonanno et al, 1990; Maertens and Luzi, 1995 in Maertens et al, 1995).

The research from El-Kalaway (1997) showed that mean rabbit weight at birth, 21 and 28 days of rabbit weight, daily gain from birth to 21 days and preweaning mortality percentages at different ages were not signicantly affected by hormone treatment but milk production from does. Weaning of rabbit kids were effected by litter size at birth, mothering ability and milk production of does. According to Sartika and Dwiyanto (1995) stated that the growth of high litter size faster than low litter size because it was caused from traits of mothering ability. One of traits mothering ability was milk production. Based on FAO (1997), milk production depends on prolactin, a lactogenic hormone. Therefore, hCG can not effect of LA21 and LA35 because it was affected by prolactin hormone.

**CONCLUSION**

In conclusion, this research provides on affected of hCG hormone, shows that hCG can increase reproduction productivity of does rabbit especially for estrus, male receptivity, percent of pregnant and litter size alive traits because the function of hCG like LH hormone in rabbit. Therefore, in this a preliminary study shows that hCG can be used to increased reproduction productivity in rabbit farm in Indonesia. However, hCG hormone can’t effect to litter alive 21 and litter alive 35 trait.
REFERENCES

The Use of Vaginal Smear Method Based on the Morphology of the Vaginal Mucosa Epithelial Cells for the Dairy Cows Cycle Estrus Detection

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Corresponding email: jokoriyanto19@yahoo.com

ABSTRACT: The purpose of this study was to identify the estrus cycle in dairy cows based on epithelial cell morphology appearance vagina produced by vagine smear vagina mucosal cells. The research was use of Fries Holstein crossbred cow as many as 21 head. All cows were synchronized use PGF2α and GnRH hormone by injected intra muscular injection PGF2α injection carried out twice with an interval of 11 days and on day 13 injection of GnRH by intra muscular (IM). Epithelial cells were taken using the cotton bud then reviewed on an object glass. The vagine smear results were stained with Giemsa 3%. Vagine epithelial cells was observed using a microscope magnification 10x45 and 10x100. Estrus detection is also implemented using the heat detector Draminski brands. The results showed that (1) the cells are round and oval has a larger cell than the cell cytoplasm called parabasal on metestrus phase, (2) epithelial cells and small oval-shaped and slightly irregular, but there is still a cell wall and has a large nucleus called intermediate cells during diestrus, (3) the cell's nucleus irregularly shaped (polygonal) but still the cell nucleus and cell wall faded and most of cornification of epithelial cells called superficial cells are found during proestrus, (3) cell-shaped flat, translucent and transparent and does not contain a cell nucleus and cell wall occurs cornification classified as anuclear cells occurs in estrus phase. When estrus number of superficial cells cornification reaches 90.57 to 94.19% of all cells obtained in the observations. Estrus detection results using the heat detector at the time proestrous and estrous showed a low the numbers of 175-240 whereas the currently metestrous and diestrous between 350-500. The conclusion of this study was vagine smear method using 3% Giemsa there parabasal cells, intermediate, superficial, and anuclear during the estrous cycle. The use of vaginal The Pap method can be used for detection of estrus cycle in dairy cows.

Keywords: vaginal smear, vaginal mucosa epithelial cells, dairy cows, cycle estrus, detection

INTRODUCTION

Efforts to increase the milk production from Holstein Friesian crossbred cow should be supported in a proper way in reproductive management, especially in the accuracy of estrus detection. This has influenced the the determination of appropriate time for insemination. On the other hand there's also a dairy cow who experience silent-heat making it difficult for farmers accurately detect estrus (Bearden et al., 2004; Putro, 2008; Forde et al., 2011). Estrus detection by visual observation as seeing changes in behavior, mucus estrus, color and swelling of the vulva are still inadequate so that the necessary required other detection more accurate (Hafez and Hafez, 2000). Estrus detection through vaginal epithelial cell morphology changes in vaginal smear method can determine the accuracy of detection during estrus cycle. Tool heat detector is capable of displaying digital numbers on the screen that shows the changes in cattle estrus cycle. Detection methods vagine smear and heat detector, both are able to determine the estrous cycle in beef cattle appropriately (Riyanto et al., 2014). The purpose of this study was to identify the estrus cycle in
dairy cows based on epithelial cell morphology vagina appearance produced by vagine smear vagina mucosal cells and the use of heat detector.

MATERIALS AND METHODS

This study has used 21 heads of Holstein Friesian crossbred that have BCS 3.5 (1-5), has been birth at least 1 time, aged <6 years old, and not in a state of pregnant. Cow estrus synchronization has been done using a synthetic hormone preparations PGF2α by Lutaprostat® and GnRH synthetic by Conceptase®. Injection intervals of the first and second injection PGF2α for 11 days and GnRH injection is done after 48 hours of the second PGF2α injection (Sunarto, et al., 2014). PGF2α and GnRH hormone injection, both carried out by intramuscular injection. During the 11 days of estrus detection is done 3 times a day (morning, afternoon, evening) visually and by vaginal smear method. After injection of GnRH within 24 hours was observed estrus detection every 3 hours. Vaginal epithelial cell morphology observation using vagine smear staining method 3% Giemsa (Riyanto et al., 2014). Swabs in epithelial cells vagina done about 2-5 cm in vagina using a cotton bud that had previously been dipped in physiological NaCl solution. Cells attached to the cotton bud then applied to the object glas allowed to stand for about 1 hour, then immersed into the liquid methanol, then drained and put in 3% Giemsa solution and then rinsed with aquadest. Epithelial cell morphology can be observed using microscopy and optical lab with magnification 10x4 and 10x10. Observations type and shape of each cell found in swabs obtained can be used to determine the estrus phase of cattle. Counting the percentage of superficial cells done by looking for the entire cell number and the number of superficial cells, and taken third place in the first observation of the same preparations, to obtain an average yield of superficial cells (Puspita, 2013). Estrus detection by using the tool of brand Draminski Heat Detector. The tip tool has two cathode ring inserted into vagina then press the contact button on the tool three times to appears and can be viewed on the monitor, the numbers look a scale of 100-500 and the lower numbers indicate the cow estrus (Riyanto et al., 2014).

RESULTS AND DISCUSSION

Estrus phase at Holstein Friesian crossbred cow has been observed with smear vaginal epithelial cells. Cell shape changes are superficial cells, anuclear cells, intermediate cells and parabasal cells. Estrus detection results by vaginal smear method can be seen in Figure 1. Changes in the morphology of vaginal epithelial cells in cows Peranakan Ongole (PO) there are four types of superficial cells, anuclear cell, parabasal cell, and intermediates cell that can be used for estrus detection and determination of the estrous cycle (Riyanto et al., 2014).
The cell's nucleus irregularly shaped (polygonal) but still the cell nucleus and cell wall faded and most of cornification of epithelial cells called superficial cells are found during proestrus (Figure 1A). Proestrus phase in the Ongole crossbred cows are largely epithelial cells undergo cornification so irregular cell shape and characteristics are included in superficial cells (Riyanto et al., 2014). Cell-shaped flat, translucent and transparent and does not contain a cell nucleus and cell wall occurs cornification classified as anuclear cells occurs in estrus phase (Figure 1B). From the estrus phase is almost 100% cornification cells, and these characteristics classified in anuclear cells. Cells form flat, clear transparent, no walls, and no cell nucleus this happens because of the cornification process. (Riyanto et al., 2014). The cells are round and oval has a larger cell than the cell cytoplasm called parabasal on metesrus phase (Figure 1C). Riyanto et al., (2014) observed vaginal smears show this parabasal cells are round and oval nucleus has a larger section than the cytoplasm is usually looked thick. Epithelial cells and small oval-shaped and slightly irregular, but there is still a cell wall and has a large nucleus during diestrus called intermediate cells (Figure 1D). In this phase there are cell wall and most of the cells are not cornification. Riyanto et al. (2014) stated that the cells intermediate and parabasal more prominently on the diestrus phase in accordance with the luteal phase is controlled by the hormone progesterone. When estrus number of superficial cells cornification Reaches 90.57±2.45%, 90.57 to 94.19±3.05% 94.19% of all cells Obtained in the observations. The results showed that of the calculation of superficial cells in the cow cornification during the follicular phase. Puspita (2013) stated that the number of superficial cells cornification which dominates 50% to 90% of the total number of cells, then the animal is in a state of estrus. Ramadan (2014) and Saifuddin (2014) stated that the increased number of superficial cells is probably caused by the hormone estrogen which leads to changes in the walls of the vaginal epithelial cells and epithelial cell cornification. Detection results using the heat detector at the time proestrous and estrous Showed a low the numbers of 175-250 whereas the currently metestrous and diestrous between 350-500. The principle of how the appliance heat detector Draminski production during estrus cows is 110 to 370 units. Indications digit heat detector stated that the lower figure shown it is increasingly approaching estrus (Ramadan, 2014 and Saifuddin, 2014). Yanhendri (2007) states that the use of a heat detector Haupner® German production in Simmental cattle seen in the range of 30-40 ohm (300-400 units). The use of heat detector at Ongole cross bred show number 200-350 when proestur and estrus while at metestrus and diestrus figures show 350-600 (Riyanto, et al., 2014)

**CONCLUSIONS**

The conclusion of this study was vagine smear method using 3% Giemsa there parabasal cells, intermediate. superficial, and anuclear during the estrous cycle. The use of vaginal smear method can be used for detection of estrus cycle in dairy cows. At the time of estrus epithelial cells vagine dominated by superficial cells cornification up to 95%. Tool heat detector can be used for detection of estrus cycle in dairy cows, the numbers 175-250 on proestrus and estrus phase and 350-500 on metestrus and diestrus phase.
REFERENCES


Optimization of Bovine Sperm Sexing:
Modification of Column Length and Separation Time

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ABSTRACT: The aim of this research is to determine the effect of sperm separation using albumin column with the modification of the column length and time of separation on sperm quality and the effectiveness of sperm separation. Semen was collected using an AV, evaluated and then separated using albumin column technique. The design of this research was factorial 2x2 with two treatments of length column: 2 ml (control) vs 3 ml (treatment) and two treatments of time separation (15 vs 30 minutes). The percentages of motility, live and dead and TAU of separated sperm were better in upper fraction compare to the lower fraction in both of the control group and the treatment group. The sperm motility in control group was 74.0 - 75.6% and 62.5 - 63.9% for upper fraction and lower fraction respectively. Compare to the treatment group were 70-70% dan 46 – 50% % for upper fraction and lower fraction respectively. Sperm concentration had a tendency to be reduced in the lower fraction and treatment group. The results form the control group showed that the ratio of X and Y sperm could be changed from 48%:52% (fresh semen) to 57%: 42.5% (separation time: 15 minutes) and 83.75%:16.25% (separation time: 30 minutes) for the upper fraction. For the lower fraction the ratio of X:Y were 30%:70% (15 minutes) and 26.25%:73.75% (30 minutes). In the other hand, form the treatment group of 30-minute time separation, showed that the ratio of X and Y were 85%:15% (upper fraction) and 21.70%:78.30% (lower fraction). From the results, it can be concluded that the technology of sperm separation column albumin is still effective to separate X and Y sperm chromosomes in semen quality after separation and the sperm X and Y ratio achieved.

Keywords: Bovine, Sexing, Sperm, Albumin column

INTRODUCTION

Effort to increase the efficiency of using Artificial Insemination (AI) in cattle is how to obtain the effectiveness of sperm separation (sexing sperm) technology to separate X and Y sperm chromosomes. Sexing sperm technology can improve livestock production if farmers can get calves sex as desired. Many experiments have been done to control the sex ratio of calves from cows conception. Ericsson and Glass (1982) reported the X and Y sperm separation media using Bovine Serum Albumin (BSA) in human, based on motility differences. X and Y sperm separation by using egg-albumin media has also been reported by some researchers (Saili, 1999). To improve semen quality post-separation using egg-albumin has been reported with adding of isomethyl-xhantine (Sianturi et al., 2003) and cholesterol, gluthation (Sianturi et al., 2007). From many methods of sexing sperm, the most common method is based on the difference in density or motility, but there are still not as expected, where the results of pregnancy rates and the expected calves-sex are still unsatisfactory. Sexing sperm technology with high percentage of sex-matched is by Flow Cytometry, but these tools are very expensive and the concentration of sperm produced is very low, and there are concerns of the damage and gene mutations as a result using laser treatment (Seidel et al., 1997). The purpose of this study, is to examine the effect of modification egg-albumin column/gradient on the effectiveness of sperm sexing in dairy cows.
MATERIALS AND METHODS

Two dairy bulls used as a source of semen. Semen collected using an artificial vagina (AV) two times a week and only good quality semen used for the research. The design of this research was factorial 2x2 with two treatments of length column: 2 ml (control) vs 3 ml (treatment) and two treatments of time separation (15 vs 30 minutes).

Factor 1, Modification of column length
K : Control, 2ml Tris citrat buffer + 30% v/v egg albumin (lower fraction) and 2 ml Tris citrat buffer + 10% v/v egg albumin (upper fraction).
P : Treatment, 3ml Tris citrat buffer + 30% v/v egg albumin (lower fraction) and 3 ml Tris citrat buffer + 10% v/v egg albumin (upper fraction).

Factor 2, Time of separation
T1 : separation time 15 minute
T2 : separation time 30 minute

Semen to be separated diluted two times with diluent appropriate to treatment media, and 1 ml placed on the surface layer of albumin (separation media), then allowed for 15 and 30 minutes for sperm separation process. And took 2 ml from each of the upper and lower fractions, diluted with diluent and centrifuge for 10 minutes at a speed of 2500 rpm. Sediment obtained were diluted with diluent Tris-citrate + 20% v/v egg-yolk, then evaluated and freezed with routinely freezing method of Balitnakh Laboratory of Reproduction.

The parameters observed, percentage of X and Y sperm based on morphometry of sperm wide head, sperm concentration, percentages of motility, live and dead sperm, intact apical ridge (IAR) before and after sperm separation and after frozen of the sexed semen. All data were analyzed statistically followed Steel and Torrie (1993).

RESULT AND DISCUSSION

Quality of fresh semen obtained generally meet the criteria of a good bull semen. Fresh semen, had 1-15 ml volume, creamy white color, viscous consistency, mass movement (+++) and had an average of live sperm lives more than 80% (Toelihere, 1985). The morphometry observation of the fresh semen, showed that the percentage of spermatozoa X and Y approaching 50%: 50% (X: Y: 48%: 52%), this is in accordance with the general state of the composition of spermatozoa X and Y in the fresh semen is 50%: 50%, and after fertilization, the zygote will be 50% male and 50% female (Mc.Donald, 1989).

In Table 1., it shows the percentage sperm motility of separated (sexed) semen from control and treatment group. The result shows that generally better sperm motility in the control group compare to the treatment group, that are: 74.0 to 75.6% and from 62.5 to 63.9% for the upper and lower fractions, respectively. Compared to the treatment column 70-70% and 46-50% for the upper and lower fractions, respectively. In the treatment group, in lower fraction, sperm motility is fairly low, 46% - 50%, where with this low motility are not good to be frozen. It maybe because the sperm trying to pierce the longer of fraction column, that was 3 ml of sexing media (equivalent to approximately 3-cm height column) and more concentrated with high viscosity solution. Surely, it will drain energy and motility of sperm will be greatly decreased because the sperm have to penetrate a longer column of separation media consisting of two layers/columns with a high viscosity of 10% and 30% egg albumin.
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October 20-22, 2015, Yogyakarta, Indonesia

Table 1. The effect of modified length albumin column and time of separation on the percentage of sperm motility (%M)

<table>
<thead>
<tr>
<th>Column Treatment</th>
<th>Separation Time</th>
<th>Upper Fraction</th>
<th>Lower Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (2 ml)</td>
<td>15 minutes</td>
<td>74.0 ± 5.5</td>
<td>62.5 ± 2.7</td>
</tr>
<tr>
<td></td>
<td>30 minutes</td>
<td>75.6 ± 5.3</td>
<td>63.9 ± 7.0</td>
</tr>
<tr>
<td>Treatment (3 ml)</td>
<td>15 minutes</td>
<td>70.0 ± 10.0</td>
<td>46.0 ± 8.9</td>
</tr>
<tr>
<td></td>
<td>30 minutes</td>
<td>70.0 ± 7.1</td>
<td>50.0 ± 13.1</td>
</tr>
</tbody>
</table>

Equivalent to sperm motility, the percentage of live sperm (% LD) in the lower fraction of the treatment group also decreased by 63.4% and 77.4% for the time of the separation of 15 minutes and 30 minutes respectively (Table 2.). As for the upper fraction of the treatment group, % LD still about 83-84%. From the results of Tables 1 and 2, it can be said that although sperm motility has also declined, but the percentage of live sperm were still higher.

Table 2. The effect of modified length albumin column and time of separation on the percentage live-sperm (%LD)

<table>
<thead>
<tr>
<th>Column Treatment</th>
<th>Separation Time</th>
<th>Upper Fraction</th>
<th>Lower Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (2 ml)</td>
<td>15 minutes</td>
<td>86.6 ± 7.1</td>
<td>81.2 ± 4.1</td>
</tr>
<tr>
<td></td>
<td>30 minutes</td>
<td>85.6 ± 4.9</td>
<td>80.9 ± 5.5</td>
</tr>
<tr>
<td>Treatment (3 ml)</td>
<td>15 minutes</td>
<td>83.0 ± 6.4</td>
<td>63.4 ± 13.9</td>
</tr>
<tr>
<td></td>
<td>30 minutes</td>
<td>84.3 ± 5.6</td>
<td>77.4 ± 7.3</td>
</tr>
</tbody>
</table>

Table 3. shows the percentage of sperm that have intact apical ridge (% IAR). From the table it appears that in general % IAR are still good, ranging from 78-89% and deserves to be frozen. IAR is tendency lower with a longer separation time (30 minutes) for both control and treatment groups.

Table 3. The effect of modified length albumin column and time of separation on the percentage of Intact Apical Ridge (%IAR)

<table>
<thead>
<tr>
<th>Column Treatment</th>
<th>Separation Time</th>
<th>Upper Fraction</th>
<th>Lower Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (2 ml)</td>
<td>15 minutes</td>
<td>87.2 ± 2.6</td>
<td>83.8 ± 4.7</td>
</tr>
<tr>
<td></td>
<td>30 minutes</td>
<td>77.7 ± 13.2</td>
<td>79.4 ± 10.4</td>
</tr>
<tr>
<td>Treatment (3 ml)</td>
<td>15 minutes</td>
<td>89.0 ± 8.7</td>
<td>85.8 ± 5.6</td>
</tr>
<tr>
<td></td>
<td>30 minutes</td>
<td>80.3 ± 8.5</td>
<td>79.6 ± 11.6</td>
</tr>
</tbody>
</table>

This is certainly acceptable, with a longer time, the majority of spermatozoa trying to penetrate more viscous liquids media damaged the sperm acrosome/apical.

Table 4 describes the effect of column modification and duration time of separation to the concentration of spermatozoa. The sperm concentration in the control group and upper fraction were 186.3 and 198.6 million spermatozoa/ml for separation time 15 and 30 minutes respectively. For the bottom fraction were 23.8 and 92.5 million spermatozoa/ml for 15 and 30 minutes. As for the middle fraction (not in Table), the concentration of spermatozoa is still quite high at 187.5 and 155.0 million spermatozoa / ml.

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Tabel 4. The effect of modified length albumin column and time of separation on the sperm concentration

<table>
<thead>
<tr>
<th>Column Treatment</th>
<th>Separation Time</th>
<th>Upper Fraction (x 10^6 sperm/ml)</th>
<th>Lower Fraction (x 10^6 sperm/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (2 ml)</td>
<td>15 minutes</td>
<td>186.3 + 44.2</td>
<td>23.8 + 6.3</td>
</tr>
<tr>
<td></td>
<td>30 minutes</td>
<td>198.6 + 76.9</td>
<td>92.5 + 50.1</td>
</tr>
<tr>
<td>Treatment (3 ml)</td>
<td>15 minutes</td>
<td>136.0 + 32.7</td>
<td>12.5 + 2.9</td>
</tr>
<tr>
<td></td>
<td>30 minutes</td>
<td>177.0 + 49.7</td>
<td>87.0 + 23.9</td>
</tr>
</tbody>
</table>

From these results, the concentration of sperm yields for lower fractions was very low, 23.8 million sperm/ml for 15 minutes. This concentration is too low and would be difficult to further processing, to be frozen or to be chilled (chilled semen). The smaller sperm concentration obtained, is likely the greater Y sperm purity filtered.

The data in Table 5, albumin column separation techniques can change the ratio of X: Y of 48: 52% (fresh semen) to 57.5: 42.5% (the separation time 15 minutes) and 83.75: 16.25% (the separation time 30 minutes) for upper fraction and control group. From this comparison, 15 minutes of separation time was not enough to separate the X and Y sperm, but after 30 minutes, it was a tendency to increase the percentage of X sperm. In contrast, for the lower fraction of control group, changed the ratio of X and Y to 30: 70% (15 min) and 26.25: 73.75% (30 min).

Tabel 5. The effect of modified length albumin column and time of separation on the ratio of X and Y sperm (%)

<table>
<thead>
<tr>
<th>Perlakuan kolom</th>
<th>Upper Fraction</th>
<th>Lower Fraction</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X-sperm</td>
<td>Y-sperm</td>
<td>X-sperm</td>
<td>Y-sperm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control (2 ml)</td>
<td>15 minutes</td>
<td>57.50</td>
<td>42.50</td>
<td>30.00</td>
<td>70.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30 minutes</td>
<td>83.75</td>
<td>16.25</td>
<td>26.25</td>
<td>73.75</td>
<td></td>
</tr>
<tr>
<td>Treatment (3 ml)</td>
<td>15 minutes</td>
<td>62.50</td>
<td>37.50</td>
<td>42.50</td>
<td>57.50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30 minutes</td>
<td>85.00</td>
<td>15.00</td>
<td>21.70</td>
<td>78.30</td>
<td></td>
</tr>
</tbody>
</table>

Whereas in the treatment group, for 15-minutes separation time, obtained X and Y proportion of 62.50: 37.5% (upper fraction) and 42.5: 57.50% (lower fraction). For 30-minutes, the ratio of X and Y percentage were 85: 15% for upper fraction and 21.70: 78.30% for the lower fraction.

In general, the results showed that the 15-min separation time is not enough to obtain optimal results, especially in the upper fraction, because it is still a small portion of Y sperm that swim down to the lower fraction. After the 30 minutes of time separation, then the results of the X-sperm percentage ratio has further improved, ie. 83.75% and 85% respectively for the control and treatment groups, because most of Y-sperm already swim down through the lower-fractions.

From all of research results, sexing sperm technology using egg albumin columns is still effective to separate X and Y sperm, in terms of quality and ratio of X and Y sperm obtained. The sexed sperm concentration in this study is still inadequate to be processed further or to be frozen. This is possibility caused by several factors, beside as sexing sperm techniques, separation media and separation time which is still not optimum and of course, the quality of fresh semen also affect the results of this study.
CONCLUSION

1. The time separation of 15-minutes is not adequate to get the ratio of X and Y sperm as expected.
2. The separation of sperm using albumin column, in the control group may alter the ratio of X: Y of 48: 52% (fresh semen) to 83.75: 16.25% for the upper fraction and 30-minutes of separation time, while for the lower fraction to 26, 25: 73.75%.
3. In the treatment group, 30-minutes of time separation, the gain of percentage ratio of X and Y sperm was 85:15% for upper fraction and 22:78% for lower fraction.
4. Sexing sperm technology using egg native-chicken albumin is still effective to separate X and Y dairy bull sperm, both in sperm quality after separation and the sperm X and Y ratio achieved, but sexed sperm concentration produced from lower fraction is still inadequate.

REFERENCES


ABSTRACT: The aim of the present study was to determine the effect of incubation time in TALP medium on the detailed motility and velocity of spermatozoa characteristics. Four rams (R9, R12, R13, R16) of proven fertility were used in this study. Semen was collected by electroejaculation. Rams semen was collected with 4 replicates, respectively to analyzed the motility and velocity characteristics by using the computer-aided semen analysis (CASA). Data were analyzed using SPSS software program. The results showed that percentage of motile, progressive and rapid were significantly decreased from 0 to 120 minutes incubation. In contrast, percentage of static was significantly increased from 21.6% to 71.3% at 0 to 120 minutes incubation. Ram 12 had the best motile with 76.3% at 0 minute incubation and 40.3% at 120 minutes incubation. Average path velocity (VAP), progressive velocity (VSL) and track speed (VCL) at 0 incubation were 91.2 µm/s, 72.2 µm/s and 134 µm/s afterward decreased to 49 µm/s, 40.8 um/s and 77.7 µm/s at 120 minutes incubation, respectively. In conclusion, rams and incubation time were influenced the motility and velocity of spermatozoa.

Keywords: Motility, Velocity, Rams Spermatozoa.

INTRODUCTION

Motility and longevity of sperm are an important factor for sperm to reach the oviducts for fertilization. In a recent study, subjective motility of sperm was investigated in a number of species. Progressive motility appears essential for the passage between the processes and folds of the utero-tubal junction before ovulation. Recent studies by using computer-aided semen analysis (CASA) to define motility characteristics in a number of species including goats (Batista et al., 2002), sheep (Bag et al., 2002), and camels (Al-Qarawi et al., 2002)

Traditionally, motility of spermatozoa has been assessed by visual estimation using a microscope. The element of subjectivity and its attendant drawbacks of human error and bias, is introduced when using this approach. Realizing this disadvantage, attention has been given in recent years to objective methods of evaluating sperm motility by using photomicrography, videomicrography, and automatic motility analyzer The aim of the present study was to determine the effects of incubation time in TALP medium on the detailed motility and velocity spermatozoa characteristics, analyzed using CASA.

MATERIAL AND METHODS

Animal

Four rams (R9, R12, R13, R16) of proven fertility were used in this study. Semen was collected by electroejaculation using standard procedures (Ismaya, 2014). Rams semen was collected with 4 replicates, to analyzed the detailed motility and longevity.

Media

In this study, modifications of sperm-TALP (Tyrode’s-albumin-lactate-pyruvate) medium was used for sperm culture (Ismaya, 2003) consisted of 100 mM NaCl, 3.1 mM KCl, 2 mM CaCl$_2$, 0.4 mM MgCl$_2$, 25 mM NaHCO$_3$, 21.6 mM L-Lactic acid, 10 mM HEPES, 1 mM Sodium pyruvate, and bovine serum albumin (BSA fraction-5) 6 mg/ml was prepared to dilution of semen at 39°C.
Semen handling and semen dilution

Semen was collected into 15 ml sterile a plastic centrifuge tube (Rohre/tube, Sarstedt, Germany) and a placed into polystrylene box warmed to 39°C by bottles of warm water. The study was conducted on semen from four rams and was repeated three times. The interval time between collection of semen and first analysis of spermatozoa in CASA was about 5 minutes.

Motility, velocity and sperm head analysis

Fifty micro litter of fresh semen from each semen sample was diluted in small tube to 600 ul in TALP medium. The study was conducted on semen from four rams and repeated three times. Sperm motility, velocity and morphology characteristics analysis was performed using computer-aided semen analysis (CASA) system (Hamilton Thorne Research version 10, Beverly MA, USA). Briefly, a 2 µl aliquot of sample was placed in the micro cell chamber, 20 micron (La Jolla CA, USA). At least 200 spermatozoa were counted with CASA to evaluate the sperm motility and velocity. Sperm motility and velocity variables including: percentage of motile, progressive, rapid sperm and average path velocity (VAP), straight-line velocity (VSL).

Statistical analysis

Data were analyzed using SPSS software program (SPSS 11.0 Brief Guide, New Jersey). Data effect of incubation time on motility and velocity were analyzed using analysis of variance one way classification, and the level of significance was considered P≤ 0.05. The differences between means was tested by least significant difference test (LSD).

RESULTS AND DISCUSSION

Detailed motility and velocity of ram spermatozoa in TALP medium

Detailed percentage of motile, progressive and rapid at 0 incubation were 78.4%, 54.5% and 64.1% (Figure 1), whereas at 120 minutes incubation the percentage of motile, progressive and rapid were 29%, 12.5% and 15.4%, respectively. The results showed that percentage of motile, progressive and rapid were significantly decreased from 0 to 120 minutes incubation. In contrast, percentage of static was significantly increased from 21.6% to 71.3% at 0 to 120 minutes incubation. Percentage of motile and rapid at 0 and 30 minutes incubation were not significantly different, contrary percentage of progressive at 0 and 30 minutes incubation were statistically different (P≤ 0.05). Incubation time was influenced the rapid of sperm, average rapid of sperm decreased from 64.1% to 15.4% at 0 to 120 minutes incubation.

At 120 minutes incubation VCL rate of 0 to 20 µm/s was highest contrary with VCL rate at more than 180 µm/s the highest percentage of VCL was at 0 incubation. The VCL of sperm varied between 0 to 180 µm/s and influenced by incubation time.

Ram 13 had VAP of 101 µm/s, ram 9 (95.1µm/s), ram 12 (88 µm/s) and ram 16 (80.6 µm/s) at 0 minute incubation afterward decreased to 45.4 µm/s, 42 µm/s, 57.4 µm/s and 51 µm/s at 120 minutes incubation, respectively. At 0 minute incubation ram 13 and ram 9 had VSL of 92.9 µm/s and 80.5 µm/s respectively, whereas ram 12 and ram16 had lower, there was 60.9 µm/s and 55.1 µm/s, respectively. At 0 minute of incubation ram 9, 12, 13 and 16 had VCL of 149 µm/s, 142 µm/s, 136 µm/s and 109 µm/s respectively afterward decreased to 65.4 µm/s, 87.4 µm/s, 74.1 µm/s and 84 µm/s at 120 minutes of incubation, respectively.

Some factors that influenced of sperm motility in vitro were quality of semen, media of semen, pH of medium, temperature, and morphology of sperm (Ismaya, 2014). In this study showed that rams and incubation time influenced the motility and longevity of spermatozoa in diluted semen at 39°C.
ACKNOWLEDGMENTS

The author would like to thank Prof. Phillip Summers of the James Cook University Australia for support, comments and providing the facilities. This work was financed by World Bank.

REFERENCES

Figure 2  Effect of incubation in TALP medium at 39 °C on the average path velocity (Figure A), straight-line velocity (Figure B) and curvilinear velocity (Figure C) of spermatozoa from rams (R13, R12, R16, R9) (mean ± SEM). Different letters above bars indicate significant differences ($P \leq 0.05$) within each incubation time.
Figure 1

Effect of incubation in TALP medium at 39 °C on the percentage of motile (Figure A), progressively motile (Figure B) and rapidly motile (Figure C) spermatozoa from rams (R13, R12, R16, R9) (mean ± SEM). Different letters above bars indicate significant differences ($P \leq 0.05$) within each incubation time.
The Effect of Trehalose Level in Tris-Based Medium on Sperm Membrane Integrity of Boer Goat Semen after Cooling

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ABSTRACT: This study was conducted to evaluate the effect of trehalose level in tris-based medium on sperm membrane integrity of Boer goat semen after cooling. Semen was collected from 6 bucks using artificial vagina. Fresh semen evaluated for colour, pH, volume, concentration, mass motility, individual motility, life sperm, sperm abnormality and sperm membrane integrity. Semen was diluted with tris-based medium supplemented with different level of trehalose (1.5; 2.5 and 3.5%) with the ratio of 1 semen : 9 diluter. Sampling was conducted as purposive sampling, i.e. semen used should has mass motility of 2+ and individual motility of 70%. Immediately after dilution semen was stored in 3-5°C and sperm membrane integrity percentage was observed at 0, 24 and 48 h. The obtained data were analyze with Analysis of Variance (ANOVA) and continued by Least Significant Different if there was significant or very significant difference between groups. The experiment was designed using completely random design (3 treatments and 10 replications). The results showed that the level of trehalose (1.5, 2.5 and 3.5% had very significant effect (P<0.01) on sperm membrane integrity percentage in 0 h of cooling (65.99; 64.67 and 57.46% respectively), 24 h of cooling (56.58; 55.89 and 48.80% respectively); 48 h of cooling (47.49; 48.75 and 39.38% respectively). It was concluded, that the trehalose levels for resulting in optimal sperm membrane integrity were 1.5%. It was suggested, that for resulting in optimal sperm membrane integrity after cooling of Boer goat semen in tris-based medium should be supplemented with 1.5% trehalose.

Key words: Boer goat semen, cooling, trehalose, sperm membrane integrity

INTRODUCTION

Sperm membrane integrity is an important indicator for characterization of sperm quality after processing. During dilution and cooling, sperm membrane integrity reduce corresponding to appropriate processing technique and cryoprotectant used. Disaccharides have a stabilizing effect on biological membrane. Trehalose, a disaccharide of glucose can be viewed as naturally occurring stabilizing agents. Trehalose is found in animals capable of enduring cold temperatures (Sum et al., 2003). This study was conducted to evaluate the effect of trehalose level in tris-based medium on sperm membrane integrity of Boer goat semen after cooling.

MATERIALS AND METHODS

Semen was collected from 6 male mature (2.0 - 2.5 y) with about 100 kg in weight, using artificial vagina (Evans and Maxwell, 1987). The bucks were maintained at Field Laboratory of the Faculty of Animal Husbandry Sumber Sekar, Brawijaya University Malang. After collection, fresh semen was evaluated macroscopically (colour, pH, volume) and microscopically (concentration, mass motility, individual motility, life sperm, abnormal sperm and membrane integrity of sperm). Sampling was conducted as purposive sampling. Only semen with mass motility minimal 2+ and individual motility of sperm more than 70% was used for research material. Semen collection was regularly conducted twice a week per individu of animal.

The selected semen was diluted with tris-based medium supplemented with different level of trehalose (1.5; 2.5 and 3.5%) with the ratio of 1 semen : 9 diluter. Immediately after
dilution semen was stored in the refrigerator (3-5ºC) and sperm membrane integrity was observed at 0, 24 and 48 h after cooling (Neild, et al., 1999). The obtained data were analyze with Analysis of Variance (ANOVA) and continued by Least Significant Different if there was significant or very significant difference between groups. The experiment was designed using completely random design (3 treatments and 10 replications).

**RESULTS AND DISCUSSION**

**Characteristics of fresh Boer goat semen**

Table 1. shows that the characteristics of Boer goat semen used in this study was normal.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Creamy</td>
</tr>
<tr>
<td>Ph</td>
<td>7.00 ± 0.0</td>
</tr>
<tr>
<td>Volume (ml)</td>
<td>0.81 ± 0.33</td>
</tr>
<tr>
<td>Concentration (106/ml)</td>
<td>3387 ± 230.32</td>
</tr>
<tr>
<td>Mass motility</td>
<td>2+ - 3+</td>
</tr>
<tr>
<td>Sperm Individual motility (%)</td>
<td>74.50 ± 3.69</td>
</tr>
<tr>
<td>Life sperm (%)</td>
<td>88.03 ± 3.07</td>
</tr>
<tr>
<td>Abnormal sperm (%)</td>
<td>6.87 ± 1.98</td>
</tr>
<tr>
<td>Sperm membrane integrity (%)</td>
<td>72.67 ± 3.66</td>
</tr>
</tbody>
</table>

**Sperm membrane integrity after cooling**

Percentage of sperm membrane integrity of Boer goat semen after cooling diluted with tris-based diluent containing different levels of trehalose is shown in Table 2.

<table>
<thead>
<tr>
<th>Time of cooling (h)</th>
<th>Trehalose levels (%)</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.5</td>
<td>65.99 ± 6.94b</td>
</tr>
<tr>
<td>0</td>
<td>2.5</td>
<td>64.67 ± 4.41b</td>
</tr>
<tr>
<td></td>
<td>3.5</td>
<td>57.46 ± 5.50a</td>
</tr>
<tr>
<td>24</td>
<td>1.5</td>
<td>56.58 ± 4.50b</td>
</tr>
<tr>
<td></td>
<td>2.5</td>
<td>55.89 ± 4.95b</td>
</tr>
<tr>
<td></td>
<td>3.5</td>
<td>48.80 ± 6.74a</td>
</tr>
<tr>
<td>48</td>
<td>1.5</td>
<td>47.49 ± 7.05b</td>
</tr>
<tr>
<td></td>
<td>2.5</td>
<td>48.75 ± 6.57b</td>
</tr>
<tr>
<td></td>
<td>3.5</td>
<td>39.38 ± 9.31a</td>
</tr>
</tbody>
</table>

<sup>a, b</sup> within column highly significant different (P<0.01)
Table 2. shows that the membrane integrity of sperm was highly significant different (P<0.01) after cooling between trehalose treatment groups. In general, it was shown that both 1.5 and 2.5% trehalose in tris-based diluent showed an optimal level for maintaining the sperm membrane integrity after cooling compared to the level of 3.5% trehalose, but 1.5% trehalose is more economic. Trehalose 3.5% maybe too high level for maintaining sperm membrane integrity. The role of trehalose in the protection of sperm during cooling acted by maintaining the membrane integrity of sperm (lipid bilayer) by formation of hydrogen bounds at O2, O3 and O4 of trehalose structure with phosphate and carbonyl groups of lipid the sperm membrane stability could maintained and the sperm damage originated from diluent and temperature shock could be maintained (Sum et.al, 2003).

CONCLUSION

Based on the study, it was concluded that the addition 1.5% trehalose in tris-based medium resulting optimal sperm membrane integrity Boer goat semen after cooling. It was suggested, that for resulting optimal sperm membrane integrity after cooling of Boer goat semen in tris-based medium should be supplemented with 1.5% trehalose.

REFERENCES

The Reproductive Efficiency of Filial Ongole (PO), Limousin and Simmental Crossbred Cows at Situbondo District

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²Student of Animal Husbandry Faculty, Brawijaya University

ABSTRACT: The efficiency of reproduction is very important to be maintained on cows, because they will produce offspring on their lifetime. Cross breeding is a method that usually used to increase the beef cattle population on the farm. Nevertheless it causes the performances of reproduction will reduces in some population. The objective of this research was to evaluate the reproductive efficiency of beef cattle which were raised by the farmer in the source breeding area at Situbondo District. The materials used in this research were 333 cows of Filial Ongole cattles (PO), Limousin and Simmental Crossbred cattle at the third and fourth parity condition which were resulted by artificial insemination (AI) and taken from the AI acceptor record card. The research variable observed was the reproductive performance of PO cows, Limousin cows, and Simmental cows including Conception Rate (CR), Service per conception (S/C), Days open (DO), Calving Interval (CI) and Index Fertility (IF). The data were analyzed by using descriptive analysis and unpair t-test comparison. The results showed the average of CR, S/C, DO, CI and IF at the third parity were 64.28%; 1.42±0.58; 125.28±24.20 of days; 411.06±24.05 days; 45.27 on PO cows; 61.86 %; 1.39±0.51; 114.24±16.31 of days; 399.79±16.51 of days; 55.37 on Limousin cows; 65.04 %; 1.40±0.58; 113.10±19.05 of days; 398.30±18.85 of days; 58.42 on Simmental cows. Meanwhile the average value of CI, S/C, DO, CI and IF at the fourth parity condition were 65.17%; 1.41±0.59; 123.94±21.49 of days; 409.54±22.02 of days; 47.21 for PO cows; 67.79 %; 1.37±0.58, 116.46±16.56 of days; 402.44±21.17 of days; 58.48 for Limousin cows; and 60.19 %; 1.46±0.59; 116.46±16.11 of days; 398.56±16.56 of days; 53.22 for Simmental cows. The value of DO and CI between Simmental cows and Limousin cows did not show any significant difference (p>0.05), meanwhile those value showed the significant difference (p<0.05) on Simmental and Limousin cows with PO cows. It can be concluded that with a good breeding maintenance management, the reproduction on Limousin and Simmental crossbred is more efficient than PO cows.

Keywords: Reproductive efficiency, Artificial Insemination, Conception Rate, Service per conception, and Calving Interval

INTRODUCTION

The national population of beef cattle from the year 2007 is about 11,159,789 million heads, in order to fulfill the needs of higher demand for meat the population of beef cattle is still not sufficient, it can be seen from the number of cattle imported from Australia is about 700 to 800 thousand per year. One of the policies that have been made to overcome this problem is by crossing the local cattle with cattle imports that aims to increase the production of local cattle with having a good adaptability

The presence of crossing policy causes the population of Simmental beef cattle and Limousin (Bos taurus) is increasing and interesting in the society. Both of cattle breed are expected to increase the productivity of livestock because there are combination of the characteristic traits from the two of breed or more. Moreover the heterosis (hybrid vigour) displayed by crosses between of cross breeding from the offspring and the parent will increase the production of the characteristic traits, but not the reproduction (Astuti, 2004).

One of the government's policy to increase the productivity of beef cattle in Indonesia is performed by crossing program. The policy is conducted with crossing the PO cows with...
breed of Limousin and Simental (*Bos taurus*). Crosses with utilize only the heterosis can improve the production characteristics, but not the reproduction. While in Indonesia the reproductive performance are still relatively low due to lack of the farmer knowledge about the problems of reproduction and also many of PO cows is crossed with Limousin and Simental that maintained in the society. Based on the facts above came the idea that the presence of crossing will causes the joined traits between two crossed breed, especially the traits of production and adaptability which will affects the reproductive efficiency, so that need the evaluation of the reproductive efficiency of the various beef cattle breeds. Therefore, this study is expected to provide an overview the reproductive efficiency on PO cows, Limousin and Simental crossbred in sub district Panji and Kapongan of Situbondo district.

**MATERIALS AND METHODS**

Research was conducted in sub district Panji and Kapongan of Situbondo district. Materials used in this research were 112 heads of filial ongole (PO) cows, 118 heads of Limousin crossbred cows and 113 heads of Simental crossbred cows at the third and fourth parity condition which were resulted by artificial insemination (AI) and has a record reproduction such as AI card acceptor.

**Research Methods**

The method used in this research was case study method. The data were taken from primary and secondary data. Primary data were obtained from interviews to farmers and inseminator by using questionnaires directly, while the secondary data were obtained by taking the data from the recording of reproduction (AI card acceptor) Department of Animal Husbandry Regional Level II.

**Research Variables**

The research variables observed were the reproductive performans of PO cows, Limousin and Simental crossbred cows including Conception Rate (CR), Service per Conception (S/C), Days Open (DO), and Calving Interval (CI).

**Data Analysis**

The data obtained were tabulated and analyzed descriptively. The fertility index (FI) was calculated according to Brand de Kruiif (1975), quoted by Matheij (1982) by the formula:

\[
FI = \frac{\% \text{ of pregnancy after first AI} - (DO - 125)}{\text{The number of insemination per conception}} \\
= \frac{\text{CR} - (DO - 125)}{S/C}
\]

The number of CR, S/C, DO and CI were valculated by the formula below:

\[
\text{CR} = \frac{\text{The number of pregnant cows at the first AI}}{\text{The number of all cows inseminated}} \times 100\% \\
\text{S/C} = \frac{\text{The number of cows inseminated until pregnant}}{\text{The number of pregnant cows}} \\
\text{DO} = \text{the interval between partus or the period between partus until pregnancy (when the next estrous cycle after breeding the estrous did not appear, then the cows was declared as a pregnant cow)} \\
\text{CI} = \text{the period between partus and the next partus or previous}
\]
RESULTS AND DISCUSSION

Service per Conception (S/C) of PO cows, Limousin dan Simmental crossbred cows
S/C is the amount of insemination needed by cows to causes the pregnancy (Gebeyehu, Asmarew, and Asseged, 2000). The average value of the S/C were shown in Table 1.

Table 1. The mean value of S/C of PO, Limousin and Simmental crossbred cows

<table>
<thead>
<tr>
<th>No</th>
<th>Breed</th>
<th>N</th>
<th>P 3</th>
<th>P 4</th>
<th>Mean±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PO</td>
<td>112</td>
<td>1.42±0.58</td>
<td>1.41±0.59</td>
<td>1.42±0.01</td>
</tr>
<tr>
<td>2</td>
<td>Limousin crossbred</td>
<td>118</td>
<td>1.39±0.51</td>
<td>1.37±0.58</td>
<td>1.38±0.01</td>
</tr>
<tr>
<td>3</td>
<td>Simmental crossbred</td>
<td>103</td>
<td>1.40±0.58</td>
<td>1.46±0.59</td>
<td>1.43±0.04</td>
</tr>
<tr>
<td></td>
<td>Mean±SD</td>
<td></td>
<td>1.40±0.01</td>
<td>1.41±0.03</td>
<td>1.41±0.03</td>
</tr>
</tbody>
</table>

Note: P3 = third parity  
P4 = fourth parity

Table 1 showed the value of the S/C in the category of ideal, this because the cows were showed the visible signs of estrous when inseminated. According to Gebeyehu et al. (2000) reveals that the range of the S/C value normally is ranges between 1.62, then it will have a range of DO about 60 to 90 days to keep the CI in about 365of days. According to corah and Lusby (2007) the calves weaning should be at the age of 90 days. Astuti (2004); Aryogi, Arasyd, and Mariono (2006) mention that the value of S/C from the smallest to the biggest is about 2.9 and 2.23 in PO cows respectively. Limousin and Simental crossbred cows in Indonesia had almost the same value of S/C with the PO cows, because Limousin and Simental crossbred cows was the resulted of crossbreeding with PO cows that has been adapted to the environmental conditions in Indonesia.

Conception Rate (CR) of PO cows, Limousin and Simmental crossbred cows

Table 2 showed the average value of CR amounted to 63.72% at the third parity and 64.38% at the fourth parity. The CR value was within the normal ranges when compared to Touchberry opinion (2003) that the CR value is 60% to maintain the calving interval remains of 365 days. Therefore, it was suggested to keep the DO average time of 90 days. Although the value of CR in the observation was still in the normal category, but the CI value was long namely more than 365 days.

Table 2. the mean value of CR of PO cows, Limousin and simmental crossbred cows

<table>
<thead>
<tr>
<th>No</th>
<th>Breed</th>
<th>N</th>
<th>P3 (%)</th>
<th>P4 (%)</th>
<th>Mean (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PO</td>
<td>112</td>
<td>64.28</td>
<td>65.17</td>
<td>64.37</td>
</tr>
<tr>
<td>2</td>
<td>Limousin crossbred</td>
<td>118</td>
<td>61.86</td>
<td>67.79</td>
<td>64.83</td>
</tr>
<tr>
<td>3</td>
<td>Simmental crossbred</td>
<td>103</td>
<td>65.04</td>
<td>60.19</td>
<td>62.62</td>
</tr>
<tr>
<td></td>
<td>Mean (%)</td>
<td></td>
<td>63.73</td>
<td>64.38</td>
<td>64.06</td>
</tr>
</tbody>
</table>

Note: P3 = third parity  
P4 = fourth parity

The best CR value at fourth parity was found 67.79% on Simmental crossbred cows, while at the third parity 3 the best CR value was 65.04% on PO cows. It was described that Simental crossbred cows at fourth parity and PO cows at third parity has a good characteristics of estrous signs which can be seen from the card acceptor, thus the farmer can detected the estrous cows easily. According to Bormann, Totir, Kachman (2006) the capabilities of cows for pregnant cows at the first insemination were strongly depended on the environmental variation. Moreover, feed
nutrients received by cows before and after birth also affected the CR value, because the deficiency of nutrients before partus causes the delayed estrous cycle.

**Days Open (DO) of PO cows, Limousin and Simmental crossbred cows.**

The average value of the DO were 117.54 ± 6.72 days at third parity and 118.95 ± 4.31 days at fourth parity. This value showed that DO long in the research location was still not efficient, because according to Smith (2002), the average time of partus to pregnant on cows is about 60-90 days. More DO long showed the reproductive efficiency was low and it would not be profitable to farmer. DO is an indicator of the reproductive efficiency of livestock. Inefficient DO at research location was caused by cows insemination at the third or fourth estrous. The average value and the unpaired t-test resulted of DO can be seen in Table 3.

**Table 3.** The mean values of DO of PO cows, Limousin and Simmental crossbred cows

<table>
<thead>
<tr>
<th>No</th>
<th>Breeds</th>
<th>amount (n)</th>
<th>Parity 3</th>
<th>Parity 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PO cows</td>
<td>112</td>
<td>125.28±24.20a</td>
<td>123.94±21.49a</td>
</tr>
<tr>
<td>2</td>
<td>Limousin crossbred</td>
<td>118</td>
<td>114.24±16.31b</td>
<td>116.46±20.54b</td>
</tr>
<tr>
<td>3</td>
<td>Simmental crossbred</td>
<td>103</td>
<td>113.10±19.05b</td>
<td>112.77±16.11b</td>
</tr>
<tr>
<td></td>
<td>Mean±SD</td>
<td></td>
<td>117.54±6.72</td>
<td>118.95±4.31</td>
</tr>
</tbody>
</table>

Note: the superscripts (a,b) on the same column showed the significant differences (P<0.05).

DO value of Limousin and Simmental crossbred were shorter than PO cows. This data showed that breed of Bos taurus and bos indicus cattle have a different DO value. *Bos taurus* cattle in the studied area was derived from PO cows which were inseminated with straw of Limousin and Simental cattle. It causes the Limousin and Simmental crossbred cows can adapt well in the studied location. Based on opinion of Astuti (2004) heterosis and environmental interactions are very important, therefore the crossess of certain breeds that suitable in one environment is not necessarily suited to other environments. Jordan (2003) mention that heat stress on the environment will affect the estrous, so that will affect both the DO and CI. DO value on Limousin and Simmental crossbred cows were better than the PO cows, it proved that the estrous signs on Limousin and Simmental crossbred were good so the farmers could detect estrous easily Hafez (2000) reveals that DO can be minimized by thus increasing the efficiency of estrus detection, by mating cows between 55-85 days after partus. Some estrous cows can be detected by observing for two times a week and by using the tools of detection and periodiks table.

**Calving Interval (CI) of PO cows, Limousin and Simmental crossbred cows**

The average of CI value were more than one year which were not efficient. This happened because the interval of partus until conception back was too long. According to Winugroho (2002) longer calving interval is the problem of inefficiency productivity of beef cattle in Indonesia.

**Table 4.** The mean values of CI of PO cows, Limousin and Simmental crossbred cows

<table>
<thead>
<tr>
<th>No</th>
<th>Breeds</th>
<th>N</th>
<th>Third parity</th>
<th>Fourth parity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PO cows</td>
<td>112</td>
<td>411.06±24.05a</td>
<td>409.54±22.02a</td>
</tr>
<tr>
<td>2</td>
<td>Limousin crossbred</td>
<td>118</td>
<td>399.79±16.51b</td>
<td>402.44±21.17b</td>
</tr>
<tr>
<td>3</td>
<td>Simmental crossbred</td>
<td>103</td>
<td>398.30±18.85b</td>
<td>398.56±16.56b</td>
</tr>
<tr>
<td></td>
<td>Mean±SD</td>
<td></td>
<td>403.04±6.97</td>
<td>403.49±5.60</td>
</tr>
</tbody>
</table>

Note: the superscripts (a,b) on the same column showed the significant differences (P<0.05).

The Limousin and Simmental crossbred cows has a shorter CI than PO cows. This because
the farmer were waited the body of cows return to normal before mated, meanwhile the Limousin and Simmental crossbred cows were faster in the recovery of the body after partus compared to PO cows with a good feeding management. With the rapid recovery of the body after partus, the DO long will become shorter thus also affect the CI. According to Smith (2002) reveals that the average of Days Open is the overall indicator of an efficient reproductive status. If the DO value is 60-90 days, the CI value can be achieved in under 365 days.

**Fertility index of PO cows, Limousin and Simmental crossbred cows**

Based on Table 5 it can be seen that the fertility of Simmental crossbred cows were better than the Limousin crossbred cows and PO cows at the third parity, while at the fourth parity, the Limousin crossbred cows have a better fertility compared to Simmental crossbred and PO cows. The value of the highest fertility was still lower than the status value of normal fertility. Mattheij (1982) reveals that the status value of normal fertility is 60. The difference fertility status value of those breeds cattle were caused by the varians of S/C, CR and DO value.

**Table 5. The mean of fertility index of PO cows, Limousin and Simmental crossbred cows**

<table>
<thead>
<tr>
<th>No</th>
<th>Breed</th>
<th>N</th>
<th>P3</th>
<th>P4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PO cows</td>
<td>112</td>
<td>45.27</td>
<td>47.21</td>
</tr>
<tr>
<td>2</td>
<td>Limousin crossbred</td>
<td>118</td>
<td>55.37</td>
<td>58.48</td>
</tr>
<tr>
<td>3</td>
<td>Simmental crossbred</td>
<td>103</td>
<td>58.42</td>
<td>53.22</td>
</tr>
<tr>
<td></td>
<td>Mean±SD</td>
<td></td>
<td>53.02±6.88</td>
<td>52.97±5.63</td>
</tr>
</tbody>
</table>

Note:  
P3 = third parity  
P4 = fourth parity

The fertility value on PO cows, Limousin and Simmental crossbred cow were lower than normal rate (60). Meanwhile the value of S/C and CR in the study location were in the ideal category. The low of fertility value showed that the management of cows reproduction on the research location was not efficient.

**CONCLUSIONS AND SUGGESTIONS**

**Conclusion**

In the research location, Limousin and Simental crossbred cows have more efficient reproduction than PO cows.

**Suggestion**

1. in maintenance of Limousin and Simental crossbred cows, the farmers suggested to improve the feed quality when the cows are 8 months pregnant until the calves stop nursing to speed up the recovery of the body after partus, because the both types of cows are less adaptive to feed poor.
2. in order to shorted the CI time, the farmers are advised to mated the cows during the second estrous and do not wait the calfs weaned in advances.

**REFERENCES**


Reproductive Performances of Ongole Crossbred Cattle Using Artificial Insemination Sexed Semen with Different Methods

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ABSTRACT: Artificial Insemination (AI) clearly shows to improve the genetic quality of cattle which can be applied on cattle breeding farm. Sexing spermatozoa is a method that provides more value, because it may produce sex of calf as expected. There are several methods of sexing sperm that can be frozen and has been generated including frozen sexed semen using White Yolk Sedimentation and frozen sexed semen using Percoll Gradient Centrifugation. The purpose of this research was to determine the success of AI with frozen sexed semen based on non return rate (NRR), service per conception (S/C), conception rate (CR), and percentage of pregnancy. In this study, the total number of 81 acceptors was divided into 3 treatment groups, such as non sexed semen (T0); Frozen sexed semen using White Yolk Sedimentation (T1), and Frozen sexed semen using Percoll Gradient Centrifugation (T2). The results showed the differences of NRR percentage on those treatments, which were T0, had 74.07\( \pm \)12.00\% of NRR; T1 had 65.43\( \pm \)5.66\% of NRR and T2 had 64.19\( \pm \)8.56\% of NRR respectively. The highest percentage of pregnancy was 59.25\% at T0, followed by 51.85\% at T1 and the lowest percentage of pregnancy was 44.44\% at T2. The service per conception was found 2.31 at T0 followed by 3.00 at T2 and 3.33 at T1. Furthermore the highest of conception rate was found 44\% at T0, continued with 25.91\% at T2 and 18.51\% at T1. The study concludes that the AI with frozen sexed semen remains able to give good performances of reproduction on Ongole crossbred cattle. This study suggests that the quality of frozen sexed semen should be increased to have better reproductive performances on Ongole crossbred cattle.

Key words: sexing, artificial insemination, White Yolk Sedimentation method, Percoll Gradient Centrifugation method.

INTRODUCTION

Artificial insemination using sperm sexing provide benefits to the livestock industry, among others, required for beef cattle industry with the male sex, For Fattening. There are various methods of sexing spermatozoa has been found including the sedimentation method using albumin column and density gradient centrifugation percoll (Hafez and Hafez, 2008) Sexing method easily applied is egg white sedimentation and Percoll density gradient centrifugation method (SGDP) because after having been frozen more than 30\% motility and proportion have spermatozoa Y>80\% (Susilawati, 2014). Research results Susilawati (20015) show by using sperm without sexing, It produced 50\% male calves, whereas Artificial Insemination using Sperm sexing (percoll density gradient centrifugation) resulting of 75\% male calf. It is necessary to research on the application of frozen semen sexing, using egg white sedimentation and density gradient centrifugation percoll on the folk husbandry to the success of pregnancy.
 MATERIALS AND METHODS  

Research conducted on a farm owned by the people, using 81 head of beef cattle adult females, between the ages of 1.5 to 5 years and Normal Fisiology. The method used in this research is the Experimental. Cows in AI is 81 Head consisting of, T1 = 27 Head Cows are in AI using frozen semen sexing spermatozoa containing chromosome Y with methods Sedimentation egg whites. T2 = 27 Head cows in AI using semen sexing spermatozoa containing chromosome Y with methods Percoll density gradient centrifugation and T0 = 27 Head in AI using frozen semen non sexing (control). AI method on the recto vaginal 4+ position (deep insemination) (Susilawati, 2011). Pregnancy examinations done two ways: method Non Return Rate (NRR), NRR 1 (18-21 days), NRR 2 (38-41 days) and NRR 3 (58-61 days) and Rectal palpation performed 60 days after AI.  
1. Non Return Rate (NRR) include NRR 1, NRR 2 dan NRR3  
NRR values obtained by observing estrus on days 21, 42 and 63 after the AI. If it does not show signs of estrus in the day then assumed pregnant cattle Susilawati (2011a) and (Susilawati, 2013)  
2. Service per Conception  
Value of the S / C is obtained by counting the number of AI services provided in the acceptor to occur gestation, the formula S / C is as follows:  
\[ S/C = \frac{(\text{Total insemination until a pregnancy})}{(\text{The number of cows that at AI})} \]  
Janes and Stewart (1992 ) and Susilawati (2013)  
3. Conception Rate  
CR value is obtained by calculating a successful cattle AI pregnant at first, with the following formula  
\[ CR = \frac{\text{the number of pregnant females \_ the first AI results}}{\text{the total number of females were inseminated}} \times 100\% \]  
Jainudeen and Hafez, 2008) and Susilawati (2013)  
4. Rectal Examination is the accepted method of pregnancy diagnosis in Cow. In this procedure, the uterus is palpated throught the rectal will to detect the uterine enlargement occuring during pregnancy and the fetus or fetal membrane (Jaenudeen and Hafez, 2008)  

Data Analysis  
Collection of data from the field, were analyzed descriptively, followed by statistical analysis. Statistical design of experiments to test the NRR using nested, While the statistical design to test the S / C, CR, using the test one way classification Further test used is the Least Significance Difference (LSD)  

RESULTS AND DISCUSSION  
Post Thawing Motility (PTM) of frozen semen sexing lower than non frozen semen sexing at table 1
The quality of sperm sexing resulting lower than the results of previous studies conducted by Susilawati (2005) that is the percentage of sperm motility after sexing using density gradient centrifugation percoll is 55% after freezing and thawing in population of spermatozoa X to 35%, whereas the population of spermatozoa Y 40% It is because of this research printing process (filling and chilling) not good, so that liquid nitrogen can enter into the straw. in the opinion Ervandi et al., 2013 dan Purwoistri et al., 2013 Spermatozoa sexing using egg white sedimentation decreased motility due to the increase of spermatozoa with low membrane integrity and spermatozoa undergo the acrosome reaction. The quality of frozen sperm sexing is strongly influenced by handling during the process of sexing and freezing, so that sperm sexing his post thawing Motility lower than in controls, this is because it is based Susilawati (2014) that spermatozoa sexing by using centrifugation damaged membranes, resulting in a decrease in sperm quality. Frozen sperm sexing AI used in this study was lower than previous research. Decrease in the quality of the frozen sperm sexing lab caused the plug on less dense straw. This resulted in liquid N2 can enter into the straw and damaged spermatozoa. low sperm motility can be used to AI, based on the research Susilawati (2011b) AI using frozen sperm motility percentage between 5-20% can be used to AI

Diagnosis results Gestation between observation methods NRR with Rectal palpation method

The results showed there are differences between NRR pregnancy diagnosis by rectal palpation method at table 2

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Gestation examination</th>
<th>Rectal palpation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cow (Head)</td>
<td>NRR last observation</td>
<td>Rectal palpation</td>
</tr>
<tr>
<td></td>
<td>pregnant</td>
<td>not pregnant</td>
</tr>
<tr>
<td>P0</td>
<td>20</td>
<td>74.07%</td>
</tr>
<tr>
<td>P1</td>
<td>16</td>
<td>59.26%</td>
</tr>
<tr>
<td>P2</td>
<td>16</td>
<td>59.26%</td>
</tr>
</tbody>
</table>

(59.25%). pregnancy diagnosis in the percent difference between the observations NRR with rectal palpation consecutive start T0, T1 and T2 is 14.82%; 14.82% and 7.41%. Meaning that there has been a silent heat or death of the embryo that many this research. The results are consistent with the statement Jainudeen and Hafez (2008) and Susilawati (2011b) which states that the differences between the percentages of pregnancy based NRR with rectal palpation, if NRR of 70% then it is
likely to dropped if detected by rectal palpation be 60-65%.

**Service per Conception**

The results of statistical test to the calculation of the S/C on various treatments did not show significant differences (P <0.05). However Value S/C best in the treatment group T0 = 2.31, followed at T2 = 3.0 and the ugliest in the treatment group T1 = 3.33. The result is lower when compared with previous research (Susilawati, 2005) Services per conception in Position 4 and 4+ frozen semen control was 1.42 and 1.25. whereas AI using frozen semen sexing by density gradient centrifugation percoll is 2 and 1.83. S/C at position 4+ better than the 4 position. The high S/C is caused by the poor quality of sperm sexing used. Jones and Stewart, (1992) the mean number of services per pregnancy base on data from pregnant cow gives an estima of fertility in cows. At the reasearch very different from the true of services per pregnancy when the inseminations of non- pregnant cows are included. Following from that, appropriate formulae are derived for estimating true and apparent number of services per pregnancy. factors other than the quality of sperm is timeliness of Artificial Insemination and estrus Quality, Perry et al. (2007) stated that the probability of success of artificial insemination greatly influenced the timing of insemination, Also standing estrus determine the success or failure of insemination and also an indication of ovulation in cattle. Cows were used In this research are given feed less this is causing many silent heat cows or early embryonic death

**Conception Rate**

Conception Rate value resulting at T0 (44.44%) is control, the lowest at T1 (18.51%) while T2 (25.92%). Results of statistical tests on the various treatments are not significant differences (P<0.05). Resulting percentage CR is lower than the results research Susilawati (2005) and Susilawati (2014) which states that value of CR on spermatozoa Y is 70% the AI with Position 4, while at position 4+ resulting 80%. while according Susilawati (2011b) AI using sperm motility between 5-20% with a yield of pregnancy 65%. the results of AI at position 4 resulted in pregnancy 77.5%, whereas the position 4+, generating 87.5% of gestation. The low yield is due to the quality of research results sexing semen used more bad and and also physiologically cattle also not good because of the low quality of the feed given.

**CONCLUSION**

AI treatment using sperm sexing with SGDP method gives a higher percentage of pregnancy of 51.85%, AI treatment compared to using semen sexing with albumin column separation method which is only 44.44%. However, AI results using frozen semen is 59.25%.

**SUGGESTION**

Packaging of sperm sexing improved and the AI in cattle that good maintenance management so that good reproductive physiology.

**ACKNOWLEDGEMENTS**

Education and Culture Ministry and Brawijaya University which has provided research funding BOPTN.
REFERENCES


ABSTRACT: Crossbreeding beef cattle cause genetic changes related to its physiology and reproductive traits. This study was conducted to evaluate physiology and reproductive responses of crossing beef cows, that maintained in locations with different temperature and air humidity. Crossing between Peranakan Ongole cow with Simmental (SIMPO) or with Limousin (LIMPO) bull, each as 10 heads, kept in lowlands and highlands area. Parameters observed: environmental conditions, physiology and reproduction performances of cow. Data obtained are analysed by t-test and or presented descriptively. The results showed: daily air temperature that comfortable for cows at 4 pm until 8 am in lowland or at 4 pm until 10 am in highland, resulting in high respiration and pulse frequencies cows in lowland (28.7 and 86.3 times/minute); nutrient rations intake that less (especially in cows at lowlands), causing slow secretion pattern of progesterone and too fast secretion pattern of estrogen hormones, so achievement of its concentrations at before until after estrus were still high (minimal levels of progesterone from 3.2 to 5.2 ng/mL; maximum levels of estrogen from 27.8 to 35.3 pg/mL); abnormality patterns and levels of reproductive hormones secretion, is thought to be because declining reproduction performance of the crossing beef cows (estrous cycles 19 until 38 days; calving interval 427 until 479 days). Concluded, crossing beef cows are better be maintained in highlands than in lowlands.

Keywords: Physiological Response, Reproduction Respons, Crossing Beef Cows

INTRODUCTION

Various attempts have been made by the Government to increase the production of beef in the country, such as grading up, through artificial insemination (AI), to local beef cattle with Bos taurus. The implementation of its AI program that has been going on large area application, then in smallholder farmers have formed various levels of crossing blood composition in almost region.

Straw are the most widely used in AI program are Bos taurus breed, they are Simmental and Limousin cattle. Then, they are crossed by Indonesian local cattle, such is Peranakan Ongole (PO), and produced offspring cattle that are called as SIMPO dan LIMPO cattle. Bos taurus cattle is cattle from temperate zone countries. Genetically, Bos taurus have high potential to growth rate, but its physiologically not resistant to tropical conditions (high temperature), also certain quality and quantity of feed and management standard maintenance (Astuti et al., 2002), so SIMPO or LIMPO cows will inherited trait half advantage and weakness of Bos taurus. The main consideration of using Bos taurus straw at AI program still based on size of body cow, limited ability to environmental conditions and patterns of maintenance adapt (Robertshaw, 1984) that affect to its physiologically and biologically status, still often neglected.

Beef cattle experiencing environmental stress will be tried by overcome (Williamson and Payne, 1993) through changes in behavior (Esmay and Dixon, 1986). If cow is still not able to cope with stress, will be followed by physiological changes, and last through enzymatic and hormonal changes (Robertshaw, 1984). Such changes, it will directly affect disturb fertility; some
informations from farmers reported that fertility rate of SIMPO and LIMPO cows that is traditional maintained, turned out to be no better than local cows (Aryogi, 2005).

Based on problems mentioned above, this study was conducted to determine physiology and reproductive responses of crossing beef cows that are kept in a location with different altitudes, and how its effects mechanism so can affect to reproductive performance of cows.

**MATERIALS AND METHODS**

This study is a combination between field activities (observations of environmental conditions and cows for 3 months during dry season) and laboratory activities (reproductive hormone analysis).

**Materials**

This study used 20 heads of crossing cows of SIMPO and LIMPO (blood composition 75% SIMPO/LIMPO : 25% PO) and 10 heads PO cows in farmers, each spread in low-land areas at a villages in Sleman regency and high-land areas at a villages in Magelang regency, Central Java province. For identification of reproductive hormones, used blood serum from five crossing cows and three PO cows. The tools used to identify : environmental conditions are thermometer and hygrometer; cattle condition used thermometer, stetoscope, stopwatch, a set of blood samples, ultra sonography equipment, also a set tools and materials analysis of reproductive hormones with ELISA method.

**Methods**

Environmental observation of research location conditions, such as temperature and humidity at around and in stalls, are done every 4 hours for 2 x 24 hours per month, each in five places. Observations on the first day at 00, 04, 08, 12, 16 and 20 o’clock, while on the second day at 02, 06, 10, 14, 18 and 22 o’clock.

Observation of environmental conditions effect on cows physiology, such as body temperature, respiration and pulse rates frequency, and nutrients ration consumption, are done at same time and place with environmental observations.

Reproduction observations performance of cattle is done visually, directly interview to farmers and officers, rectal palpation, checking ovaries by ultrasonography tool, sampling blood in jugular vein using tubes with anti coagulant EDTA. Hormones are analysed by progesterone kit (PIA kit) and estrogen kit (EIA kit).

Blood sampling scheme are as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>the end of estrus before cow was observed (not taken blood samples)</td>
</tr>
<tr>
<td>b</td>
<td>one day before cow is expected estrus. Taken blood sampling 1 time</td>
</tr>
<tr>
<td>c</td>
<td>24 hours during the day estrus. Taken blood sampling 4 times</td>
</tr>
<tr>
<td>d</td>
<td>6-12 hours after the day estrus ends. Taken blood sampling 1 time</td>
</tr>
</tbody>
</table>

**Parameters observed:**

1. Environmental conditions : air temperature
2. Physiology performance cows : respiration and pulse frequency : quantity and quality rations that is consumptioned
3. Reproduction performance cows  
   : anoestrus post partus (APP)  
   : service per conception (S / C)  
   : secretion pattern and concentration of hormones  

The data obtained were processed and presented descriptively or analysed by t-test (to compare among PO with SIMPO/LIMPO)

RESULTS AND DISCUSSION

A. Environmental Conditions

Environmental conditions in low land is a flat area; altitude between 30 - 75 m asl; dry land; hot temperature; rain season 5 months/year. Environmental conditions in high lands is hill area; altitude 800 - 1050 m asl; dry land; cool/cold temperature; rain season 6-7 months/year. Based on differences environmental conditions in two locations, expected to cause different effects on physiology and reproductive performance of crossing cows.

B. Air Temperature

Data air temperature observation at both sites, showed in Figure 1. It appears:

1. diurnal temperature in lowlands are always higher than in highlands area
2. comfort zone of sub-tropical cattle zone is 13 to 25 C, while tropical cattle is 22 to 30 C (Yousef, 1984b). If crossing cow inherited both genetic traits, it is predicted that comfort zone of crossing cow is about 18 to 28 C (Aryogi, 2005). From Figure 1 show that crossing cow in lowlands area, experienced comfort zone during at 16 to 8 o’clock; whereas crossing cow in highlands almost every time to experience comfort zone, except at 12 to 14 o’clock.

![Figure 1. The diurnal air temperature at research locations](image)

Environmental temperature conditions that are unfavorable for crossing cows (SIMPO and LIMPO), especially that in lowlands area, are estimated to cause interference with physiology of cow, being for PO cows that are genetically more resistant to heat, it is not expected to occur.

C. Physiology Performance of Crossing Cow

Observations on performance of crossing cow, consisting of physiology and reproduction performance. Data resulted of study showed in Figure 2 to 5.

![Figure 2. Pulse frequency of cow](image)
Figures 2 showed that pulse frequency: cow in lowland (LL) greater than in highland (HL); crossing cow (S/L) higher than PO cow.

Figures 3 show that, respiration frequency: cow in lowlands greater than in highlands; crossing cow higher than PO cow.

![Figure 3. Respiration frequency of cow](image)

**D. Reproduction Performance of Crossing Cow**

Reproduction performance data of cow listed in Table 1. It appears that cow in lowlands showed lower reproduction performance than cow in highlands; crossing cow lower than PO cow; and crossing cow in lowlands lower than cow in highlands. It is believed as effect of interaction between environmental conditions and genetic crossing cow. At local cows (PO) looks hot temperature in lowlands did not significantly affect.

**Table 1. Performance of reproductive cows**

<table>
<thead>
<tr>
<th>Observations</th>
<th>Location</th>
<th>PO</th>
<th>SIMPO</th>
<th>LIMPO</th>
</tr>
</thead>
<tbody>
<tr>
<td>APP (days)</td>
<td>LL</td>
<td>118.73 ± 19.66&lt;sup&gt;b&lt;/sup&gt;</td>
<td>120.21 ± 14.37&lt;sup&gt;b&lt;/sup&gt;</td>
<td>112.73 ± 13.67&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>HL</td>
<td>119.95 ± 9.78&lt;sup&gt;b&lt;/sup&gt;</td>
<td>114.15 ± 7.12&lt;sup&gt;a&lt;/sup&gt;</td>
<td>110.47 ± 9.89&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>SE (days)</td>
<td>LL</td>
<td>19.75 ± 1.68&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.92 ± 5.22&lt;sup&gt;a&lt;/sup&gt;</td>
<td>33.05 ± 4.76&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>HL</td>
<td>20.45 ± 1.72&lt;sup&gt;a&lt;/sup&gt;</td>
<td>21.64 ± 1.58&lt;sup&gt;a&lt;/sup&gt;</td>
<td>31.63 ± 2.60&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>S/C (times)</td>
<td>LL</td>
<td>1.56 ± 0.75&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.02 ± 0.69&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.97 ± 0.72&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>HL</td>
<td>1.31 ± 0.47</td>
<td>1.55 ± 0.66</td>
<td>1.61 ± 0.67</td>
</tr>
<tr>
<td>LB (days)</td>
<td>LL</td>
<td>284.40 ± 3.82</td>
<td>287.61 ± 4.25</td>
<td>287.23 ± 3.50</td>
</tr>
<tr>
<td></td>
<td>HL</td>
<td>283.38 ± 3.74</td>
<td>288.13 ± 3.53</td>
<td>286.17 ± 2.73</td>
</tr>
<tr>
<td>CI (days)</td>
<td>LL</td>
<td>432.36 ± 11.78&lt;sup&gt;b&lt;/sup&gt;</td>
<td>446.55 ± 19.18&lt;sup&gt;b&lt;/sup&gt;</td>
<td>461.23 ± 17.67&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>HL</td>
<td>413.87 ± 26.49&lt;sup&gt;y&lt;/sup&gt;</td>
<td>422.73 ± 24.16&lt;sup&gt;y&lt;/sup&gt;</td>
<td>420.62 ± 27.13&lt;sup&gt;y&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Description: APP = anoestrus post parturition; S / C = service per conception; SE = estrus cycle; LB = long bunting; CI = calving interval. a, b different superscript in same row, significantly different (P <0.01); y, z different superscript in same column, significantly different (P <0.01).

Reproduction performance of crossing cows (especially in lowlands) that are lower than in highlands or than local cow, allegedly because it is associated with occurrence of abnormalities (quantity and or quality) secretion of reproductive hormones such as progesterone, estrogen and luteinizing. Results of progesterone and estrogen analysis in cows at before until after estrus, showed in Figure 4 and 5.

Alleged decline in reproductive performance of crossing cow, is caused by abnormalities of
reproductive hormones as influence of environmental conditions that unfavorable to physiological cows, it is strengthened by results of follicle development via rectal palpation and using ultrasonography tool which indicates that crossing cows do not immediately experience estrus although its follicle development has reached stage ready for ovulation. Follicle size from 10 x 8 mm, at PO cow proved can be used as a benchmark estimate that cow will experience estrus 2 to 4 days later, but crossing cow proved will experience estrus between 7 to 11 days later.

Progesterone profile is a sharp decline in last 6 hours before estrus, to reach its lowest level in about 6 hours during estrus, then levels increased quickly in hours after occurrence of estrus. The pattern of progesterone profile was not different between cows in lowlands and highlands, only in lowlands levels decline is lower but speed increase is higher, and there is a tendency that level of hormone levels of PO, SIMPO or LIMPO cows in lowland greater than in highlands.

Decreased levels of progesterone in PO cows is the biggest, followed by LIMPO and the smallest is SIMPO cows; the lowest level of progesterone around 6 hours of estrus occur, achieved by PO cows (1.7 and 2.2 ng/mL), then LIMPO cows (2.3 and 2.2 ng/mL) and the last SIMPO cows (4, 0 and 4.7 ng/mL).

Figure 4. Profile of progesterone of cow

For estrogen profile it is opposite with progesterone, which increased sharply in last 6 hours before estrus, so achieve the highest levels in about 6 hours during estrus, then levels dropped back quickly in hours after occurrence of estrus. Estrogen profile pattern is also not different between cows in lowlands and high-lands, only that in highlands speed increase higher and decrease speed slower, so hormone levels of all cows in highlands greater than in lowlands.

Achievement highest level of estrogen done in hours of estrus occur, looks different between cows in lowlands and in highlands. In the lowlands, highest level of estrogen are achieved by SIMPO cows (35.31 pg/mL), then LIMPO cow (27.83 pg/mL) and the last PO cow (17.09 pg/mL);
while in highlands are reached by LIMPO cow (44.38 pg/mL), then PO cow (37.85 pg/mL) and the last SIMPO cow (24.81 pg/mL).

CONCLUSION

Observation of respiration, pulse, rectal palpation, ultrasound and analysis of reproductive hormone profiles, showed that temperature and humidity identifiable effect on physiology and reproduction performance of crossing cows.

REFERENCES


Supplementation of Cysteine on Plasma Membrane Integrity of Buck Spermatozoa

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ABSTRACT: The purpose of the study was to determine Cysteine supplementation in the extender to plasma membrane integrity. Semen was collected using artificial vagina from buck aged 2 to 2.5 years in normal reproduction. The design used was randomized block design with ten replications. Semen collection was done once a week. Only fresh semen with a minimum of 70% motile sperm and 80% morphologically normal were used in this research. Andromed as a based extender was diluted using aquabidest with a ratio of 1:4. The treatment was different concentration of Cysteine as follows: 0.0 mM (P0); 0.5 mM (P1), 1.0 mM (P2) and 1.5 mM (P3). Data analysis using analysis of variance (ANOVA). If there were any differences, Duncan test will be used for further analysis. The results showed that the percentage plasma membrane integrity on before freezing at 1 mM (75.64%) was higher (P < 0.05) compared with a dose of 0.0 g (73.78%), and dose of 0.5 mM (72.93%), but did not differ (P > 0.05) with a dose of 0.5 mM g (75.46%). Plasma membrane integrity on post thawing for P2 (73.16%) was higher (P < 0.05) than P0 (69.8%), P1 (71.53%) and P3 (70.7%). It was concluded that supplementation of Cysteine 1.0 mM is optimum concentration to maintain plasma membrane integrity of buck frozen semen.

Keywords: Andromed, Cysteine, Plasma membrane integrity, Semen, Buck

INTRODUCTION

One of the factors that influence the success of the artificial insemination application is the quality of frozen semen. It has been demonstrated that cryopreservation is associated with oxidative stress (Bergeron et al., 2006). Previous results showed that although buck spermatozoa have motility after freezing to thawing about 40-60%, but only about 10-30% who do not have biological damage (Gadea, 2005). Moreover, freezing and thawing of sperm will increased the reactive oxygen species (ROS), producing DNA damage, cytoskeleton alterations, inhibition of the sperm–oocyte fusion and affecting the sperm axoneme that is associated with the loss of motility (Breininger et al., 2005). Sperm were sensitive to peroxidative damage due to the high content of unsaturated fatty acids in the phospholipids of the plasma membrane and the relative low antioxidant capacity of goat seminal plasma. The formation of ROS generated by destruction of the plasma membrane caused a decrease in the ability of sperm motility and increase the damage that would affect morphology of sperm capacitation and acrosome reaction.

Efforts to minimize lipid peroxidation was use antioxidants that have the ability to reduce, extinguish or suppress free radical reactions (Agarwal et al., 2005). Supplementation of Cysteine in Andromed was expected to prevent free radicals during processing and storage of frozen semen so that it will maintain quality of frozen semen. The purpose of this study was to determine effect of Cysteine supplementation on plasma membrane integrity.

MATERIALS AND METHODS

Semen collection and Semen dilution

Semen was collected from buck aged from 2 to 2.5 years using an artificial vagina. Semen...
collection was done once a week. Only fresh semen with a minimum of 70% motile sperm and 80% morphologically normal were used in this research. Andromed as a based extender was diluted using aquabidest with a ratio of 1:4. Cysteine in different concentration was supplemented in based extender as follows: 0.0 mM (P0); 0.5 mM (P1), 1.0 mM (P2) and 1.5 mM (P3)

**Freezing and thawing procedure**

Semen put in the straw with concentration 75 million/ml, cooled for 2 h at 5°C. Freezing is done by putting straw in the steam of nitrogen (N2) liquid for 10 min. and then stored for 24 h. Thawing was done by dipping the straw into water for 30 sec.

**Evaluation of plasma membrane integrity**

Evaluation of plasma membrane integrity using a solution of Hypo-Osmotic Swelling (HOS) test as follows: 0.1 ml of semen in 1 ml solution of fructose and sodium citrate, then incubated 30-60 min and observed swelling of the tail with 400 x magnification.

**Research Design and Data Analysis**

The design used was randomized block design. Each treatment was repeated ten times. Data analysis using analysis of variance (ANOVA). If there were any differences, Duncan test will used for further analysis.

**RESULTS AND DISCUSSION**

Membrane integrity is not only important for metabolism but also certain changes in membrane components, especially during fertilization. Plasma membrane damage would cause the loss of sperm motility because of loss of cellular components and inactivation of proteins essential enzyme in the acrosome. (Dorado *et al.*, 2010). Percentage of plasma membrane integrity of spermatozoa at freezing stage and dose Cysteine can be seen in Table 1.

<table>
<thead>
<tr>
<th>Freezing stages</th>
<th>Concentration of Cysteine (mM)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td>Before freezing</td>
<td>73.78±2.52 a</td>
</tr>
<tr>
<td>Post thawing</td>
<td>69.80±3.20 a</td>
</tr>
</tbody>
</table>

Different superscript in the same row indicate significantly different (p <0.05)

The results showed that the percentage plasma membrane integrity at Cysteine concentration of 1.0 mM (75.46%) was higher (P <0.05) than 0.0 g (73.78%), and 0.6 g (72.93%), but did not differ (P> 0.05) with 0.5 mM (75.46%). The equilibrated phase was carried out for 2 h at a temperature of 3-50C, predicted Cysteine has a role in protection on plasma membrane (Meseguer *et al.*, 2004). Results of radical chain reaction of lipid peroxidation peroxide can only be stopped by an antioxidant that has the ability to break the chain reaction. Optimal concentration of Cysteine as antioxidant effect was to 1.0 mM, whereas at concentration of 1.5 mM have the possibility of negative influence of Cysteine that cause deterioration in the plasma membrane integrity. Membrane damage also occurs due to cold stress as presented by Watson (2000), that the primary membrane damage occurs during the freezing process at a temperature of 15°C to -60°C. The decreased quality of spermatozoa to cold stress due to temperature changes associated with the high ratio of saturated fatty acids and unsaturated phospholipids and low in cholesterol in membrane composition and the structure of the membrane causes an increase in opportunities
for membrane damage as a result of many hydrogen bonds are weaken and easily bound by free radicals. Once free radicals are formed, will lead to the formation of new free radicals through a chain reaction between the lipid peroxy radical occurs (Kumar et al., 2003). The ongoing chain reaction of lipid peroxidation can affect membrane integrity because free radicals can react with membrane components, especially structural components, such as membrane proteins, so the damage can take place not only at the plasma membrane but also on the internal cell (Chatterjee and Gagnon., 2001; Fonseca et al., 2005).

Normal metabolic process will generate many free radicals, especially onion superoxide (Zhao et al., 2009). Initiation phase of free radical formation has been ongoing since the semen was collected and when the dilution occurred due to contact with oxygen. Cysteine supplementation showed suppression effect against lipid peroxidation chain reaction. There is significant effect on the dilution stage, probably because this stage play a role in an optimal Cysteine as antioxidants in maintaining membrane integrity against lipid peroxidation reaction.

Damage to the plasma membrane other than that due to peroxidation can be caused also by osmotic stress when exposed to a hypertonic medium. Cryoprotectant glycerol also has a direct protective effect on the plasma membrane. Glycerol is directly bonded with polar heads of membrane phospholipids and interact with membrane proteins and induce the formation of membrane structures which lead to restructuring of the membrane and affect membrane fluidity due to increased side chain fatty acids (Cerolini et al., 2000; Munsi et al., 2007).

The negative effect of Cysteine 1.5 mM on the plasma membrane integrity may be due to too high Cysteine concentrations that cause ineffective antioxidant action even become a prooxidant (free radicals) that precisely reproduce the formation of radicals. Changes in antioxidant function becomes prooxidant or free radicals cause more unsaturated fatty acids that are subjected to free radicals (Nur et al., 2005). This situation further accelerate and expand the incidence of lipid peroxidation of sperm plasma membrane damage due to loss of some essential unsaturated fatty acids.

CONCLUSIONS

Cysteine concentration in Andromed extender will affect the integrity of the plasma membrane. Cysteine supplementation with 1.0 mM concentration is most well maintain the integrity of the plasma membrane.

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Estrous Behavior in the Thoroughbred-Indonesian Local Crossbred Mares

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ABSTRACT: The development of horse breeding industry in Indonesia was commenced through horse racing events held all over the country. It were accelerated by the development of Thoroughbred-Indonesian local Crossbred horses. There are many broodmares injured during their racing time and retired from the racetracks. They may still has a reproductive vigor to continue on producing offsprings. A few information has been reported on the monitoring the reproductive capacity of the mares. The objective of this study was to explore the estrus behavior correlated with ultrasonography imaging of the ovarian dynamics of the Thoroughbred-Indonesian local crossbred mares. Three Thoroughbred-Indonesian local crossbred mares with 6.25-12.5% of local genetics aged 12-20 years old were used in this study. Ultrasonography examination was done every morning at approximately at the same time. Estrus behavior was observed by using teaser stallions following a standard method. Results of the experiment indicated that mares show estrous behavior such as winked vulva, squatting, receive the stallion, tail raised, urinating, and mating stand in the ovulation time that occurred in the day 25.4±3.78 (estrous cycle) correlated with the diameter of dominat follicle 4.2±1.44 cm. In conclusion, Estrous behavior can be used to monitor the estrous cycle to optimized the mating time in the mares.

Keywords: estrous, behavior, teasing, mares

INTRODUCTION

Indonesian equine industry is being develop in recent years as the effect of horse racing activity around the country. The Up Grading system for Indonesian local mares with Thoroughbred stallions resulted the Crosbred Horses, named G3,G4 and KPI (Kuda Pacu Indonesia) that have 6.25 to 25 percent of local genetic. KPI is resulted from G3 x G3, G3 x G4 and G4 x G4 (PP. PORDASI 2000 cit. Berliana 2007)

Reproductive cycles are correlated with many phenomenon including: puberty, sexual maturity, breeding season, estorus cycle, post partum sexual activity, and aging (Hafez, 2000). In the other hand, Donadeu and Ginther (2002) reported that follicular waves are developed in the middle of estrous cycle, and there will be just single dominat follicle will be ovulated by the end of Estrous. Interovulatory interval in mares consist of various minor follicular wave combination that wont ovulated and major waves, that the biggest follicle will be dominant and ovulated.

Interovulatory interval has begun by the time that ovulation occured and will be ended in the next ovulation of the next estrous cycle. The length of interovulatory interval are 21-22 days for horses, and 24 days for ponies (Ginther, 1992). Follicle will grow normally until the beginning of deviation. After deviation, dominat follicle will continued to grow, and subordinate follicles will be regreted. Deviation is begin when the size of dominat follicle is 22.5mm (Ginther et al, 2004)

Indonesian horse breeding system is traditionally managed. One of the subsystem is the
measurement of the mating time according to the estrus behavior. That caused the result have not optimum yet. The Ultrasoundography (USG) method has begin to used by some practitioners in order to give accurate mating time by combine the traditional system with the USG method to improve pregnancy rate in mares.

The aim of this study was to explore the estrous behavior related to ultrasonography imaging of the ovarian dynamics in the estrous cycle of the Thoroughbred-Indonesian local crossbred mares. The result of this study can be referred as the general information to estimate the optimum mating time based on the estrous behavior and ovarian dynamics ultrasonography imaging.

MATERIALS AND METHODS

This study was held at the Reproduction Rehabilitation Unit, Department of Reproduction, Clinic, and Pathology, Faculty of Veterinary Medicine, Bogor Agricultural University, Bogor, Indonesia. Three Thoroughbred-Indonesian local crossbred mares that contains 6.25 until 12.5 percent of local genetic sources, aged 12-20 years old were used in this study. The mares were fed fresh grasses and pellets that contains 12 percent of Proteins.

The equipments that used in this study include: USG (ALOKA SSD-500, Aloka Co. Ltd, Japan), linear probe 5 MHz (ALOKA UST-588U-5, Aloka Co. Ltd. Japan), (SONY, UP-895 MD, Video Graphic Printer, Japan), syringe (One Med, PT. Jaya Mas Medica Industri), plastic gloves (Europlex®, Divasa Farmativa, S.A.), lubrication gel, PGF2α (Dinoprost, Norprost 0.5% W/V, Norbrook Laboratories Limited, Newry), hCG (Chorulon, Intervet, Cambridge), and 70% alcohol.

Estrous and Ovulation Synchronization

This study was begun by injection of PGF2α (Dinoprost, Norprost 0.5% W/V, Norbrook Laboratories Limited, Newry) single-dose in the luteal phase to synchronize the estrous cycle. Followed by hCG injection (Chorulon, Intervet, Cambridge) single-dose 1500 I.U. when the dominant follicle obtain 30mm in size.

Estrous Behavior

The observation of estrous behavior done twice, the first, one day after PGF injection until ovulation occurred, and the second begun when day 17 until ovulation by teasing methods. Observation based on scoring system according to Coleman dan Powell (2004) below:

<table>
<thead>
<tr>
<th>Score</th>
<th>Estrous sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Agresive to the stallion, even attacking or kicking</td>
</tr>
<tr>
<td>1</td>
<td>Stay when the stallion is approaching</td>
</tr>
<tr>
<td>2</td>
<td>Begin to approach the stallion, winked vulva, tail raising</td>
</tr>
<tr>
<td>3</td>
<td>More attracted to stallion, tail raising, squatting, urinating</td>
</tr>
<tr>
<td>4</td>
<td>Strongly attracted to stallion, winked vulva, and continuous urinating</td>
</tr>
</tbody>
</table>

Source: Coleman dan Powell (2004)

Ultrasonography

USG examination done every day at the same time, begun shortly after the estrous synchronization, and every four hours shortly after the injection of hCG until ovulation occurred to observe the ovarian dynamics, include the diameter of the corpus luteum (CL), number and size of the follicles. The diameter of each preovulatory follicle measured by the average value (Shirazi, 2004).
Data Analysis
The collected data presented descriptively by calculating the average and standard deviation. Analysis was used software MS Office Excel 2007.

RESULT AND DISCUSSION

Estrous and Ovulation Syncronization

Tabel 2. Estrous and ovulation Syncronization

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Largest Follicle diameter (cm)</td>
<td></td>
</tr>
<tr>
<td>Early PGF2α treatment</td>
<td>2.63 ± 0.06</td>
</tr>
<tr>
<td>Early hCG treatment</td>
<td>3.27 ± 0.12</td>
</tr>
<tr>
<td>Maximum</td>
<td>4.50 ± 0.52</td>
</tr>
<tr>
<td>Day before ovulation</td>
<td>4.50 ± 0.52</td>
</tr>
<tr>
<td>CL Diameter (cm)</td>
<td></td>
</tr>
<tr>
<td>Early PGF2α treatment</td>
<td>2.17 ± 0.15</td>
</tr>
<tr>
<td>Early hCG treatment</td>
<td>1.77 ± 0.45</td>
</tr>
<tr>
<td>Day before ovulation</td>
<td>0.83 ± 0.32</td>
</tr>
<tr>
<td>Estrous (days)</td>
<td></td>
</tr>
<tr>
<td>Early PGF2α treatment to estrous onset interval</td>
<td>1.33 ± 0.58</td>
</tr>
<tr>
<td>Estrous duration</td>
<td>4.00 ± 1.00</td>
</tr>
<tr>
<td>Interval to ovulation occured</td>
<td></td>
</tr>
<tr>
<td>Early PGF2α treatment (days)</td>
<td>5.33 ± 1.15</td>
</tr>
<tr>
<td>Early hCG treatment (hours)</td>
<td>66.67 ± 10.07</td>
</tr>
</tbody>
</table>

Estrous and ovulation synchronization were administered PGF2α 2ml i.m and hCG 1500 IU i.m obtained the results as shown in table 2. The average diameter of the largest follicles at the beginning of PGF2α treatment was 2.63±0.06 cm, while in initial hCG treatment amounted to 3.27±0.12 cm. The average maximum diameter of the largest follicle reached on the day before ovulation, that is equal to 4.50 ± 0.52 cm. Bergfelt et al (2007) reported that the average diameter of the largest follicles at the beginning of PGF2α treatment amounted to 2.27±0.19 cm with a range of 1 to 4 cm, whereas at the beginning of hCG treatment amounted to 3.15±0.15 cm in the range of 1.9 up to 4.5 cm. The average diameter of the largest follicle reached a maximum one day before ovulation by 3.65±0.1 cm. The average diameter of the CL at the beginning of PGF2α treatment obtained at 2.17±0.15 cm, whereas at the beginning of hCG treatment amounted to 1.77±0.45 cm, and one day before ovulation by 0.83±0.32 cm. Average Interval from early PGF2α treatment to the onset of estrous throughout 1.33±0.58 days, while the average duration of estrous was 4.00±1.00 days. Interval to achieve ovulation by the initial PGF2α treatment was 5.33±1.15 days,
while from the beginning of hCG treatment was 66.67±10.07 hours. Conversely, if the follicle has reached its maximum diameter during the luteal phase dominated by progesterone, then the follicle will regress, and there will be recruitment of new follicles, then estrus and ovulation will be delayed (Samper et al., 1993).

**Ovarian Dynamics and Estrous Behavior**

Based on the research that has been done using ultrasonography every day at the same time on three mares, it’s founded the ovarian dynamics include the development and regression of follicles and CL consisting of waves of follicles, and its correlated to estrous behavior scoring during 1 estrous cycle. Based on the data of all the horses in this study can be seen that the average estrous cycle length was 25.4±3.78 days with 2 to 3 follicular waves and estrous duration was 6.8±1.92 days. The average maximum diameter of the largest follicle before ovulation is 4.4±4.2 cm with a range of 3.0 to 5.8 cm. Donadeu and Ginther (2002) reported that the ovulatory follicular waves developed in the mid estrous cycle time and usually one follicle will ovulated at the end of estrous cycle. The interval between ovulation in horses consists of various combinations of follicular minor waves, where the largest follicles do not become dominant, as well as major waves, where the largest follicle becomes dominant. The average length of the interval between ovulation is 21 or 22 days for horses, and 24 days for ponies (Ginther 1992).

![Figure 1. Estrous Behavior scoring visualization in mares: a) Score 0, b) Score 1, c) Score 2, d) Score 3, and e) Score 4](image)

Individual behavior during estrous varies among individual horses, but tend to be the same between cycles. Signs of estrous can be seen, among others: the acceptance of the stallion, tail raised, frequent urination, vulva showed rhythmic contractions (winking), and squatting. Signs of estrous is also consistent with the observation that has been done by Coleman and Powell (2004), Waring (2003) and Hafez (2000).

Observation of estrous behavior indicates that the moments before ovulation will be marked by the achievement of the maximum score 3, which is characterized by showed attracted to the stallion, tail raised, winked vulva, squatting and urination and score 4, which is characterized by strong interest to the stallion, thrusting buttock ti the stallion, tail raised, winked vulva and
continuous urination. From these results, it is expected in an attempt to increase pregnancy rate in horses, mating should be carried out when estrous behavior score reaches 3 or 4.

CONCLUSION

In conclusion, Synchronization with PGF2α resulted estrous after 1.33±0.58 days, with estrus duration 4.00±1.00 days, and ovulation occurred 66.67±10.07 hours after hCG administration when the follicle diameter reached 4.50±0.52 cm. While estrus cycle was 25.4±3.78 days with 2 to 3 follicular waves, estrous duration was 6.8±1.92 days, and naturally ovulatory follicle diameter was 4.2 cm±1.24. Ovulation occurs in estrus behavior score 3-4. Estrous behavior can be used to monitor the estrous cycle to optimize the mating time in the mares.

REFERENCES

Preservation of Bull Cement Technology Applications without Freezing Proceed and Utilization of Epididymis as a Slaughterhouse as a Waste Product to Optimized on Bali Cattle Artificial Insemination in Remote Areas

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ABSTRACT: Currently the application of Artificial Insemination (AI) Reproductive Technology has been urged to be developed in the remote area. The applications of these technologies were to accelerate the population of Bali Cattle in remote areas. The increase in income of farmers is done by increasing the number of births, the number of pregnancy and the number of breeding. Increasing the genetic quality becomes an important factor for remote areas for accelerating the increase in the income of farmers. The limitation of Artificial Insemination Equipment such as Liquid Nitrogen (N₂) for maintaining the frozen cement Bali cattle is the big problem recently. Without liquid N₂ would impossible to maintain the spermatozoa still alive to apply the AI in the difficult area. To solve the problem we need to preservation the cement without frozen method, which will not need N₂ liquid. The availability of good cement becomes a critical success factor. Waste from slaughterhouses (RPH) in the form of a bull testicle and good genetic quality can be utilized in the form of spermatozoa using semen collection method from epididymis are expected to be used as a liquid cement to AI. Liquid nitrogen must be produced by special chemical plant and are usually located in urban areas or areas that are easily affordable transportation. This research has used the tannins as a substance that can prolong life of bull sperm without freezing methods. These researches showed that two methods production of cement could improve the AI program and increased the pregnancy rate of Bali Cattle at remote area. By this cement/sperm we can serve the sperm for AI in the remote area. The program will continue until the result of NTT as a source of national cattle and calf birth Bali cattle. This succeed will be a pilot project to applied this technology in the different areas where lack of equipment and facilities to increase the cattle population in Indonesia.

Keywords: sperm, artificial insemination, Bali Cattle, pregnancy, epididymis

INTRODUCTION

Artificial insemination is one important method and has been applied to improve the quality and quantity of genetic using insemination using a sperm in the cervix to place the estrus females (Hafez, 2000, Bearden 1980 and 1997, Evans 1987). Spermatozoa were first discovered by Leuwenhoek on cement and testes (Austin and Short, 1982). According to Garner and Hafez, (1987) spermatozoa is a long cell consisting of a flat head and a tail containing nucleus containing the device for cell movement. Sperm cells enveloped by plasma membrane called plasmalemma. The big problem of application of AI in Indonesia is availability of Liquid Nitrogen (N₂) to keep
the sperm of frozen condition. The problem of transportation and distance will make very difficult to serve the appropriate management. Reproductive failure is a major source of economic loss in the beef industry. The majority of this loss occurs because cows do not become pregnant during a defined breeding season. Therefore, the goal of any breeding program (AI or natural service; synchronized or not) is to maximize the number of females that become pregnant (Perry et al., 2011).

Post thawing motility 40 % is National standard in Indonesia; need the N$_2$ liquid, so by this research we have tried to maintain the live sperm without cryopreservation process. Tannins were collected from Lamtoro leaves (Leucaena leucocephala) as divulging chemicals capable of binding substances that cause the cessation of the process of energy metabolism without the freezing process. Tannin is a derivative of polyphenols in the form of condensed tannins (Arranz et al., 2009), also known as polymer proanthocyanids 2-50 until flavonoids. Tannin as already known contain the flavonoids that can be a decapacitation factor of sperm on female reproductive track. Decapacitation factors are expected to restrain the use of nutrients for the metabolism so that the power of his life can be extended and will return to work when the decapacitation factors released by chemical or manually by a centrifuge at a certain rotation speed. These factors increase the stability of the membrane decapacitation with, among others maintaining the physiological ratio cholesterol / phospholipid. Pressing the influx of Ca AMP, press the increase in Ca intracellular, and is able to bind the protein complex and are bound to the ion Ca, Mg, Na and K. In the absence of the metabolism of nutrients in spermatozoa can survive a long time and does not happen any changes in the spermatozoa to put the female goat reproductive tract and release reversible bonding process occurs tannin (Ponci et al., 2000). Tannins have a strong ability to bind to proteins with high affinity, large molecular, and open. Tannins are also capable of binding protein-protein or protein complex that is bound with ions of Ca, Mg, Na and K; carbohydrates, and fats. Tannin supplementations (such as tannins Leucocephala) in the preparation of liquid sperm are expected to maintain the viability of spermatozoa during storage without freezing. It is suspected, the function of tannins can bind and retain the decapacitation factors on spermatozoa and seminal plasma membrane, thereby preventing premature capacitation and the early death of spermatozoa during storage (Calvi L. et al., 1995 and Mirajuddin, 2012). This researched have done to define two steps of semen preparation which fix with the local situation of area, which has limitation for AI equipment to increasing the population of Bali cattle.

MATERIAL AND METHODS

The main material was the extraction of Lamtoro leaves. Tannin is obtained by extracting the Lamtoro leaf at Integrated Research and Testing Institute of the University of Gadjah Mada (UGM LPPT). Tannin obtained was used as a supplement in cement dilution of the sperm after collection from the bull. Spermatozoa collected from Bull by the method of artificial vagina, after finished, the fresh semen were evaluated followed by dilution process. This dilution supplemented by tannin. Supplemented media with subsequent spermatozoa were stored in a refrigerator at a temperature of 4 degrees Celsius for 7 weeks. After 7 weeks, spermatozoa then ready for use artificial insemination in Bali cattle after the resipien was ready on estrus period. The waste product of Slaughter House was Semen collected the sperm from epididymis of Bull testes. The media for sperm were PBS, physiological saline and eosin-Negrosin. Furthermore, the testicles are washed using a physiological Na Cl solution and then collected evaluation of spermatozoa the epididymis is separated from the testicles. After spermatozoa regardless of caudal epididymis, sperm motility examination and counting of live-dead percentage of spermatozoa by eosin and negrosin staining.
In this study, the evaluation of the quality of spermatozoa has been carried out by examined the sperm motility under the microscope before use and the percentage of dead spermatozoa a live examined by negrosin eosin staining method. Pregnancy of Bali cattle have done checking at 2 months of age pregnancy after completed Artificial insemination by rectal palpation methods. All the data were analyzed by ANOVA and had significance difference by probability P< 0.05.

RESULTS AND DISCUSSION

Table 1: Mean of pregnancy rate, motility of spermatozoa and percentage of dead live sperm on three types of spermatozoa performed artificial insemination in Bali Cattle

<table>
<thead>
<tr>
<th>No</th>
<th>Sperm</th>
<th>Pregnancy rate (%)</th>
<th>Motility (%)</th>
<th>Live and dead presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>With tannin</td>
<td>21 ± 1.5</td>
<td>30 ± 1.8</td>
<td>35 ± 3.1</td>
</tr>
<tr>
<td>2</td>
<td>Epidemical sperm</td>
<td>18 ± 2.3</td>
<td>31 ± 2.3</td>
<td>36 ± 2.5</td>
</tr>
<tr>
<td>3</td>
<td>Control (frozen)</td>
<td>30 ± 3.1</td>
<td>40 ± 2.7</td>
<td>37 ± 2.8</td>
</tr>
</tbody>
</table>

As shown in Table 1 that no significant differences between the three types of spermatozoa that have been used, such as, first spermatozoa were not frozen but preserved with tannin on media diluent, spermatozoa results of the collection of epididymis in slaughterhouse and as a control spermatozoa frozen in liquid nitrogen. Pregnancy rate, motility rate and live and dead sperm showed no significantly difference it means the quality of three types sperm as equal, so base on these resulted we can use all types of sperm for AI on cattle. Motility and viability of sperm when preserved lower quality compared to fresh semen, it is supported by a statement Lamirande et al. (1997) that the metabolism of spermatozoa as living cells can produce a product called Reactive Oxygen Species (ROS). ROS production is a factor responsible for the decrease in motility, vitality, and the fertilization capability of spermatozoa during the process of preservation. Another study conducted by Ansari et al. (2010) stated that the freezing process for the purpose of preservation of spermatozoa can accelerate the production of ROS. Research conducted Awda et al. (2009) and Hall, C.A dan Cuppet, S.L.( 1997) states that the Reactive Oxygen Species has a dual function on spermatozoa. At low concentrations to induce ROS function in the process of sperm capacitation, hyper activation process, the integrity of the acrosome, and play a role also in the process of fusion of sperm and oocyte. Whereas at high concentrations and excess, ROS can cause DNA damage, inhibits the fusion process between spermatozoa and oocytes, as well as decrease the motility of spermatozoa. These data has been able to prove that the spermatozoa result of preservation without freezing and without liquid N\textsubscript{2}, at day 7 was still able to produce a pregnancy in Bali cattle, suggesting that preservation without liquid N2 can be as an alternative to that areas where lack of liquid N, for maintaining the frozen spermatozoa. Further use epididymis spermatozoa can also be used as an alternative to the male which slaughters as a source of spermatozoa and can be used as a rescue method for superior genetically males to be slaughtered. Sperm epididymis has opportunity to collected and still alive and has the capability for fertilization as explained by Tajick et al. (2007) too investigate the proportion of normal sperm cells in bovine epididymis, bovine testicles, obtained from a local slaughterhouses, epididymis were incised and sperm cells were transferred into slide glasses where eosin nigrosin stain was applied either in the place or in laboratory. When sperm were stained in slaughterhouse, 88% of caput epididymis sperm were a live Moreover Briz (1995) reported that Sperm quality in the caput, corpus, and caudal regions of the epididymis of healthy and sexually mature Landrace boars. Epididymis sperm characteristics were examined by light microscopy, scanning electron microscopy, and transmission electron
microscopy. Sperm vitality decreased very slightly although progressively with the transport of sperm through the epididymis. Fukuda Y et al. (1990) reported that the pregnancy is the one of the parameter the successfully of spermatozoa. In this research the pregnancy had occurred, that means the sperm quality had been proved had the quality and capability to fertilized the egg by AI methods. Local resources are also able to perform this simple technology and what is needed is assistance and guidance of the process of collection of epididymis spermatozoa from a local abattoir. The pregnancy success will make remote areas have no hope of developing reproductive technologies so that the population can be increased and the utilization of local resources will be growing.

CONCLUSION

This research could be concluded that the use of spermatozoa is preserved without freezing and utilization of spermatozoa derived from the epididymis as slaughterhouse waste. These methods a alternative source of spermatozoa for artificial insemination in Bali cattle. Even, this method had pregnancy rate still did not satisfactory yet, but has been able to prove and as an alternative method to develop artificial insemination of Bali cattle in remote areas to increase the cattle population of Bali and increasing of farmer income.

REFERENCES


Sperm Quality of Gembrong Goat in Bali, East Java and North Sumatera after Extended with Citrate-egg Yolk, Tris-egg Yolk and Andromed®

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ABSTRACT: The aims of this study were to compare tris-egg yolk and citrate-egg yolk extender on the quality of Gembrong goats semen in three different place, Bali, East Java, and North Sumatera. Semen was collected from 9 heads aged 2-4 years using artificial vagina. Semen was evaluated macroscopic and microscopically. Collected semen devided in two tubes and extended with citrate-egg yolk (CEY) and tris-egg yolk (TEY). There were significant differences (P<0.05) on the motility between CEY and TEY extender in the three places Bali (CEY (85 ± 3.5) TEY (90 ± 2.1)); East Java (CEY (82 ± 2.5) TEY (88 ± 3.1)); and North Sumatera (CEY (82 ± 4.5) TEY (85 ± 4.1)). There were no significant differences on viability and abnormality between CEY and TEY extender in the three places, viability in Bali (CEY (91 ± 3.5) TEY (92 ± 4.1)); East Java (CEY (88 ± 2.5) TEY (89 ± 3.1)); and North Sumatera (CEY (86 ± 2.5) TEY (85 ± 3.1)); abnormality in Bali (CEY (11 ± 1.5) TEY (10 ± 1.1)); East Java (CEY (13 ± 2.5) TEY (11 ± 2.1)); and North Sumatera (CEY (16 ± 4.5) TEY (14 ± 3.1)). In conclusion CEY support the sperm motility as good as TEY of Gembrong goats in three places Bali, East Java, and North Sumatera respectively.

Keywords: Gembrong goats, Semen, Citrate-Egg Yolk, Tris-Egg Yolk

INTRODUCTION

The Government has issued the Regulation No. 48/2011 on Animal Genetic Resources (AGR) and Livestock Breeding. One of AGR goats owned by Indonesia is Gembrong goat. Naming Gembrong on this goat come originally from the shape and condition of thick fur on the head, like long hair (Bali = Gembrong).

Sidadolog et al. (2013) reported that the number of Gembrong adult goats in farmer group of Wisnu Segara consists of 1 white goat aged 3.5 years, 2 brown goats (mixed) aged 2.5 years and 1 white goat aged 2 years. Body weight of Gembrong adult male goat varies from 18-35 kg in accordance with the age, with an average of 25 ± 7.44 kg. Ear length is relatively the same, between 12-15 cm with an average of 13.25 ± 1.29 cm. Head index, as the representation of head shape, is the ratio between the width and length of the head, ranging from 70.58-87.50%, with an average of 77.81 ± 7.90%. Head profile of Gembrong goat tends to shape long ellipse. Horn length also varies greatly, it is arched back and the length varies according to age between 8-15 cm with an average of 11.75 ± 2.99 cm. Body size of Gembrong goat shows characteristic signs of Kacang goat. Besides in Karangasem Bali, Gembrong goats are also farmed in Pacet, Mojokerto, East Java and Sei-Putih, North Sumatera.

The Research Center for Agricultural Technology Bali reported that, in 1970s the number of this goat was still about 200 heads. In 1996 the number decreased to 80 heads and in 1998 remained 64 heads. Astuti et al. (2007) stated that at present, the population of Gembrong goats is
very alarming. It is presumed that the population is diminishing every year, so there are no more than 50 heads. According to the records of Indonesia Science Institute (LIPI) and Sidadolog et al. (2013) the population of Gembrong goat at present is 29 heads farmed in Karangasem Bali and 20 heads in Mojokerto, making a total of 49 heads. Based on FAO (2004) this population is categorized as very dangerous and endangered.

Based on those facts, the efforts to save Gembrong goat are necessarily required so as to increase the population and to provide economic value for the farmer of Gembrong goat. One concrete step in saving Gembrong goat to improve the population is the need for semen bank. Semen bank is necessary because the population growth of Gembrong goat with natural mating is very slow and having some problems especially the needs for superior male. Another effort is to perform mating arrangement either naturally or using frozen semen from the semen bank through the Artificial Insemination (AI) or natural mating.

The use of extender is required in the production of frozen semen and it plays an important role in maintaining the quality of spermatozoa during storage. It is therefore necessary to study the quality of Gembrong goat semen using extenders such as citrate-egg yolk, tris-egg yolk and Andromed®.

This study was conducted to determine the sperm quality of Gembrong goat using citrate-egg yolk (CKT), tris-egg yolk (TKT), and Andromed® (ADR) as extenders in three conservation places of Gembrong goat in Bali, East Java and North Sumatera.

MATERIALS AND METHODS

This study used 9 male Gembrong goats aged 2-4 years from three (3) different places. The sperms were collected using artificial vagina, and then were assessed macroscopically and microscopically which includes motility, viability and abnormality of spermatozoa. The sperms were divided into three tubes and extended with CKT, TKT, and ADR. The data observed were motility, viability and abnormality of spermatozoa. Mean and standard deviation were used to analize sperm characteristics, while one-way ANOVA was used to analize motility, viability, and abnormality of spermatozoa.

RESULTS AND DISCUSSION

The results showed that the motility of Gembrong goat in Bali using extender of CKT 85±3.5, TKT 90±2.1 and ADR 93±2.1 had significant effect (P <0.05). While the viability CKT 91±3.5, TKT 92±4.1 and ADR 91±4.2 and abnormality CKT 11±1.5, TKT 10±1.1 and ADR 10±1.2 showed no significant differences in the three extenders (Table 1).

<table>
<thead>
<tr>
<th>Variable</th>
<th>CKT</th>
<th>TKT</th>
<th>ADR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motility</td>
<td>85 ± 3.5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>90 ± 2.1&lt;sup&gt;b&lt;/sup&gt;</td>
<td>93 ± 2.1&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Viability</td>
<td>91 ± 3.5</td>
<td>92 ± 4.1</td>
<td>91 ± 4.2</td>
</tr>
<tr>
<td>Abnormality</td>
<td>11 ± 1.5</td>
<td>10 ± 1.1</td>
<td>10 ± 1.2</td>
</tr>
</tbody>
</table>

<sup>a,b,c</sup> different superscripts in different columns indicate significant differences (P <0.05)
Motility of Gembrong goat in East Java using extenders of CKT 82±2.5, TKT 88±3.1, and ADR 89±3.2 showed significant effect (P <0.05). While the viability CKT 88±2.5, TKT 89±3.1, and ADR 92±3.3 and abnormality CKT 13±2.5, TKT 11±2.1 and ADR 10±2.4 did not show significant differences (P> 0.05) in the three extenders. (Table 2)

Table 2. Average of motility, viability and abnormality of spermatozoa of Gembrong goats in East Java extended with CKT, TKT, and ADR

<table>
<thead>
<tr>
<th>Variable</th>
<th>CKT</th>
<th>TKT</th>
<th>ADR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motility</td>
<td>82 ± 2.5a</td>
<td>88 ± 3.1b</td>
<td>89 ± 3.2c</td>
</tr>
<tr>
<td>Viability</td>
<td>88 ± 2.5</td>
<td>89 ± 3.1</td>
<td>92 ± 3.3</td>
</tr>
<tr>
<td>Abnormality</td>
<td>13 ± 2.5</td>
<td>11 ± 2.1</td>
<td>10 ± 2.4</td>
</tr>
</tbody>
</table>

a,b,c different superscripts in different columns indicate significant differences (P <0.05)

Motility of Gembrong goats in North Sumatera using extenders of CKT 82±4.5, TKT 85±4.1, and ADR 87±4.1 showed significant effect (P <0.05). While the viability CKT 86±2.5, TKT 85±3.1, and 86±3.3 and abnormality CKT 16±4.5, TKT 14±3.1 and ADR 15±4.1 showed no significant differences in the three extenders. (Table 3)

Table 3. Average of motility, viability and abnormality of spermatozoa of Gembrong goats in North Sumatera extended with CKT, TKT, and ADR

<table>
<thead>
<tr>
<th>Variable</th>
<th>CKT</th>
<th>TKT</th>
<th>ADR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motility</td>
<td>82 ± 4.5a</td>
<td>85 ± 4.1b</td>
<td>87 ± 4.1c</td>
</tr>
<tr>
<td>Viability</td>
<td>86 ± 2.5</td>
<td>85 ± 3.1</td>
<td>86 ± 3.3</td>
</tr>
<tr>
<td>Abnormality</td>
<td>16 ± 4.5</td>
<td>14 ± 3.1</td>
<td>15 ± 4.1</td>
</tr>
</tbody>
</table>

a,b,c different superscripts in different columns indicate significant differences (P <0.05)

Motility showed significant differences among the three extenders. The highest motility was in ADR extender in three (3) different places 93±2.1 in Bali, 89±3.2 in East Java and 87±4.1 in North Sumatera. Andromed® is one of commercial extenders that is made from tris comprising of phospholipids, tris-(hydroxymethyl)-aminomethan, citric acid, fructose, glycerol, tilosin tartrate, gentamicin sulfate, spektinomycin, and lincomycin (Minitub, 2001).

The content of fructose, beside as a source of energy that can be readily used in metabolism, is also known to be able to maintain osmosis pressure in extender (Azawi et al., 1993). Surachman et al. (2009) reported that the addition of sucrose 4% in Andromed® extender will be able to maintain the quality of epididymis spermatozoa of Belang buffalo up to 24 hours of storage in liquid form.

The energy generated from the process of sucrose breakage can be used for biomolecular processes such as protein synthesis to maintain cell organelles to remain active to perform its functions in keeping spermatozoa alive. Andromed® has the best effect on the quality of Limousin-cow spermatozoa than tris-egg yolk and skim milk (Suharyati and Hartono, 2011).

The viability of the three extenders in the 3 (three) places showed no significant differences. This is because the basic material of the three extenders is egg yolk which acts as an energy source and a protective agent containing lipoproteins and lecithin to protect and maintain the integrity of protein coat on the cell membrane of the sperm to prevent cold shock (Salisbury and Van demark, 2001).
Abnormality of the three extenders in the 3 (three) places showed no significant differences. Abnormality was still within the limits of the abnormality for artificial insemination (AI) as recommended by Toelihere (1993) and Hafez (2000), as long as it does not reach 205. Abnormal spermatozoa is usually caused by the shock of cold or heat, X-ray, an imbalance of nutrients and protein (Arifiantini et al., 2005)

CONCLUSION

The use of extender of CKT, TKT, and ADR affected the motility but did not affect the viability and abnormality in sperm of Gembrong goats in some places of Bali, East Java and North Sumatera.

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The Response of Gonadotrophin Hormone at Different Dose on Time of Oestrus, the Profile of Progesterone, Estrogen and Corpus Luteum of Ongole Crossed Cows

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ABSTRACT: Pregnant mare’s serum gonadotrophin (PMSG) was one of the gonadotrophin hormones which often used for improving the process of ovarian follicular development and formation of egg cells (oocytes). This study aims to determine the effect of inducing hormone gonadotrophin (PMSG) at different doses on the incidence of oestrus, estrogen and progesterone concentrations in the blood and the number of corpus luteum. The research was conducted approximately four months at Indonesia Beef Cattle Research Station (IBCRS). The treatment of different PMSG dose, namely A = 1000 IU, B = 1300 IU and C = 1600 IU. The implementation of gonadotrophin hormones began with the ovulation synchronization (ovsynch) using a combination of Gonadotropin Releasing Hormone (GnRH) and Prostaglandin (PGF) 2 alpha and PMSG. Completely randomized design was used in this research and collected data were analyzed one-way ANOVA. Variables measured were: time of oOestrus and mating, the concentration of the hormone estrogen, progesterone and the number of corpus luteum. The results showed that there was no difference between treatment of PMSG hormones or oestrus sign. PMSG treatment of the time of first oestrus at different dose showed treatment A = 48.0 ± 50.3 hours, B = 45.6 ± 12.9 hours, C = 55.2 ± 48.1 hours. The second of oOestrus and mating evidence at different dose showed treatment A, B and C, were 67.2 ± 47.7; 69.6 ± 44.5 and 105.6 ± 68.1 hours, respectively. Effect of different doses of PMSG treatment was also not different on the concentration of estrogen and progesterone, namely, 16.4 ± 19.4 pg/ml and 7.2 ± 7.1 ng/ml (treatment A), 25.9 ± 17.4 pg/ml and 6.7 ± 5.8 ng/ml (treatment B), and 20.9 ± 20.0 pg/ml and 5.0 ± 6.4 ng/ml (treatment C), while the number of corpus luteum in ovarian right and left on the treatment, also showed no difference, namely 2.5 ± 2.4 ovaries (treatment A), 3.3 ± 1.4 ovaries (treatment B) and 2.1 ± 1.9 ovaries (treatment C). It can be concluded that the treatment of combination hormone of GnRH, PGF 2 alpha, PMSG and showed positive response to the appearance of oestrus and the number of corpus luteum in Ongole Crossed cows.

Keywords: Ongole Crossed Cows, Progesterone, Estrogen, Corpus Luteum.

INTRODUCTION

Pregnant mare’s serum gonadotrophin (PMSG) is a gonadotrophin hormone which can be used to improve performance in the ovarian follicle growth process and the formation of the oocyte. Maximazing resource follicles as endogenous hormones can be done by super ovulation. Super ovulation is a way to increase the number of oocytes in the ovaries until ovulation occurs. The next development was followed by an increase in the number of corpus luteum that one of its functions is as a producer of progesterone to maintain pregnancy and support the life of the fetus until birth.

Super ovulation in cattle can use the PMSG as PMSG injection can be performed only once
with a 40-125 hour time interval (Gonzalez et al., 1994; Hernawan, 2003) compared to Follicle Stimulating Hormone/FSH (injection twice) at intervals of 12 hours for 3-5 days (Situmorang and Triwulaningsih, 2004). PMSG also has the ability as hormones FSH and LH as well as stimulating the secretion of hormones in the formation of the hormone progesterone, ovulation (Bindon and Piper, 1982; Bono et al., 1991; Anchap Akesan, 1997). Synchronization programs with combination of PMSG and PGF2α can increase the number of corpus luteum, oestrus and pregnancy (Barile et al., 2007; Shu-Bin Fu et al., 2012).

This study aims to determine the effect of the hormone gonadotrophin (PMSG) at different dose on the incidence of oestrus, estrogen and progesterone concentrations in blood and the amount of the corpus luteum in Ongole Crossed cows.

MATERIALS AND METHODS

Research was conducted approximately four months at Indonesia Beef Cattle Research Station (IBCRS). The treatment of different PMSG doses were: A = 1000 IU, B=1300 IU and C = 1600 IU. Before the injection of PMSG, injection combination Prostaglandin (PGF) 2 alpha with super ovulation schedule on the first day injected GnRH (1 cc IM), day 8 was injected PGF 2 alpha (5 cc IM), day 10 was injected GnRH (1 cc IM), day 11 early oestrus, days to -21 injected PMSG appropriate dose and on days 22-28 of lust and mating.

Implementation of gonadotrophin hormones began with the synchronization of ovulation using a combination of GnRH, and PGF2 alpha. Collected data were processed using the Completely Randomized Disign and one-way ANOVA. Variables measured were: time of oestrus and mating, the concentration of the hormone estrogen, progesterone and the number of corpus luteum (CL).

RESULTS AND DISCUSSION

Oestrus and Mating

Oestrus in cows depends on several factors, such as lactating cows still produce the hormone prolactin to stimulate the anterior pituitary to secrete FSH and LH which could lead to oestrus in cows. The incidence of oestrus in cattle after injected GnRH, PGF2 alpha, and PMSG with different doses are presented in Table 1.

Table 1. Time of oOestrus and mating in PO cows who received treatment gonadotrophin hormone

<table>
<thead>
<tr>
<th>Item</th>
<th>Treatment doses</th>
<th>Value P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oestrus time after injection of hormones Gn RH and PGF 2 alpha (hours)</td>
<td>A = 48.0±50.3, B = 45.6 ± 12.9, C = 55.2±48</td>
<td>0.875</td>
</tr>
<tr>
<td>Oestrus and mating time after the injection of PMSG (hours)</td>
<td>A = 67.2 ± 47.7, B = 69.6±44.5, C = 105.6±68.1</td>
<td>0.179</td>
</tr>
</tbody>
</table>

Note: A=Dose PMSG 1000 IU, B=dose PMSG 1300 IU dan C=dose PMSG 1600 IU

The results showed that there was no difference between the dose of combination hormone ovulation to the oestrus and mating time (Table 1). Research results together with a report
(Gonzalez et al., 1994; Hernawan, 2003) showed that the half-life ranging from 40 hours to 125 hours PMSG, so only required one injection. Thus dose of PMSG 1000 IU is sufficient to indicate the time oestrus and mating in cattle PO, so it is necessary to add dose of PMSG as suggested by Situmorang and Triwulaningsih (2005) that for the injection of PMSG just once, whereas FSH injections twice at intervals of 12 hours for 3-5 days. Lower doses of PMSG were suggested to increase of the percentage of pregnancy rate in cow’s lower side effects (Shu-Bin Fu et al., 2012).

**Estrogen, Progesterone, Corpus Luteum**

Table 2. The concentration of the hormones estrogen and progesterone in PO cows who received treatment gonadotrophin hormone

<table>
<thead>
<tr>
<th>Name of Hormone</th>
<th>Treatment doses</th>
<th>Value P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estrogen hormone levels (pg / ml)</td>
<td>16.4±19.4</td>
<td>25.9±17.4</td>
</tr>
<tr>
<td>Progesterone hormone levels (ng / ml)</td>
<td>7.2±7.1</td>
<td>6.7±5.8</td>
</tr>
</tbody>
</table>

*Note: A=Dose PMSG 1000 IU, B=dose PMSG 1300 IU dan C= dose PMSG 1600 IU*

The concentration of the hormone estrogen and progesterone on third PMSG treatment were no different, but the concentration was enough progesterone and estrogen combination with a GnRH injection, PGF 2 alpha and PMSG 1000 IU doses, to super ovulation with the number of corpus luteum marked more than one (Table 3). The concentration of progesterone on the day of initiation of superovulation was positively correlated with ovulation rate and the level on the day of oestrus was negatively correlated with superovulatory response (Anchap Akesan, 1997) and PMSG have the ability as hormone FSH and LH as well as stimulating secretion of hormones in the formation of the hormone progesterone, ovulation (Bindon and Piper, 1982; Bono et al., 1991; Anchap Akesan, 1997).

Table 3. Total of corpus luteum in PO cows who received treatment gonadotropin hormone

<table>
<thead>
<tr>
<th>Number of Corpus Luteum</th>
<th>Treatment doses</th>
<th>Value P</th>
</tr>
</thead>
<tbody>
<tr>
<td>corpus luteum right side (ovary)</td>
<td>1.5±1.3</td>
<td>2.3±1.2</td>
</tr>
<tr>
<td>corpus luteum left side (ovary)</td>
<td>1.0±1.4</td>
<td>1.2±1.0</td>
</tr>
<tr>
<td>Total of corpus luteum (ovary)</td>
<td>2.5±2.4</td>
<td>3.3±1.4</td>
</tr>
</tbody>
</table>

*Note: A=Dose PMSG 1000 IU, B=dose PMSG 1300 IU dan C= dose PMSG 1600 IU*

Rectal palpation results showed that the number of corpus luteum was no difference between the combination of GnRH, PGF 2 alpha and PMSG doses, but the number of corpus luteum seems to have more than one (Table 3). Giving PMSG combined with PGF 2 Alpha can also increase the number of corpus luteum, oestrus and pregnancy ((Barile et al., 2007; Shu-Bin Fu et al., 2012). Similarly, the opinion Udin et al. (2007) showed that PMSG directly affect oocyte maturation by stimulating the development of the oocyte nucleus so that the number of oocytes that stops its development only slightly. With the development of oocytes that more and more and the faster it will effect the number of corpus luteum which will be formed after ovulation (Anchap Akesan, 1997).
CONCLUSION

It is concluded that combination hormone of GnRH, PGF 2 alpha, and PMSG showed positive response to the appearance and the number of corpus luteum oestrus in cattle of local PO.

REFERENCES


Reproductive performances of Thin-tailed and Garut ewes raised in the same condition


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Corresponding email: panjono@ugm.ac.id

ABSTRACT: This study was conducted to observe the reproductive performances of Thin-tailed and Garut ewes which were raised in the same condition. Six heads of Thin-tailed ewes and ten heads of Garut ewes were used in this study. The pregnant ewes were raised individually in the slatted house. After lambing, the ewes were kept together with their lambs prior to weaning. After weaning, the ewes were sent to the colonial pen, raised together with the same breed ram for mating. They were raised until their next lambing. Data collected was analyzed using one way analysis of variance. Litter size, birth weight, weaning weight, preweaning morality of Thin-tailed and Garut lambs were 1.5±0.6 and 1.3±0.5 heads, 2.7±0.7 and 1.8±0.8 kg/head, 9.7±3.4 and 7.7±3.7 kg/head, and 8.3±20.4 and 15.0±33.8%, respectively. There was no significant difference litter size, birth weight, weaning weight, preweaning morality between Thin-tailed and Garut lambs. Lambing interval, reproduction index and production index of Thin-tailed and Garut ewes were 271.3±55.9 and 228.0±40.4 days, 1.8±0.6 and 1.7±0.9 head/year, and 19.3±12.7 and 16.1±12.4 kg/year, respectively. There was no significant difference lambing interval, reproduction index and production index between Thin-tailed and Garut ewes. It is concluded that reproductive performance of Thin-tailed and Garut ewes which are raised in the same condition are similar.

Keywords: Reproductive performance, Thin-tailed ewe, Garut ewe

INTRODUCTION

Sheep have been a popular animal in Indonesia. In 2014, the population of sheep in Indonesia is 15.72 million heads and the majority of them are in Java and Sumatera islands (BPS, 2015). Breed of sheep raised by farmer is vary depend on the farmers preference and government program. Some of the breeds which are common raised in Indonesia are Thin-tailed and Garut sheep. Thin-tailed sheep are developed in Java and Sumatera islands. Javan Thin-tailed sheep are characterized with thin of tail and black spotted around eyes (Astuti et al., 2007). Furthermore, Astuti et al. (2007) stated that they are small in size but adaptive to the poor condition. Garut sheep, also known as Priangan sheep, are developed in Garut regency, West Java province. They are characterized with rudimental or small earlobe and triangular tail (Kementan, 2011). Garut ram have well developed horn and commonly used for ram fighting.

Because of their attractive appearance and performance, Garut sheep are getting popularity among farmers outside Garut regency, including Yogyakarta Special Province. Several studies have been done to observe the reproductive performance of Thin-tailed and Garut sheep. However, those studies were done in the separated location and there is little information about their performances which were raised in the same condition. This study was conducted to observe the reproductive performances of Thin-tailed and Garut ewes which were raised in the same condition.
MATERIALS AND METHODS

Study was conducted at Laboratory of Meat, Draught and Companion animals, Faculty Animal Science, Universitas Gadjah Mada, Yogyakarta, Indonesia. Six heads of Thin-tailed ewes and ten heads of Garut ewes were used in this study. The pregnant ewes were raised individually in the slatted house. After lambing, the ewes were kept together with their lambs prior to weaning. After weaning, the ewes were sent to the colonial pen, raised together with the same breed ram for mating. All of animals were fed with the same diet which consisted of concentrate and King Grass. Concentrate and King Grass were given ad libitum. They were raised until their next lambing.

Variables observed included litter size, birth weight, weaning weight, preweaning morality, lambing interval, reproduction index (RI) and production index (PI). Litter size, birth weight, weaning weight and preweaning mortality were observed on the first lambing. RI was calculated as follows:

\[
RI \ (\text{head/year}) = \frac{365 \ \text{Litter size (head)} \times (1 - \text{mortality} \ (%))}{\text{Lambing interval (day)}}
\]

PI was calculated as follow:

\[
PI \ (\text{kg/year}) = RI \ (\text{head/year}) \times \text{weaning weight (kg/head)}
\]

Data collected was analyzed using one way analysis of variance.

RESULTS AND DISCUSSION

Reproductive performance of Thin-tailed and Garut ewes is presented at Table 1. There were no significant difference litter size, birth and weaning weights, preweaning mortality and lambing interval between Thin-tailed and Garut ewes. This might due to the closed genetic relationship between them. Astuti et al. (2007) described that Garut sheep was the result of crossbreeding of Thin-tailed sheep and Merino sheep and, later, the crossbred were crossed with South African Fat-tailed sheep. Both Thin-tailed and Garut sheep already adapted to Indonesian climate.

Table 1. Reproductive performance of Thin-tailed and Garut ewes which were raised in the same condition

<table>
<thead>
<tr>
<th>Variable</th>
<th>Thin-tailed</th>
<th>Garut</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Litter size (head)</td>
<td>1.5±0.6</td>
<td>1.3±0.5</td>
<td>Ns</td>
</tr>
<tr>
<td>Birth weight (kg/head)</td>
<td>2.7±0.7</td>
<td>1.8±0.8</td>
<td>Ns</td>
</tr>
<tr>
<td>Weaning weight (kg/head)</td>
<td>9.7±3.4</td>
<td>7.7±3.7</td>
<td>Ns</td>
</tr>
<tr>
<td>Preweaning mortality (%)</td>
<td>8.3±20.4</td>
<td>15.0±33.8</td>
<td>Ns</td>
</tr>
<tr>
<td>Lambing interval (day)</td>
<td>271.3±55.9</td>
<td>228.0±40.4</td>
<td>Ns</td>
</tr>
<tr>
<td>Reproduction index (head/year)</td>
<td>1.8±0.6</td>
<td>1.7±0.9</td>
<td>Ns</td>
</tr>
<tr>
<td>Production index (kg/year)</td>
<td>19.3±12.7</td>
<td>16.1±12.4</td>
<td>Ns</td>
</tr>
</tbody>
</table>

Ns: non-significant.

There was no significant difference RI between Thin-tailed and Garut ewes (Table 1). This was due to the similar lambing interval, litter size and preweaning mortality between them. There
was no significant difference PI between Thin-tailed and Garut ewes. This was due to the similar RI and weaning weight between them.

In addition to the closed genetic relationship between Thin-tailed and Garut sheep, standard deviation values of all variables observed were high. This indicated that the genetic variation in every group was high.

CONCLUSIONS

Reproductive performances of Thin-tailed and Garut ewes which are raised in the same condition are similar. Selective breeding is needed to improve the performance of Thin-tailed as well as Garut sheep.

REFERENCES


Effect of Doe Blood Serum Supplementation to Buck Semen on the Head to Head Agglutination Test

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²Faculty of Agriculture Studies- Department of Animal Production, Sudan University Of Science and Technology, Khartoum North, Shambat P.O Box: 407.

Corresponding Email: haren20101@hotmail.com

ABSTRACT: The aim of this study was to determine the effect of adding caprine blood serum on the extended semen quality of two exotic breeds and one local Sudanese breed namely Nubian (local), Saaneen and Shami (exotic). This experiment was conducted in two farms, the first in Khartoum Center for Improvement Goat Breed (Ministry of Animals Wealth). The second farm in Animal Production Research Centre farm for small ruminants belonging to the Ministry of Animal Wealth. Semen and blood samples from 27 bucks and 27 doe were collected by use (AV). The goat blood serum was added to skimmed milk and egg yolk semen extenders, serum composed 10% of each extender. The effects of the goat blood serum, together with skim milk and egg yolk extenders for the stored semen were evaluated in vitro at temperatures of 5°C. The results demonstrated that the characteristics of 10% serum treated semen extended in egg yolk or skim milk and stored at 5°C was significant (P>0.05) effects on all studied traits compared with skim milk or yolk egg extended semen. The sex associated with skim milk and egg yolk in the three breeds on the motility, acrosome integrity and agglutination. Hormonal effect also observed in this study reflected sex influence on this phenomenon since demonstrating the significant effect of estrogen comparing to progesterone. The effect of blood serum and the conservation period on the stored semen are also quite clear in this study. A significant (P>0.05) difference showed the Nubian semen maintained better quality during 7 days of conservation compared to Saaneen and Shami semen.

Keywords: goat breeds, doe blood serum, buck semen, and (HHA) test.

INTRODUCTION

The population of goats in Sudan since 2011 is 30,649,000 according to Ministry of Animal resources (Robert and Thomas, 2001). AI in animal breeding programs provides an opportunity to accelerate genetic improvement though widespread use of desirable sires’. Concomitant with this advantage is the control and check of diseases and their spread. One of the major problems in the using of (AI) is the decreasing quality of semen during cryopreservation and thawing. Researchers have made considerable progress in correcting this problem, but have only been partially successful, especially in regard to certain animals, e.g, buffalo (Makkawi, 1987) (Robert Taylor and Thomas, 2001). The semen is usually mixed with an extender that dilutes to a greater the ejaculate volume which allows a single ejaculate to be processed into several units of semen. The extender is usually composed of nutrients such as milk, egg yolk, a citrate buffer, antibiotics, and glycerol (Robert Taylor and Thomas 2001). In the Sudan, most of the cattle and goats population is scattered in areas lacking facilities such as refrigeration plus the problem of improper
transportation must be considered, for an effective of artificial insemination program in those areas, fresh semen extension and transportation without loss of semen quality is essential for AI to be successful (Makkawi, 1987). Estrogens are the group of hormone derived from estradiol - 17-b steroids, mainly secreted by ovaries, placenta, and even testes (Finlay, 1976). The main function of estrogens is the development, functioning and maintenance of the female genital organs, by stimulating protein synthesis and mitosis (Finlay, 1976) while Hafez (1993) added that estrogens in the doe produced by theca enterna and granulose cells of the ovarian follicle under the positive control of LH and FSH. The secondary roles of estrogens include body confirmation and mammary gland development, Progesterone is produced by CL of non-pregnant doe and CL and placenta of the pregnant doe (Gordon, 1997 and Robinson, 1988). The effect of progesterone is obvious at the target tissue, after that tissue has been stimulated by estrogen which leads to synergistic response. When progesterone level in blood is constant, it will prohibit the pituitary gland from secretion of GNRH, which appears in the length of diestrus phase.

MATERIALS AND METHODS

The experiment was conducted in two farms are: Khartoum Center for Improvement of Goat Breed (Ministry of agriculture and Animals Wealth and Irrigation). The farm import two kinds of goats the first one is Saaneen (females) form Holland, and the second one is Shami breed, which comes from Cyperus and this breed seems to be big in shape and have long hair and comparatively low milk production. The second farm is Animal Production Research Centre Farm (small ruminants unite ) belonging to the Ministry of Animal Resource and Fisheries for local breed (Nubian goats). Semen and blood samples from 27 bucks and 27 doe were collected by use (AV) using the technique developed by Salisbury and Willett (1940) The goat blood serum was added to skimmed milk and egg yolk semen extenders, serum composed 10% of each extender. The effects of the goat blood serum, together with skim milk and egg yolk extenders for the stored semen were evaluated in vitro at temperatures of 5°C. Blood from the jugular veins of three breeds centrifuged at 6000 rpm for 15 minutes to extract the serum. The serum was conserved in a water bath at 37°C for 30 minutes to avoid immunological reactions due to the blood compliments (Senger Saacke, 1976) and to destroy spermicidal factors (Chang, 1947, Aalseth et al., 1978). The serum was identified by labeling according to the breed and stored in refrigerator until it was used. Then added Penicillin (act in both Gram +ve and Gram -ve bacteria and streptomycin were added), each 100 ml of skim milk extender contained 75 mg of penicillin and 50 mg of streptomycin. This blood serum was later used to constitute 10% volume of the skim milk or yolk egg. Each of the sera collected from does was used separately in an extended semen samples to compare the influence of sex and serum on the extended semen.

Semen Extension: each of the semen samples extended with one of six extenders.

The composition of those extenders as following:

1. Skim milk alone + (SSM)
2. Egg yolk alone (SEY)
3. Skim milk + 10% doe blood serum (SSMdS)
4. Egg yolk + 10% doe blood serum (SEYdS)
Preparing of blood serum and egg yolk

The skim milk was heated to 92-95°C for 10 minutes and cooled in controlled room temperature (20 to 22°C). The heating was performed to destroy Lactenin, a spermicide (Flipse et al., 1954) recommended procedure of heating the milk by boiling water in a stainless steel pan, adding 200 ml of skim milk to a sterilized flask, placing it in the pan of hot water and controlling at 92 to 95°C for 10 minutes was used. The skim milk was then cooled to 5°C and antibiotics were added. The extender then ready for use (Skim milk 0.5% fat). The yolk of an egg was separated on a filter paper. Fresh eggs were always obtained, cracked gently to pour off the egg white and have separated the yolk. The egg yolk was then put on filter paper to be separated and collected. Statistical Analysis, Data was analyzed by (SAS) programming. One-factor Analysis of Variance (CRD) was performed. Means were tested and to separated treatment using Duncan’s Multiple Range Test (DMRT) referred to (Steel et al., 1997), correlation also was used.

RESULTS AND DISCUSSION

Table (1): Correlation (r) between mortality and agglutination of female goats’ serum

<table>
<thead>
<tr>
<th>Goat breed</th>
<th>Variable</th>
<th>Day of Replicate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Nubian</td>
<td>NM</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>NE</td>
<td>0.83</td>
</tr>
<tr>
<td>Saaneen</td>
<td>SM</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>0.79</td>
</tr>
<tr>
<td>Shami</td>
<td>ShM</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>ShE</td>
<td>0.70</td>
</tr>
</tbody>
</table>

Table (2): Correlation (r) between agglutination and acrosome integrity on serum of female goats

<table>
<thead>
<tr>
<th>Goat breed</th>
<th>Variable</th>
<th>Day of Replicate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Nubian</td>
<td>NM</td>
<td>0.59</td>
</tr>
<tr>
<td></td>
<td>NE</td>
<td>0.81</td>
</tr>
<tr>
<td>Saaneen</td>
<td>SM</td>
<td>0.59</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>0.77</td>
</tr>
<tr>
<td>Shami</td>
<td>ShM</td>
<td>0.63</td>
</tr>
<tr>
<td></td>
<td>ShE</td>
<td>0.65</td>
</tr>
</tbody>
</table>

Table (3): Correlation (r) between agglutination and estrogen on serum of female goats

<table>
<thead>
<tr>
<th>Goat breed</th>
<th>Variable</th>
<th>Day of Replicate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Nubian</td>
<td>NM</td>
<td>0.62</td>
</tr>
<tr>
<td></td>
<td>NE</td>
<td>0.88</td>
</tr>
<tr>
<td>Saaneen</td>
<td>SM</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>0.84</td>
</tr>
<tr>
<td>Shami</td>
<td>ShM</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>ShE</td>
<td>0.80</td>
</tr>
</tbody>
</table>

Table (4): Correlation (r) between agglutination and progesterone on serum of female goats

<table>
<thead>
<tr>
<th>Goat breed</th>
<th>Variable</th>
<th>Day of Replicate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Nubian</td>
<td>NM</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>NE</td>
<td>0.70</td>
</tr>
<tr>
<td>Saaneen</td>
<td>SM</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>0.60</td>
</tr>
<tr>
<td>Shami</td>
<td>ShM</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>ShE</td>
<td>0.50</td>
</tr>
</tbody>
</table>

NM = Nubian with skimmed milk, NE = Nubian with egg yolk, SM= Saaneen with skimmed milk, SE= Saaneen with egg yolk, ShM = Shami with skimmed milk, ShE= Shami with egg yolk.
Table (5): Correlation (r) between acrosome integrity and estrogen on serum of female goats

<table>
<thead>
<tr>
<th>Goat breed</th>
<th>Variable</th>
<th>Day of Replicate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Nubian</td>
<td>NM</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>NE</td>
<td>0.70</td>
</tr>
<tr>
<td>Saaneen</td>
<td>SM</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>0.60</td>
</tr>
<tr>
<td>Shami</td>
<td>ShM</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>ShE</td>
<td>0.50</td>
</tr>
</tbody>
</table>

NM = Nubian with skimmed milk, NE = Nubian with egg yolk, SM= Saaneen with skimmed milk, SE= Saaneen with egg yolk, ShM = Shami with skimmed milk, ShE= Shami with egg yolk.

Table (6): Correlation (r) between acrosome integrity and progesterone on serum of female goats.

<table>
<thead>
<tr>
<th>Goat breed</th>
<th>Variable</th>
<th>Day of Replicate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Nubian</td>
<td>NM</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>NE</td>
<td>0.70</td>
</tr>
<tr>
<td>Saaneen</td>
<td>SM</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>0.60</td>
</tr>
<tr>
<td>Shami</td>
<td>ShM</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>ShE</td>
<td>0.50</td>
</tr>
</tbody>
</table>

NM = Nubian with skimmed milk, NE = Nubian with egg yolk, SM= Saaneen with skimmed milk, SE= Saaneen with egg yolk, ShM = Shami with skimmed milk, ShE= Shami with egg yolk.

Table (7): means of blood hormone (Estrogen and Progesterone) of female goats

<table>
<thead>
<tr>
<th>Goat Breed</th>
<th>Estrogen</th>
<th>Progesterone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nubian female</td>
<td>8 ±0.9</td>
<td>3 ±1.2</td>
</tr>
<tr>
<td>Saaneen female</td>
<td>7 ±0.9</td>
<td>2.7 ±1.2</td>
</tr>
<tr>
<td>Shami female</td>
<td>5.5 ±0.9</td>
<td>2.5 ±1.2</td>
</tr>
</tbody>
</table>

Mean ± SD value(s) bearing different superscript letter(s) within columns are significantly different (P<0.05).

Three breeds of goats namely Nubian (local) and Saaneen and Shami (exotic) were used in this study to determine the effect of adding caprine blood serum on the extended semen quality of those breeds. The results showed that sex associated with breed effect in all studied characters since there is a significant (P>0. 05) effect of doe’s blood serum of Nubian goats, Saaneen and Shami respectively. Estrogen and progesterone in blood serum were studied to investigate the effects of semen extenders. Semen of Nubian buck containing egg yolk plus doe blood serum showed significant effect (P>0. 05) and high correlation between mortality and agglutination (Table 1), acrosome integrity and agglutination (Table 2), agglutination and estrogen (Table 3), agglutination and progesterone (Table 4), acrosome integrity and estrogen (Table 5) and acrosome integrity and progesterone (Table 6), this might be due to the effect of the hormones in the does blood serum and some enzymes in doe serum. This result agreed with Makkawi (1987) which reported the sex hormonal effect, and with Mariam (2000) and Austin (1981) repored that the female serum had some enzymes and hormones. The results obtained in this study also support the suggestion of Senger et al. (1981) that the marked difference in the degree and type of HHA caused by blood sera from the male and female due to the type of agglutinin present in the blood serum which might be under reproductive hormonal influence.
CONCLUSION

Does blood serum is recommended over buck serum for the extension of semen, which enhancing HHA test.

ACKNOWLEDGEMENT

This paper funded by authors.

REFERENCES

Determinant of Intangible Benefit and Cost in Integrated Biosystem Cattle in Yogyakarta

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ABSTRACT: Implementation of Rural Industries Research and Development Corporation (IRDC) through integrated farming with bio-cycle farming or integrated biosystem is very useful to increase the Total Economic Value. The objectives of the research was identify and measure the intangible value benefit and cost, calculate the Total Economic Value (TEV), and analyze the sensitivity of the farm business with the assumption that the change in maintenance management, pricing, and environmental changes. Sampling was carried out on cattle farmers who are members of the village group system and individual system in Sleman Regency which implement business diversification cattle and crops and organic vegetable and waste management into organic fertilizer. Measurement of intangible benefits and costs, Total Economic Value and sensitivity were analyzed descriptively in table form. The results showed that the highest value of the intangible benefits derived from the use of manure that adds value to land productivity 6,196,500 IDR/head/year or 4,312,620 IDR/AU/year, Value of intangible costs are Willingness To Accept (WTA) of 3,320,000 IDR/head/year or 2,199,500 IDR/AU/year higher than Willingness To Pay (WTP) of 456,765 IDR/head/year or 302,605 IDR/AU/year. The Total Economic Value of the assets showed that resource in village group system 237,548,645 IDR/head/year or 157,375,978 IDR/AU/year. An increasing number of cows population and improvement of the environment by offering individual system farmers willingness to relocate to the village group provides the highest TEV so that it can be concluded that the need for linkages between economic and environmental factors to increase the Total Economic Value.

Keywords: intangible benefit, intangible cost, integrated biosystem, Total Economic Value

INTRODUCTION

Every economic activity should make the process of “internalizing external costs” which takes into account the environmental cost or value of the losses suffered by the other party as one of the main components of production costs (Pearce et al., 1990). Measurement appreciation of the environment is needed to determine the intangible cost is how much willingness to pay for external costs or willingness to pay (WTP) and a willingness to accept compensation or Willingness To Accept (WTA) in cattle (Cao et al., 2010, Carson et al., 2000)). On the other hand in the assessment of environmental economics-cattle farming need to include intangible benefits or indirect use value which is a function of livestock as savings and insurance as well as the value of land productivity of livestock manure utilization. This is expected to increase the total economic value of added value environmental resources. The total economic value (TEV) is applied here as framework used to categorise ecosystem values (Hugues, 2011, Fagiola et al., 2004).

MATERIAL AND METHOD

Sleman regency election as a test site for the reason that in this area of beef cattle that could potentially be developed and had many cattle village group (Anonymous, 2003). The material in this study are farmer Sembada samples belonging to the enclosure of village groups and individual systems. Sampling was done by census farmers are taking all the respondents were joined as
members of as many as 24 farmers. Which shows the Total Economic Value of the asset value of livestock resources formulated: Net benefit = \( (\Delta B_t - \Delta C_t) / \text{head or AU / year} \) (after the discount factor is discounted at an interest rate of agricultural loans x number of cattle (head or AU).

Sensitivity analysis related to the possibility of a change in maintenance management, the addition of the cow population, output price, environmental changes then made a simulation and TEV ordered by highest value. What percent decline in CI values, the increase in selling prices, great willingness to accept compensation for relocating farmers individual system to village group is determined through interviews with farmers.

RESULTS AND DISCUSSION

Application of Integrated Bio Cycle Farming in the village group produces security measures against the resilience and availability of food and energy, namely: (1) F1 (food), namely the members of the group seeking human food in the form of plant food (rice plants, crops and vegetables) and cattle meat, (2) F2 (feed), from the cultivation of rice and pulses waste can be utilized for making fermented feed, (3) F3 (fertilizer), cattle feces to produce organic compost with a variety of nutrient content. Bio or organic fertilizer not only as fertilizer but also as a nurse ground (soil conditioner), which from an economic standpoint as well as the character of their products are not inferior to artificial fertilizers.

Figure 1. Integrated Biosystems cycle in cattle farmer-group Sembada

Table 1. Intangible Benefit and Cost Group Livestock Farmer-Sembada

<table>
<thead>
<tr>
<th>Component</th>
<th>(IDR/head/yr)</th>
<th>(IDR/AU/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intangible benefit</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livestock as savings</td>
<td>138,450</td>
<td>91,725</td>
</tr>
<tr>
<td>Livestock as insurance</td>
<td>174,665</td>
<td>115,715</td>
</tr>
<tr>
<td>Land productivity</td>
<td>6,196,500</td>
<td>4,105,181</td>
</tr>
<tr>
<td><strong>Total Intangible benefit</strong></td>
<td>6,509,615</td>
<td>4,312,620</td>
</tr>
<tr>
<td><strong>Intangible cost</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time risk based on mileage</td>
<td>100,800</td>
<td>66,780</td>
</tr>
<tr>
<td>The risk of labor</td>
<td>118,190</td>
<td>78,300</td>
</tr>
<tr>
<td><strong>Willingness To Pay (WTP)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improve livestock barn</td>
<td>180,190</td>
<td>119,375</td>
</tr>
</tbody>
</table>
Add plants around the barn 68,850 45,615
Processing cattle feces 207,725 137,615
Total WTP 456,765 302,605

Willingness To Accept (WTA)

- Subsidies on the purchase of livestock 1,000,000 662,500
- Labor wages 1,500,000 993,750
- Renting land and cattle 270,000 178,875
- The cost of transport to the barn 550,000 364,375
Total WTA 3,320,000 2,199,500
Total Intangible cost 3,995,755 2,647,185

Source: primary data, 2014

Assuming the bank rate at 7.5% and 8% interest rate insurance and dirt weight of approximately 7.5 kg/head/day, the total value of intangible benefits gained 6,509,615 IDR/head/year, or 4.312.620 IDR/AU/year. Khan et al. (2013) and Dilek et al. (2010), the most of the farmers were willing to participate in cattle insurance. Willingness To Accept (WTA) is higher than the Willingness To Pay (WTP). This is due to the compensation/damages that farmers want to switch to village group are higher than the value of WTP farmer in village group. Farmers are still reluctant to switch to village group because most groups have non-farm jobs that require a lot of work time so chose raising cattle in the house for ease in maintenance. This indicates an appreciation of the environment of the individual system is still low. They hope that if the relocation to the village group then there are groups maintain their livestock or paid for cattle raising the opportunity cost to replace their non-farm activities. The Total Economic Value of 237,548,645 IDR/year for the head or 157,375,978 IDR/year for the Animal Unit (AU). This shows the great value of resource assets in village Sembada group of beef cattle in the hamlet village Sanggrahan, Condongcatur each year.

The simulation results showed that the increase in the number of cow population is very influential on the increase in value of the total economy if farmers can increase business scale then an increase in productivity of livestock. On the other hand despite the appreciation of the individual system is still low, but if they get the socialization of the importance of raising cattle in a certain area of the environment for the sake of convenience, there will be an increase in the total economic value of the area due to the presence of enclosure group of beef cattle, so it can be concluded that the need for linkages between economic and environmental factors to increase the Total Economic Value.

Table 2. Priority Order Feasibility TEV in Village Group System for Next 5 Years

<table>
<thead>
<tr>
<th>kind</th>
<th>TEV (IDR/yr)</th>
<th>note</th>
<th>Rank order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal conditions</td>
<td>79,188,901</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>CI decline and the weaning period</td>
<td>91,569,283</td>
<td>Increased TEV 15.64%</td>
<td>4</td>
</tr>
<tr>
<td>An increase in the selling price of calves</td>
<td>98,191,866</td>
<td>Increased TEV 24.00%</td>
<td>3</td>
</tr>
<tr>
<td>Increased cow population</td>
<td>152,286,349</td>
<td>Increased TEV 92.00%</td>
<td>1</td>
</tr>
<tr>
<td>Environmental changes</td>
<td>128,276,861</td>
<td>Increased TEV 61.99%</td>
<td>2</td>
</tr>
</tbody>
</table>
CONCLUSIONS

Strengthening cooperation is necessary capital to increase the cattle population in the village group and socialization of the Department of farms and educational institutions to farmers about the importance of maintaining cows in a specific area for improvement and environmental comfort. In addition, more research is needed on the measurement of the content of organic compost to increase soil fertility at the same time increase the productivity of land.

REFERENCES


The Sustainability of Community Development in Area Pig Farming with Serasah System Based on Spiritual and Cultural Aspect

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ABSTRACT: The aim of this research is to evaluate the sustainability of pig farming with serasah system based on spiritual and cultural aspects in Kertek region, Wonosobo regency. The research was performed at six villages located in Kertek region, i.e.: Candimulyo, Candiyasan, Kapencar, Pagerejo, Purbosono and Reco, with three steps activities: preparation, data collection and data analysis. The preparation step consists of collecting information from literature review required for starting this research. Data collection was conducted to gain primary data which is related to pig farming with serasah system by observation method, in depth interview and questioner survey to identify factors that having role on pig farming sustainability with serasah system. In depth interview is started by interviewing some informants of pig farmers which have farming with serasah system. The next step is analyzed each aspect from the obtained data. The result of sustainability of spiritual and cultural aspects showed that the application of sustainability concept is a good method because inheritanced by their ancestors. It has been well done by their descendant and the spiritual of farmer is still strong. Therefore, the farmer belief toward their religion did not lose as well.

Keywords: Sustainability, Spiritual, Cultural, Pig Farming

INTRODUCTION

Livestock was a sector that has a tremendous opportunity to be developed as a business in the future. For Moslems, the pig is the animal that is illegitimate for eaten. However, in several regions in Indonesia, pigs farming are still survive such as in Sub District Kertek in Wonosobo regency. The professions as pig farmers are often become controversy in public both from the standpoint of population and religion. It is unique from one sample of pig farming in the sub district Kertek that public acceptance can receive pig farms based on Serasah system for the composting process even though the majority of the population in Sub District of Kertek were moslem. Sub district of Kertek is a mountainous area that was suitable for farming and plantation. Population of pigs in Wonosobo regency in 2013 was as much as 2,135 tails and all pigs are concentrated in Sub District Kertek (Department of Animal Husbandry Regency of Wonosobo, 2014).

Pig manure potentially contaminates settlements but pig farmers in Sub District of Kertek cope with the presence of swine livestock waste by processing the manure into compost. The purpose of waste to be processed is to prevent pollution in addition as fertilizer for local farms and plantations. According to Hartoko (1988), the motivation of pig farming based on Serasah systems were getting acceptance from the surrounding area, ease of licensing to build a pig farm of the village, safe from thieves, It didn’t takes many times, cheap, and practical. The phenomenon sustainability of pig farming based on Serasah system in the Sub district Kertek needs to be research on spiritual and cultural aspects to identify the factors that play a role in these farms.

MATERIALS AND METHODS

The study was conducted on the pig farming based on Serasah system in the sub district Kertek in Wonosobo regency. Sources of information were derived from the pig farmers (breeders). Primary data were collected by questionnaire tool. This study used a total sample of 71 respondents.
and 21 respondents of which are used to test the validity and reliability and 50 respondents in the main study to determine the sustainability of a system pig farms based on Serasah system from the spiritual and cultural aspects. The study activities carried out in three phases: preparation, data collection, and data analysis. The preparation phase included gathering activity through library information needed to begin study.

The preparation phase included gathering activity through library information was taken from the literature/documents and can be obtained from several parties concerned. Results of literature were in the form of information about the condition of the study sites, culture/behavior of farmers and people in study locations, and policies at the sites.

The data collection phase for the assessment of the sustainability of pig farms were based on Serasah system of spiritual-cultural aspects. Questionnaire survey to obtain data on the sustainability of pig farms was based on Serasah system from the spiritual and cultural aspect. Total respondents of the survey were 50 breeders with early stage were divided in quota 25% then continued at second stage. It were analyzed using simple random sampling method to select respondents. Quota sampling purposes that respondents per each village can be elected in proportion of 25%. The total sample of 25% had already represented the number of population for descriptive study (Gay and Diehl, 1992).

<table>
<thead>
<tr>
<th>Village</th>
<th>The population of pig (tail)</th>
<th>The amount of breeders (People)</th>
<th>Quota Sampling 25%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candimulyo</td>
<td>18</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Purbosono</td>
<td>107</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td>Kapencar</td>
<td>593</td>
<td>49</td>
<td>13</td>
</tr>
<tr>
<td>Candiyasan</td>
<td>632</td>
<td>86</td>
<td>22</td>
</tr>
<tr>
<td>Pagerejo</td>
<td>31</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Reco</td>
<td>754</td>
<td>96</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>2135</td>
<td>278</td>
<td>71</td>
</tr>
</tbody>
</table>


The data analysis stage were analyzed descriptively by outlining all aspects of the potential and constraints of pig farms based Serasah system in accordance with the existing material in the questionnaire. The results sustainability of pig farms based on Serasah system from spiritual and cultural aspects with the average score was divided by the highest score on the questionnaire and then multiplied by 100%. Details of the calculation were:

\[
\frac{The \ average \ score}{The \ highest \ score} \times 100\%
\]

The criteria of sustainability pig farms based on Serasah system on spiritual and cultural aspects can be seen from the results the maximal percentage reduced minimum percentage divided by the number of categories. Details of the calculation were:

\[
\frac{The \ maximum \ percentage \ - \ the \ minimum \ percentage}{The \ number \ of \ categories} \times 100\%
\]

Percentage of criteria of sustainability

\[
= \frac{100\% - 0\%}{3} = 33\%
\]
The criteria of Farm sustainability were:
66.7 to 100% : Indicates progress towards sustainability,
33.4 to 66.6% : Indicates a good start toward sustainability, and
0 to 33.3% : Indicates the need for further action to achieve sustainability.

RESULTS AND DISCUSSION

Validity measurements carried out by using Statistical Product and Service Solutions (SPSS) for Windows Version 16.0, by looking at the value of total Correlation corrected item on each item question has a negative value or the correlation value was smaller than the value of r table, it can be said to be invalid. The validity test use bivariate correlation and testing was conducted by using the Pearson correlation so that the results of 21 respondents in the spiritual-cultural aspects showed significant results. Items that are not significant can be eliminated so that the question of variable item has been able to measure what we want to measure (Cooper and Schlinder, 2011).

**Tabel 2.** The result test of validity in spiritual and cultural aspect

<table>
<thead>
<tr>
<th>Variables</th>
<th>Items</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural Sustainability</td>
<td></td>
<td>0.626*</td>
<td>0.508*</td>
<td>0.497*</td>
<td>0.445*</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>The culture and enjoyment in raising</td>
<td></td>
<td>0.676*</td>
<td>0.497*</td>
<td>0.433*</td>
<td>0.825*</td>
<td>0.497*</td>
<td>-</td>
</tr>
<tr>
<td>Entanglement between breeders</td>
<td></td>
<td>0.552*</td>
<td>0.733*</td>
<td>0.433*</td>
<td>0.665*</td>
<td>0.610*</td>
<td>0.652*</td>
</tr>
<tr>
<td>Kink breeder</td>
<td></td>
<td>0.527*</td>
<td>0.462*</td>
<td>0.743*</td>
<td>0.819*</td>
<td>0.672*</td>
<td>-</td>
</tr>
<tr>
<td>The beliefs of breeder</td>
<td></td>
<td>0.665*</td>
<td>0.569*</td>
<td>0.564*</td>
<td>0.463*</td>
<td>0.433*</td>
<td>-</td>
</tr>
<tr>
<td>Peace</td>
<td></td>
<td>0.764*</td>
<td>0.595*</td>
<td>0.866*</td>
<td>0.668*</td>
<td>0.668*</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: * = Correlation is significant at the 0.05 level (2-tailed).

**Tabel 3.** The result test of reliability from spiritual and cultural aspect

<table>
<thead>
<tr>
<th>Variabel</th>
<th>Cronbach Alpha</th>
<th>Limitation</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural Sustainability</td>
<td>0.605</td>
<td>0.60</td>
<td>Reliable</td>
</tr>
<tr>
<td>The culture and enjoyment in raising</td>
<td>0.600</td>
<td>0.60</td>
<td>Reliable</td>
</tr>
<tr>
<td>Entanglement between breeders</td>
<td>0.684</td>
<td>0.60</td>
<td>Reliable</td>
</tr>
<tr>
<td>Kink breeder</td>
<td>0.678</td>
<td>0.60</td>
<td>Reliable</td>
</tr>
<tr>
<td>The beliefs of breeder</td>
<td>0.665</td>
<td>0.60</td>
<td>Reliable</td>
</tr>
<tr>
<td>Peace</td>
<td>0.753</td>
<td>0.60</td>
<td>Reliable</td>
</tr>
</tbody>
</table>

Reliability measurements carried out also with SPSS for Windows Version 16.0. Reliability was measured by the statistical test Cronbach alpha. Cronbach alpha measurement results on the spiritual and cultural aspects are all reliable because the Cronbach alpha values > 0.60 and these variables can be said to have reliability as a measuring tool.

In the spiritual and cultural aspects indicate progress toward sustainability with a percentage of 90.1%. Thus, the level of sustainability of pig farms based on Serasah system in the Sub district Kertek, Regency of Wonosobo shows that these farms have the potential to reach a ecovillage farming from spiritual and cultural aspects.
Table 4. Assessment of the spiritual-cultural aspects

<table>
<thead>
<tr>
<th>No.</th>
<th>Sub aspect</th>
<th>The highest score</th>
<th>The average score</th>
<th>Percentage(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cultural sustainability</td>
<td>17</td>
<td>15.9</td>
<td>93.8</td>
</tr>
<tr>
<td>2.</td>
<td>The culture and enjoyment in raising</td>
<td>25</td>
<td>21.7</td>
<td>86.9</td>
</tr>
<tr>
<td>3.</td>
<td>Entanglement between breeders</td>
<td>25</td>
<td>22.5</td>
<td>90</td>
</tr>
<tr>
<td>4.</td>
<td>Kink breeder</td>
<td>22</td>
<td>20.2</td>
<td>91.8</td>
</tr>
<tr>
<td>5.</td>
<td>The beliefs of breeder</td>
<td>20</td>
<td>17.6</td>
<td>88.1</td>
</tr>
<tr>
<td>6.</td>
<td>Peace</td>
<td>20</td>
<td>18.2</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>129</strong></td>
<td><strong>116.1</strong></td>
<td><strong>90.1</strong></td>
</tr>
</tbody>
</table>

Description percentage:
66.7 to 100%: Indicates progress towards sustainability,
33.4 to 66.6%: Indicates a good start toward sustainability,
0 to 33.3%: Indicates the need for further action to achieve sustainability.

Overall, the pig farms Serasah system in the sub district Kertek from the spiritual and cultural aspect and the six sub aspect in these aspects already demonstrated progress towards sustainability. Pig farming based on Serasah system inherited by the parent was still maintained by farmers and still follows the culture that has been carried from generation to generation through stories, written reports, village elders, and skills training based breeder statement by 66%. Forms of cultural maintenance performed by local custom and custom event were adjusted to the Islamic religion which becomes the majority religion of farmers in the village. These activities include events selametan, aqiqah, circumcision, marriage, and death. 84% of breeders stated that until now they still follow the cultural heritage of his ancestors and always respect each culture inherited including the pig farms based on Serasah system continuously inherited by the parent.

Breeders perform daily activities such as breeding, farming and other work and it was not a forced thing to do. Breeders regard it was an obligation and they enjoyed. During their daily routine, farmers also strongly encourage local performing activities in the village based breeder statement by 78%. This was shown by the participation of breeders in the local performances and uses their spare time in addition to breeding, farming, and other work, and 12% stated they rather encourage these performances. In addition to following a local show, 76% of breeders expressed have more time to use their spare time doing hobbies or pleasures such as maintaining a bird and fishing in ponds and 24% stated they had many leisure times for hobbies.

Entanglement between breeders established on their daily activities, such as breeding, farming, other occupations, and often talked or discussed among breeders so that breeder still strong social relationships. Based on the statement of breeders which reach 76% and 24% stated they occasionally to have conversation among breeders. Socialization activities carried out routinely as recitals each week, mauludan each year, as well as the supplemental / incidental as informal meetings in shops, streets, and places in other villages thereby strengthening brotherhood rope between breeders based on 90 % statement breeders Sense of community can also be established because the relatively small size of the village, so that interactions between breeders from all parts of the country was quite high. Moreover, the patterns of houses in villages that face each other and without fences also allow for interaction were quite high. At the time of feeding in the morning and evening, breeders meet and talk.

About the business of cattle and pig farming operation, additionally, during the afternoon the kids love to play and joke around pigsty. Social cohesion that existed around the pigsty was a social phenomenon that was unique and hard to be replaced and breeders together to enjoy life on
a regular basis by the 86 % breeder statement.

Based on the statement of 76 % breeders a sense of togetherness among farmers has been inherited by the parent, so if there were breeders who are struggling and need help, then the other breeders will try to find solutions together. In addition 76% of most breeders can help other breeders who are weak, troubled, or pain in farming activity. The officer of PPL also supports solve solutions to breeders. One of the efforts to overcome the difficulties farmers was to give them training to strengthen its ability to address the issue of farming pigs based on Serasah system. It was based on a statement from 82 % breeders.

Sense of breeders have already well established on the first, so there are rare of disputes. A sense of togetherness was inherited by the elders in the village and still exists today. Moreover, the principle of breeders living in six villages that have always lived in harmony with nature and simplicity, so that a sense of peace can emerge because of the tranquility of daily life. The sustainability concept on pig farms based on Serasah system has been reached because the local wisdom of community/breeders was in line with the concept of sustainability. This was shown in the case of breeders who appreciated and supported by the community in farming activities, harmonization of breeders in their activities for the benefit of society as a useful compost for agricultural products originating from pig farms based on Serasah system, and the breeders can receive and care suggestions/advice from the public. It was based on the statement of breeders that reach 70%.

CONCLUSIONS

The sustainability of pig farming with serasah system based on spiritual-cultural aspect showed the progress of sustainability. The application of sustainability concept is well done because of the culture of pig breeding with serasah system that is inheritance by their ancestor is still exist till now. Besides that, the spiritual manner of farmer is still strong and the cultural activity was in accordance with the spiritual activity generating the farmer belief toward their religion did not lose. Therefore, the cultural activity still exists.

REFERENCES

Exploration of Potential Regional Resources for Beef Cattle Farming Development in Java, Indonesia

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ABSTRACT: National beef production in Indonesia from year to year has been always low compared with the consumer demand, thus it still depend on imports. The purposes of this study were: (1) to identify factors related to the regional resources which support the development of cattle farming, (2) to determine the potential resources for the development of beef cattle farming, and (3) to improve beef cattle development strategy based on the potential resources. The location taken were two provinces in Java, namely East Java Province and Special Region of Yogyakarta. Time series data from 2007 to 2012 as variables in this study were taken as each 7 and 4 regency as the samples. These data were analyzed by Multiple Regression Model using Ordinary Least Square method. The stationary test was done before using time series data by unit root tests of Augmented Dickey-Fuller (ADF). Dependent variable in the model was beef cattle population in each regency per year. Meanwhile the independent variables were population, number of farmers, price of cattle, number of cattle slaughtered, number of cattle that exit from region, number of cattle that enter to region, rice production, corn production, soybean production, cassava production in each region per year and dummy location. The results of this research showed that enhancement of corn and soybean production in a region was potential resource to increase the population of beef cattle. Moreover, the beef cattle price per kg of live weight and number of beef cattle slaughtered in a region need to be considered as the factors for strategies in developing beef cattle farming. Location has significant effect on the beef cattle development.

Keywords: Development, beef cattle farming, regional resources, Java

INTRODUCTION

Indonesia is an agricultural country because 85% of the population had livelihood as farmers, with an average ownership of arable land below 0.5 ha especially in Java. Farmers generally have a livestock including beef cattle with small scale 1-3 Animal Unit (AU), as an activity that was complementary and supplementary to the crops farming with the aim to increase their farm income. According to Stur, et al., (2013) livestock production in developing countries can be an important pathway for rural communities to get out of poverty. Based on data from the Ministry of Agriculture of the Republic of Indonesia (Suswono, 2012; Directorate General of Livestock and Animal Health, 2008 and 2013), the national consumption of beef for Indonesian society had been continuing to increase from 2007 to 2012 that is 396.00 to be 508.90 thousand tons or an average of 5.26\% per year. In the same period, national production has only increased of 4.61\% per year while imports of beef by an average of 36.98\% per year. Therefore, the development of beef cattle was good employment opportunities for farmers in the rural. The opportunity was supported by the nature of Indonesia that were geographically and demographically has a wealth of natural resources that were believed to have comparative and competitive advantages for beef cattle business (Rauf, et al., 2014). However, there were still various kinds of constraints in development of beef cattle farming such as capital, technology and human resource capabilities (Rouf, et al., 2014; Priyanto, 2011; Widiati, 2006). The main reason of the various constraints were the dynamics of agriculture resources such as soil types, climate conditions, rainfall, social and cultural conditions of the population and others. The dynamics of the use of resources that could improve crop yields will
have impact on the increase the supply of animal feed as an important resource for the livestock development (Teklewold, et al. 2013).

This study tried to seek an alternative to improve smallholder beef cattle based on the potential resources of the region to support the existing government programs. Accumulation of regional resources can provide greater inputs for production than the individual approach farmers with limited land, capital and labor. It was needed to support previous research which suggests that one strategy to develop of the beef cattle farming industry in Indonesia was encouraging of investors to develop forage industry as feed suppliers which has processed with touch of technology to make it easier for farmers to access in large quantities and low prices (Widiati, 2014). Administratively, a region can be village, sub-district, district or regency, and city which have extensive agricultural land resources and population as labor forces as well as consumer for goods and services. Furthermore, population was also the owner of capital on the region. County-level yield data can be used in applied crop insurance policy in place of farm level (Gerlt, S. et al. 2014).

A production process of agricultural including beef cattle farming in a region can be described in the following function (Penson, et al., 2002):

\[ Y = f(A, L, I, M) \]  \hspace{1cm} (1)

Where: \( Y \) = output or product, is a function of \( A = \) area/ and for various activities of farming, \( L = \) labor, \( I = \) investment/capital and \( M = \) management or technology.

Agricultural resources such as crops and beef cattle are interrelated, dependent, and supporting to each other. Therefore, the availability of resources in a region is very important to be studied in an effort to increase the population and production of beef cattle.

**MATERIALS AND METHODS**

The Province of East Java and Special Region of Yogyakarta (DIY) which were as regional suppliers of beef cattle represented as sample location. Furthermore was taken 7 regencies of the 29 regencies in East Java and four regencies or of all in DIY. This study were using time series data collected for 2007-2012 (6 years) for every sample regions that was available completely from relevant institutions related to the research, that were the Central Bureau of Statistics, Abattoirs office, Department of Animal Husbandry, and the Department of Agriculture in each regency. The existence of beef cattle development in an area can be measured from the increase in beef population from year to year as dependent variable that was included on the multiple linear regression model as shown as equation 2.

\[ BCP_{it} = \beta_o + \beta_1 Pop_{it} + \beta_2 NF_{it} + \beta_3 PC_{it} + \beta_4 CS_{it} + \beta_5 CEx_{it} + \beta_6 CE_{it} + \beta_7 RProd_{it} + \beta_8 CrProd_{it} + \beta_9 SProd_{it} + \beta_{10} CsProd_{it} + \alpha_{1D} + e_{it} \]  \hspace{1cm} (2)

The notations were:

- \( BCP_{it} \) = beef cattle population as the dependent variable in the region \( i \) in year \( t \) (head);
- \( \beta_o \) = intercept
- \( \beta_1, \beta_2, \beta_3 \ldots \beta_{10} \) = regression coefficient of independent variable of \( X_{1t}, X_{2t}, X_{3t} \ldots X_{10t} \)
- \( Pop_{it} \) = population in region \( i \), in the year of \( t \) (person);
- \( NF_{it} \) = the number of farmers in region \( i \), and year \( t \) (household);
- \( PC_{it} \) = price of cattle in region \( i \), and year \( t \) (IDR/kg live weight);
- \( CS_{it} \) = the number of cattle slaughtered in region \( i \), and year \( t \) (head/year);
- \( CEx_{it} \) = the number of cattle that exit from region \( i \), and year \( t \) (head/year);
- \( CE_{it} \) = number of cattle that enter to region \( i \), and year \( t \) (head/year);
- \( RProd_{it} \) = rice production in region \( i \), and year \( t \) (ton/year);
- \( CrProd_{it} \) = corn production in region \( i \), and year \( t \) (ton/year);
- \( SProd_{it} \) = soybean production in region \( i \), and year \( t \) (ton/year);
- \( CsProd_{it} \) = cassava production in region \( i \), and year \( t \) (ton/year);
RESULTS AND DISCUSSION

Beef cattle farming and its supporting resources in Java, Indonesia

Java is one of island, including the large islands in Indonesia which was inhabited by 138.794 million people (44.74%) and having plains area of 192,257,000 ha (7.23%) (Central Bureau of Statistics, 2013). While, East Java province has the largest population of beef cattle, which was in 2012 reached 5,019,445 heads, with population of 37.56 million of people and 1,913,213 ha of agricultural land, followed by DIY which has beef cattle population of 414,381 heads, with a population of 3.71 million people and 132,987 ha of agricultural land. East Java Province and DIY had a dense population, but population of beef cattle can still above the national average of Indonesia. Beef cattle breeding that produce bulls as a supplier of beef was usually cultivated by farm households. Generally, farmers in Java grow crops to meet the needs of staple food such as rice, corn, soybeans, peanuts, cassava and be accompanied its byproducts that used as animal feed. While outside of Java are still many forests and plantations, especially oil palm has a byproduct as a source of quality livestock feed. Nevertheless, generally the type of crop orientation is largely determined by the existing agro-ecologies in a region (Silvia and Matus, 2014).

The population of cattle and beef production in each region has fluctuated (Table 1). In 2011 there was a striking increase in livestock population, because in that year there are government assistance programs that distribute cows to farmers. However, to make a beef cattle development strategy requires the supporting factors as a basic for further policy.

Table 1. The population of cattle and beef production in east Java, DIY and Indonesia

<table>
<thead>
<tr>
<th>Year</th>
<th>East Java</th>
<th>DIY</th>
<th>Indonesia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amount (heads)</td>
<td>increase (%)</td>
<td>(heads)</td>
</tr>
<tr>
<td>2007</td>
<td>2,705,605</td>
<td>25.11</td>
<td>257,836</td>
</tr>
<tr>
<td>2008</td>
<td>3,384,902</td>
<td>2.19</td>
<td>269,927</td>
</tr>
<tr>
<td>2009</td>
<td>3,458,948</td>
<td>8.28</td>
<td>285,043</td>
</tr>
<tr>
<td>2010</td>
<td>3,745,453</td>
<td>8.28</td>
<td>290,949</td>
</tr>
</tbody>
</table>
Factors that influence to the development of beef cattle population

Based on the results of the unit root test, at the level of stationary there are three independent variables are stationary, namely the CEx, CEn and CsProd (ADF Prob <0.05). The data that are not stationary in order to become stationary, then it differentiated at the first difference level in the unit root analysis showed that all of independent variables have been stationary (ADF Prob <0.01). The data that are not stationary before the first difference level, there are possibility of co-integration which are the long-term relationships between independent and dependent variables. Therefore it was necessary to the co-integration testing considered herein using Johansen Co-integration test. The result of Johansen Co-integration test, there are three variables that are not mutually co-integrated, namely BCP with independent variables of CS, CsProd and SProd in which the value of Trace statistic was less than the critical value at 5% confidence level (P <0.05). Other independent variables were co-integrated with each other therefore in the short term there may be disequilibrium so that necessary to correction, in this research using the error correction model (ECM). Based on the ECM analysis showed that all independent variables have a residual value of significance level P <0.01 so that the ECM model were valid and the data can be used for further analysis. Ouedraogo and Bako (2014) have also conducted models of analysis of time series data using these methods. The regression analysis of the data that had been corrected was shown in Table 2.

Table 2. Results of regression analysis of the factors that influence to the development of beef cattle population.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-value</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>2.4313</td>
<td>2.2815</td>
<td>1.0657</td>
<td>0.2925</td>
</tr>
<tr>
<td>Pop</td>
<td>-0.1048</td>
<td>0.1657</td>
<td>-0.6325</td>
<td>0.5304</td>
</tr>
<tr>
<td>NF</td>
<td>0.0087</td>
<td>0.0088</td>
<td>0.9860</td>
<td>0.3296</td>
</tr>
<tr>
<td>PC</td>
<td>0.5907</td>
<td>0.1910</td>
<td>3.0895</td>
<td>0.0035***</td>
</tr>
<tr>
<td>CS</td>
<td>-0.1523</td>
<td>0.0844</td>
<td>-1.8042</td>
<td>0.0782*</td>
</tr>
<tr>
<td>CEx</td>
<td>0.0391</td>
<td>0.0233</td>
<td>1.6804</td>
<td>0.1001</td>
</tr>
</tbody>
</table>
The 6th International Seminar on Tropical Animal Production  
Integrated Approach in Developing Sustainable Tropical Animal Production  
October 20-22, 2015, Yogyakarta, Indonesia

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>t-value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEn</td>
<td>0.0332</td>
<td>0.0370</td>
<td>0.8994</td>
<td>0.3734</td>
</tr>
<tr>
<td>RProd</td>
<td>-0.1275</td>
<td>0.1190</td>
<td>-1.0712</td>
<td>0.2900</td>
</tr>
<tr>
<td>CrProd</td>
<td>0.3623</td>
<td>0.0976</td>
<td>3.7119</td>
<td>0.0006***</td>
</tr>
<tr>
<td>SProd</td>
<td>0.1234</td>
<td>0.0357</td>
<td>3.4587</td>
<td>0.0012***</td>
</tr>
<tr>
<td>CsProd</td>
<td>-0.0492</td>
<td>0.0414</td>
<td>-1.1899</td>
<td>0.2406</td>
</tr>
<tr>
<td>Dummy location</td>
<td>0.5618</td>
<td>0.2371</td>
<td>2.3693</td>
<td>0.0224**</td>
</tr>
</tbody>
</table>

R-squared 0.8856  
F-statistic 30.2566  
Adjusted R-squared 0.8564  
Prob(F-statistic) 0.0000  
Number of observation 66

Source: Results of data analysis

From Table 2 it could be observed that the adjusted $R^2 = 0.8556$ by F test ($P < 0.001$), it meant that the independent variables together could explain 85.56% to the development of beef cattle population, while the rest were described other factors that was not included in this model. Partially, the price of beef (PB), corn production (CrProd), soybean production (SProd) had positive influence to the development of beef cattle population with significant level of $P < 0.01$, and the dummy of location (D) with $P < 0.05$, meanwhile, slaughtering of cattle (SC) in an area had negative effect of $P < 0.1$. Beef prices (BP) based on live weight gave a positive response to the increase in population, thus the cattle pricing policy that was greater than the cost of production should be considered in an effort to increase of production and population of beef cattle in Indonesia. Corn and soybean production had a significant positive effect on the development of beef cattle in the region. The rice production had not significant effect, although the rice plant produced straw as potential feed for beef cattle. This is because the rice productions were generally need to be managed intensively which labor intensive, thus there was no more time left to raise the cattle. Corn and soybean production had a significant positive effect on the development of beef cattle in the region. The rice production had not significant effect, although the rice plant produced straw as potential feed for beef cattle. This is because the rice productions were generally need to be managed intensively which labor intensive, thus there was no more time left to raise the cattle. Production of rice straw in Indonesia is only about 33% for animal feed, 50% were burned and 17% for the industry (Shaphan 2008 in Herawati, 2013). The production of corn, soybeans and rice would be followed by a byproduct in the form of straw as cattle feed. The protein content in soybean straw was the highest (16.6%), followed by the content in corn straw (7.7%) and rice straw (4.10%). Moreover among these 3, corn straw was the most preferred by beef cattle (Emma, 2011; Hartadi, et al. 2005). The number of cattle slaughtered had negative significant effect on the cattle population in an area ($P < 0.1$). Therefore, to develop the beef cattle population in a region that the quota of slaughtering should be set in accordance with the number of cattle population. Furthermore, dummy location had significant differences which meant that each location had different pattern of beef cattle development.

CONCLUSIONS

The development of beef cattle in Java should be directed to areas that suitable for corn and soybean crops. Furthermore, the price of beef per kg of live weight which was an incentive instrument for beef cattle farmers can be used as a basis for policy making in order to encourage the development of beef cattle farming, likewise beef cattle slaughtering in a region. Overall, the availability of resources in each region should be considered in the development planning of beef cattle farming.
REFERENCES


Technical, Economic and Social Feasibilities of Beef Cattle Development in Bintuni Papua Barat

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Corresponding email: trieswd4@gmail.com

ABSTRACT: In order to empowerment of Papua community as well as to meet of beef requirement in Papua, then BP LNG Tangguh creates a Papua community empowerment program through development of beef cattle farm in Bintuni Regency. The approach of this program was conducted through several social and religious foundations in Bintuni. To know the readiness of the aid recepient, then a feasibility study including technical, economic and social aspect was conducted. The purpose of this study was to know reasonable of candidate aid recepient and determine input for beef cattle development based on technical, economic and social aspects. The study was conducted in Bintuni, Manimeri and Tuhiba districts, Bintuni Regency Papua Barat Province. Data was collected from 5 social and religious foundations namely Muhammadiyah Foundation, Catholic Foundation, Protestant Foundation, An-Nur Foundation and Tujuh Bersaudara Cooperation with 65 respondents from local tribes of Sebyar, Sumury and Irarutu. Indepth interview technique and direct observation was used to collect data in this study. Data was analyzed using descriptive method. Result of this study showed that technically, the average carrying capacity in 5 locations was 2-6 animal unit/ha/year, 64.57% of recepient has not experience in husbandry, 67% of people in a low level of food security, 35.54% of recipient live under poverty level and the average income IDR 43,945,758/year. Based on this study, the development of beef cattle farm in 3 foundations using mini ranch system with number of cattle of 50-60 head, meanwhile 2 foundations using mini ranch system with number of cattle of 20 head. Implementation of beef cattle development in 5 foundations should be accompanied by economic program to prevent the farmer sell their cattle before age cut off due to economic reason.

Keywords: Feasibility, Beef cattle, Empowerment, Ranch, Household

INTRODUCTION

Papua, in general is an area with huge potential for development beef cattle due to supporting region as extensive natural pasture. Based on data of BPS (2007) and Team of Monitoring and Evaluation of livestock, Papua Barat Province (2005), forage production and agricultural by product in Papua Barat Province was 42,442,750 tons produced from the area of 4,244,274 ha. That forage production is able to supply for beef cattle as much as 3,876,050 head. The availability of livestock resources particularly local feed and forage area provides a great opportunity for development beef cattle in Papua Barat province.

Population in Papua Barat Province shows a trend of increasing since present both province and regency. Rate of population growth from 2003 to 2005 was 10.83% (SUPAS, 2005) or the number of population in this province at 2005 was 643,012 head. Increasing some activities including tourism industry, hotel, restaurant, trading, transportation and business service caused Papua Barat Province needs to have the availability of adequate stocks of livestock product.

Based on data of BPS and BAPPEDA Papua Barat Province (2014), cattle slaughtering increased from 4,701 head in 2004 to 24,261 heads in 2013. Ratio of the cattle slaughtering to cattle population was increased in each year. Trend of a surge in consumption that is not balanced
with the growth of the cattle population is a challenge for government to seriously review the management aspects of beef cattle supply.

In order to empowerment of Papua community as well as to meet of beef requirement in Papua, then BP LNG Tangguh creates a Papua community empowerment program through development of beef cattle farm in Bintuni Regency. The approach of this program was conducted through several social and religious foundations in Bintuni. It is hoped that the community can play an active role as a supplier of beef demand for BP Tangguh. The objective of program in the short term is to increase community participation through the provision of beef demand for company, whereas in the long term is to provide beef to meet the needs of people in Bintuni area, even the provinces of West Papua and Papua.

**MATERIALS AND METHODS**

The study was conducted in Bintuni, Manimeri and Tuhiba districts, Bintuni Regency Papua Barat Province. Data was collected from 5 social and religious foundations namely Muhammadiyah Foundation, Catholic Foundation, Protestant Foundation, An-Nur Foundation and Tujuh Bersaudara Cooperation with 65 respondents from local tribes of Sebyar, Sumury and Irarutu. Indepth interview technique and direct observation was used to collect data in this study. Data was analyzed using descriptive method.

1. **Stocking rate**
   Calculated based on Voisin (1959) as follows:
   \[ DT = A \times B, \]
   \[ DT = \text{stocking rate} \]
   \[ A = \text{forage consumption per animal unit per month divided by forage production per Hectare} \]
   \[ B = (Y - 1)s = r, \] where \( Y = \text{Land requirement (paddock) per animal unit per year} \)
   \[ S = \text{grazing period (30 days)} \]
   \[ R = \text{rest period (70 days)} \]

   One animal unit (AU) is equivalent to a cattle with body weight of 266 kg that consume 5 kg dry matter per day. Total digestible nutrient requirement for maintenance and production is 0.6618 ton/Ha/year.

2. **Economic feasibility** is determined based on aspects of income community, poverty status and food security.
   A. **Income community** is total income obtained by each household
   B. **Food security analysis**

   The value of food security is measured by using the share of household food expenditure, using equation as below: (Supardi, 2002; Ilham dan Sinaga, 2007)

   \[ \omega = \frac{\text{Food expenditure}}{\text{Total expenditure}} \times 100\% \]

   where \( \omega = \text{share of food expenditure} \)
   a. Share of food expenditure < 60% of total expenditure is food security household.
   b. Share of food expenditure ≥ 60% of total expenditure is no food security household.
   c. Poverty criteria
To know poverty is based on criteria of Sayogyo (1986) as follows: town poor 320 kg/capita/year (3,156.16 kkal/capita/year) b. urban poor 240 kg/capita/year (2,367.12 kkal/capita/year).

3. Socio-cultural feasibility is assessed based on farmer knowledge and community perception on the development of beef cattle in various models of development.

A. Raising

Knowledge of respondent about raising cattle on all aspects of the management including feeding, disease, production, reproduction and cages were known by using interview techniques. Respondent replied were grouped into 3 categories as below:

a. They have no experience (if the respondents were able to answer the question only to 40% of the total questions).

b. They have experience but in limited knowledge (if the respondents were able to answer the question > 40% to 70% of the total questions).

c. They have experience and well knowledge (if the respondents were able to answer the question > 70% to 100% of the total questions).

B. Community perception of the development of beef cattle

Community perception of the development of beef cattle were known through some informations such as livelihood diversity, control and use of land, leadership and decision-making, religion and other cultures, and factors that support or hamper beef cattle development.

RESULTS AND DISCUSSION

Results of the study of stocking rate, economic status, strengths and weaknesses of the group as well as recommendations for pattern of beef cattle development presented in Table 1.

Estimates of stocking rate both in dry matter and TDN contents of forages ranged from 2 to 6 AU/ha/year. The stocking rate value based on fresh matter obtained in this study was lower than result reported by Sawen and Junaidi (2011) namely 4.9 and 6.6 AU/ha/year for natural pasture in Fakfak and Sorong. Nevertheless, the value was slightly better than the stocking rate of natural pasture in Papua, which averaged only 2 AU/ha/year. Reksohadiprodjo (1994) stated that a pasture is classified to be productive when at least it has stocking rate of 2.5 AU/ha/year. Therefore, if the land at the survey site will be made as the location for development of beef cattle, it can be improved through the introduction of superior species of cutting and grazing grasses, including the composition with the types of legume, and intensive raising with the cut and carry feeding system.
## Table 1. Foundation, stocking rate, economic status, and recommendation of cattle raising system in Bintuni regency

<table>
<thead>
<tr>
<th>No.</th>
<th>Fondations/ Location</th>
<th>a. Land area (m²)</th>
<th>Economic</th>
<th>Strengths and Weaknesses of members and foundation</th>
<th>Recomendation of pattern raising</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>b. Stocking rate (AU/ Ha/year)</td>
<td>a. AI (IDR/year)</td>
<td>b. PH (%)</td>
<td>c. NFS (%)</td>
</tr>
<tr>
<td>1</td>
<td>Muhammadiyah Foundation SP-5, Manimeri District</td>
<td>a. 30</td>
<td>a. 23,277,959</td>
<td>b. 23.08</td>
<td>c. 65.38</td>
</tr>
<tr>
<td>2</td>
<td>Catholic Foundation / Pasamai vilage, Manimeri District</td>
<td>a. 65.649</td>
<td>a. 43,200,000</td>
<td>b. 33.33</td>
<td>c. 50.00</td>
</tr>
<tr>
<td>3</td>
<td>Protestan Foundation / Agresigemberai Vilage (SP-5), Manimeri District</td>
<td>a. 48.511</td>
<td>a. 29,240,000</td>
<td>b. 20.00</td>
<td>c. 40.00</td>
</tr>
<tr>
<td>4</td>
<td>An-Nur Foundation / SP-1, Manimeri District</td>
<td>a. 14.75</td>
<td>a. 48,733,333</td>
<td>b. 22.22</td>
<td>c. 55.56</td>
</tr>
<tr>
<td>5</td>
<td>Tujuh Bersaudara Cooperation / Km 9 West Bintuni, Bintuni District</td>
<td>a. 29.79</td>
<td>a. 6,425,000</td>
<td>b. 35.71</td>
<td>c. 78.57</td>
</tr>
</tbody>
</table>

Note: AI: Average income; PH: Poor Household; NFS: No Food Security in Household
Respondents who are a prospective beneficiary community have an average income of IDR. 43,945,758/year. Most of respondents (64.46%) have been free of poverty, but based on the food security indicators showed that most of respondents (64.57%) have not food security. It means that they have been able to meet the basic needs of life, but not yet in a prosperous level. Thus based on economic aspect, the prospective beneficiary community is eligible for beef cattle development program to improve the welfare of the family.

Based on the results of the feasibility analysis of beef cattle business for 20 years with a scale of 60 heads was obtained BCR value of 2.8, a positive NPV at 16th year with a value of IDR 176,560,384.86 and IDR of 15.22%. This indicates that these activities can move above the prevailing bank rate (12%). It can be concluded that the beef cattle business that include community empowerment is feasible to be done.

Most of respondents approximately 68.47% didn’t have experiences in cattle raising, 27.04% of respondents have experienced but in limited knowledge, and 4.49% of respondent have experience and also have well knowledge in cattle raising. In the future, development of beef cattle, three groups will be mixed to work together in order to get transfer of knowledge and work spirit under supervision by expert.

The recommendation of pattern of cattle development in each foundation and cooperation were group system using mini ranch pattern with number of cattle of 20 heads in Muhammadiyah and An-Nur Foundations, whereas group system using mini ranch pattern with number of cattle of 50-60 heads in Catholic Foundation, Protestant Foundation and Tujuh Bersaudara Cooperation.

CONCLUSION

Based on aspects of technical, economic and social, beef cattle farm in Bintuni regency is feasible to be developed. The development of beef cattle farm in Catholic and Protestant Foundations as well as Tujuh Bersaudara Cooperation using group system with mini ranch pattern and number of cattle of 50-60 heads, meanwhile Muhammadiyah and An-Nur Foundations using group system with mini ranch pattern and number of cattle of 20 heads. The farmer will be mixed to work together between Papua and non Papua communities in order to get transfer of knowledge and work spirit.

REFERENCES

Economic Analysis and the Impact of AI Technology on Buffalo to the Farmers’ Income

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ABSTRACT: The purpose of this study was to analyze the economic impact of technology Artificial Insemination (AI) buffaloes on the income of farmers, research survey done in 2014, in West Lombok West Nusa Tenggara province Indonesia. Research is done in 4 (four) Sub district namely: district of Kediri, Uripan, Gerung and Kuripan, in one district, against 48 farmers who income AI and 32 farmers who have not received AI. The primary data obtained directly interview results either individually or in groups, refers to a questionnaire that had been prepared, secondary data obtained from the relevant authorities, research data were analyzed using descriptive, economic analysis and statistics t test (t-test). The profits of farmers who got the AI about IDR.13,43 million, the average ownership of buffaloes around 1.15 heads/farmers, the value of B/C 1.4, benefit farmers who have not gotten around IDR.12.94 million AI/farmers, the average ownership of buffaloes around 1.18 heads/farmers, the value of B/C 1.3 of the t test showed significantly different hypotheses, the value of t-test known at 13.43 and 12.94, it indicates P<0.05 means business ownership buffalo 1.15 to 1.18 heads/farmers have a positive impact on farmers who received AI compared with farmers who have not received AI buffaloes, buffaloes sale value AI is the highest result.

Keywords: economic analysis, the impact of AI buffaloes, farmers’ income

INTRODUCTION

AI technology in buffaloes aim to increase the productivity of livestock buffalo better, AI activities buffaloes estrus detection and facilitate the implementation of both natural mating, can be expected to quickly pregnant, the value of higher productivity of livestock that are not getting AI. Buffalo cattle population is expected to grow to in the foreseeable future, it appears that the AI buffaloes is a technique that is regarded as a model of a very practical method, have been carried out in institutions of farms, in addition to raising the quality of buffaloes which profitable for farmers. However, this condition has not spurred farmers to raise cattle more intensive buffalo Widarhayati et al., (2006).

Target application AI buffaloes in several locations in West Lombok regency, because farmers still traditional maintenance so performance, production is still very low and produce children who are less optimal. The value selling to be low, it is expected with the implementation of this AI can boost their offspring to be better and livestock sale value becomes higher. Besides, it also can increase income better farmer, based on the above problems, the purpose of this paper is to analyze the economic impact of technology AI buffalo on the income of farmers, is expected to be one of the bases as an introduction to specific guidelines in determining the impact of the policy on the buffalo for the next AI for the common good.

MATERIAL AND METHODS

Research location
Research carried out in West Lombok West Nusa Tenggara Indonesia, using field survey. The experiment was conducted in 2014, at 4 (for) Sub district namely: Sub district, Kediri, Uripan,
Gerung and Kuripan, in the West Lombok district against 48 farmers who income AI and 32 farmers who have not received AI buffaloes, to be interviewed groups and individuals.

Each group of farmers was taken as a sample and as research date, groups of farmers have some indicators that can be used to assess the economic analysis of the impact of AI technology to farmers who have got AI and AI farmers who have not received buffalo.

**The method of feasibility analysis buffalo**

The data used are primary data and secondary data, primary data obtained directly from the respondents on interviews, secondary data obtained from agency NTB Agriculture and Animal Health, (2014). Furthermore, the data collected, and then tabulated and processed statistically descriptive One Sample t-test and paired sample t-test (Steel *et al.*, 2000), using two sample t test is the total of buffaloes are maintained by farmers who have been in the AI and which have not AI buffalo. Meanwhile to measure the economic analysis of the structure parameter B/C ratio, Krismawati *et al.*, (2006), Ashari *et al.*, (2013), and Herman (2012).

**RESULTS AND DISCUSSION**

**Sustainability buffalo AI impact on farmers**

Based on the results of field survey concluded that, West Lombok Regency Indonesia, can be said to be a bag of buffalo livestock population, the number of buffalo in groups of farmers around 205 heads, buffaloes which received approximately AI (60%), livestock buffalo who have not received AI around (40 %), which got AI buffaloes, generating an average child born weight around 20-25 kg / head, the sale value of about IDR.4-5 million/head, the average age of about 2-4 months.

While buffalo are not the result of AI produces an average child born weight around 18-20 kg/head, the sale value of about 2 to 3.5 million/head with an average age of about 2-4 months remains low under AI results. Total the average of parent buffalo in AI and AI have not been seen in Table.1.

*Table.1. Average of ownership and success of AI buffaloes at the study site*

<table>
<thead>
<tr>
<th>No</th>
<th>Commentary</th>
<th>Farmer</th>
<th>Holding/ head</th>
<th>AI head</th>
<th>result* (%)</th>
<th>%</th>
<th>still* (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R1</td>
<td>11</td>
<td>13</td>
<td>11</td>
<td>7</td>
<td>22.5</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>R2</td>
<td>12</td>
<td>14</td>
<td>12</td>
<td>9</td>
<td>29.03</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>R3</td>
<td>12</td>
<td>13</td>
<td>12</td>
<td>8</td>
<td>25.81</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>R4</td>
<td>13</td>
<td>15</td>
<td>13</td>
<td>7</td>
<td>22.51</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
<td>55</td>
<td>48</td>
<td>31</td>
<td>100</td>
<td>17</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No</th>
<th>Commentary</th>
<th>Farmer</th>
<th>Holding/ head</th>
<th>not AI</th>
<th>result* (%)</th>
<th>%</th>
<th>still* (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R1</td>
<td>8</td>
<td>9</td>
<td>9</td>
<td>5</td>
<td>23.81</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>R2</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td>4</td>
<td>19.05</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>R3</td>
<td>8</td>
<td>10</td>
<td>10</td>
<td>5</td>
<td>23.81</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>R4</td>
<td>9</td>
<td>11</td>
<td>11</td>
<td>6</td>
<td>28.57</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td>38</td>
<td>38</td>
<td>21</td>
<td>100</td>
<td>18</td>
<td>100</td>
</tr>
</tbody>
</table>

If the data source in 2014: Description: result *) states already give birth, still *) state is still in the process of impregnation

Table.1, the show that success of the parent AI fast buffaloes pregnant or quickly produce a child in the R2-R3 around (29.03 to 25.81%) and R1-R4 still low, in this case is still in the process
of impregnation. While cattle that have not got faster AI pregnant or quickly produce children at R4, R1 and R3 value bunting same average, whereas R2, the lower the success pregnant.

**Feasibility analysis buffaloes**

Buffalo that gets, AI, and who have not received AI, can be said to be socio-economically feasible, if the sale value of buffalo in accordance with the current price, the reception input is greater than the output, then the business can be declared eligible buffalo cattle, seen in Table 2.

**Table 2.** Analysis buffalo livestock business which gets AI and AI in the farmer has not got

<table>
<thead>
<tr>
<th>Pregnant</th>
<th>value -n</th>
<th>The mean/head</th>
<th>standard deviation</th>
<th>Standard error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getting AI buffalo</td>
<td>48</td>
<td>55</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>-value of buffalo calves</td>
<td>-</td>
<td>10,00</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>-sale value buggalo</td>
<td>-</td>
<td>12,5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>-the average ownership buffalo</td>
<td>-</td>
<td>1,15</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>-gross income</td>
<td>-</td>
<td>15.24</td>
<td>3.37</td>
<td>0.45</td>
</tr>
<tr>
<td>-output /value input</td>
<td>-</td>
<td>1.81</td>
<td>4.32</td>
<td>0.44</td>
</tr>
<tr>
<td>-the production/output value</td>
<td>-</td>
<td>13.43</td>
<td>1.63</td>
<td>0.54</td>
</tr>
<tr>
<td>the value of B/C</td>
<td></td>
<td>1.4</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Gross revenue versus net income
(DF = 48), the value of the t test

<table>
<thead>
<tr>
<th>Get AI buffalo</th>
<th>48</th>
<th>55</th>
<th>-</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not to get AI buffalo</td>
<td>32</td>
<td>38</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>-value livestock breeds buffalo</td>
<td>-</td>
<td>10.00</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>-value selling buffalo</td>
<td>-</td>
<td>12.5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>-the average ownership buffalo</td>
<td>-</td>
<td>1.18</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>-gross income</td>
<td>-</td>
<td>14.75</td>
<td>3.11</td>
<td>0.42</td>
</tr>
<tr>
<td>-output /value input</td>
<td>-</td>
<td>1.81</td>
<td>4.32</td>
<td>0.44</td>
</tr>
<tr>
<td>-the production/output value</td>
<td>-</td>
<td>12.94</td>
<td>1.47</td>
<td>0.46</td>
</tr>
<tr>
<td>the value of B/C</td>
<td>-</td>
<td>1.3</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Gross revenue versus net income
(DF = 32), the value of the t test

<table>
<thead>
<tr>
<th>Get AI buffalo</th>
<th>48</th>
<th>55</th>
<th>-</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not to get AI buffalo</td>
<td>32</td>
<td>38</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 3 indicates that, the results of t test analysis was obtained benefit farmers who receive approximately AI IDR.13,43 million, the average ownership of buffalo around 1.15 heads/farmers, the value of B/C 1.4, benefit farmers who have not gotten around AI IDR.12.94 million/farmers, the average ownership of buffaloes around 1.18 heads/farmers, the value of B/C 1.3 t test results showed significantly different hypotheses, the value of t-test known at 13.43 and 12.94. It indicates P<0.05 was significant efforts buffalo ownership of 1.15 to 1.18 heads/farmers have a positive impact on farmers that receive AI, in comparison with farmers who have not received AI buffalo, cattle sale value AI results of the sale value more highs.
CONCLUSION

The results showed that, benefit farmers who receive approximately AI IDR.13.43 million, the average value of B/C 1.4, benefit farmers who have not gotten around IDR.12.94 million AI farmer, the value of B/C 1.3 of the t test showed significantly different hypotheses, the value of t-test known at 13.43 and 12.94. It indicates P <0.05 1.15 to 1.18 buffalo ownership head/farmer positive impact on farmers who received AI, compared to farmers who have not received AI buffalo, cattle selling value over the highest AI results.

REFERENCES


Department of Agriculture and Animal Health West Lombok West Nusa Tenggara Province, in 2013 the Agricultural Statistics data


An Economic Analysis of The Effect of Soil Conservation on Food and Feed Provision in Dryland Agribusinesses on Timor Island, Indonesia

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ABSTRACT: The technical and economic benefits of food and feed crop integration are important facts needed in the development of soil conservation on Timor Island. This study was conducted in South Timor Tengah (TTS) and North Timor Tengah (TTU) Regencies between March and May 2013 and was aimed to discover the amount of cash generated from food crops planted as hedgerows in vegetative conservation efforts compared to no conservation efforts, and the amount of cash generated by corn plants planted between hedgerows in five years of cultivation. The data were collected through interviews and field observations. The results of this study demonstrated that: (a) The production of feed biomass planted as hedgerows increase as time progressed and the production would stabilise after the fourth year at 25 tons ha-1year-1, (b) The relationship between biomass production and cultivation time formed a linear line with the equation $y = 6,032.63x - 592.6$. (c) The relationship between biomass income and cultivation time formed a linear line with the equation $Y = 2,021,458.37x - 2,444,254.57$, (d) Hedgerows could potentially supply the needs of 2-3 cattle per six months fattening or 4-6 cattle per year, (e) Vegetative conservation reduced the size of land effective for food crops by 10-20% and reduced food crop productivity; however, land productivity increased because the Land Equivalent Ratio (LER) was 6.74 times higher than that of unconserved soil, (f) The reduced corn plant productivity during the 5 years of maintenance formed the exponential line equation $y = 4,559.18e^{-0.34x}$ for soil which underwent vegetative conservation and the linear line equation $Y = -634.4x + 3,930$ for unconserved soil, (g) The total gross margin of vegetative conservation for five years cultivation was IDR 29,967,413 ha-1 and without conservation IDR 13,385,079 ha-1, (h) The relationship between the cultivation years and the income from land which had undergone soil conservation during the five years it was cultivated increased, creating a power regression line equation $Y = 4E+06e^{0.146x}$, whereas on unconserved soil it decreased, creating the linear regression line equation $Y = -1E+06x + 6E+06$.

Keywords: economy, soil conservation, food, feed, West Timor

INTRODUCTION

The ever increasing population of Timor Island is leading to the increased needs for larger amounts of food with more variety and better quality. At the moment, the population of Timor Island is 1,382,771 people (NTT Central Bureau of Statistics, 2012; Kupang Regency Central Bureau of Statistics, 2012). If the population growth is 1.76% per year (Postel, 2009), in the mid 21st century the population will double and at the end of the 21st it will quadruple. The challenges in the future will be more difficult because the consequences of population growth is land conversion from agricultural uses to housing, industrial and other uses, while in fact at the moment East Nusa Tenggara Province still needs to import 4,043 tons of grain, especially rice, per year (Central Bureau of Statistics NTT, 2012).
The agricultural system in Timor Island is dominated by field cultivation. Farmers cultivate food crops and perennial crops in the mixed cropping pattern. The utilization of dryland by farmers is still within the subsistence level and has low productivity (Bobihoe et al., 1999) and does not give much attention to soil conservation, resulting in a high probability of soil erosion (Subandi et al., 1997).

Besides planting crops, the farmers also raise livestock, which is an important component of the farmers’ income. Wirdahayati (2007) stated that livestock raising in NTT, especially on Timor Island, is dominated by Balinese cattle, and in the past 30 years NTT has become the largest livestock producer. Livestock raising contributes quite a lot to the household income, approximately 15-50% of the farmers’ income.

One form of soil conservation which integrates the crop component and the livestock component on one plot of land is the alley cropping pattern. The application of the alley cropping pattern is an alternative to support the development of a sustainable agricultural system. The utilization of technology in the implementation of development needs to cater to the creation of as many job opportunities as possible and increase productivity and exploit as many self-created tools as possible in order to help reach the aims of development (Mulyana, 2003 in Ritonga, 2003).

Various studies have recommended the vegetative method because not only could it curb erosion, it also guarantees increased land productivity (Sukmana and Suwardjo, 1991). The hedgerow conservation technology is technically live hedges formed from leguminous trees, terrace strengthening plants, and cover crops which are planted to follow certain contour lines. The kinds of grass often planted as terrace strengthening plants are elephant grass, cetaria, and benggala, whereas grass planted on terrace walls are usually climbing vines such as Brachiaria sp, Cynodon dactylon, Paspalum conjugatum, Penicum repens; and (c) cover crops such as Mucuna sp and Centrosema sp (Sudaryono, 1995).

According to Zamora (1995), sustainable agribusinesses must fulfill these five criteria: (a) economic viability; (b) ecologically sound and friendly; (c) socially just; (d) culturally appropriate; and (e) systems and holistic approach.

The application of vegetative conservation enables the dryland farmers to independently create a soil rehabilitation and conservation system on their land to support a sustainable agricultural production system. Plants that are planted as hedgerows do not merely control the flow of water on the surface and erosion, they also produce agricultural biomass which play a role in soil rehabilitation and fertilizers and produce nutrition-rich fodder for livestock. Reintjes et al. (1999 in Salikin, 2003) defined sustainable agriculture as the management of agricultural resources to fulfill human needs while maintaining or improving the quality of the environment and preserving natural resources. This concept emphasizes the importance of economic growth without sacrificing the quality of the environment (Mitchell et al., 2003).

This study aimed to discover (a) the additional cash generated by fodder crops planted as hedgerows in vegetative conservation compared to farms where no conservation efforts were applied, (b) the amount of cash generated by corn plants planted between hedgerows in vegetative conservation compared to farms where no conservation efforts were applied.

**METHODOLOGY**

**Location and Time**

This study is a survey research which compared the economic values of 2 kinds of land management, land where vegetative conservation efforts are applied and land where no such efforts were made during 5 years of land cultivation. The values compared were the feed biomass production and corn production. The surveys were conducted on 3 (three) villages in 2 (two regencies, Timor Tengah Selatan (TTS) and Timor Tengah Utara (TTU) Regencies, between March and May 2013.
Data Collection

_Hedgerow Plant Biomass_

The data collected consisted of:

a. The feed biomass production data collected through observations and on-site measurements.
b. The price of the biomass was determined based on the local farmers’ willingness to pay
c. The cost of labor for the hedgerow, which consisted of the labor for planting and maintaining
   the hedgerow, was collected from semi-structured interviews of farm owners
d. Data of hedgerow harvesting costs, which consisted of labor cost for harvesting hedgerow in
   one year
e. The data of the materials needed for planting the hedgerow which consisted of the number
   of pols used in planting the hedgerow and the price of a pol were collected observations and
   semi-structured interviews

The economic value of the fodder crop biomass planted as hedgerow was calculated through the amount of feed biomass production that could be harvested in one year multiplied by the value of the biomass and subtracted by the cost of labor and materials.

Data Analysis

The relationship between the year of cultivation and the total income was analyzed using linear or non-linear regression.

The tool used for analyzing the relationship model was the SPSS program for Windows version 18. From the several alternative regression models, the one with the highest determiner coefficient (R2) was chosen. This was done because the higher the R2 value, the better the regression equation is acquired.

The economic value of the land was calculated from the direct profits, consisting of the revenue and cost. The value of unconserved land was calculated from the cornagribusiness subtracted by the costs of the corn agribusiness, whereas the benefits of the vegetative conservation technology was calculated from the productivity of the feed biomass which was planted as hedgerows + the productivity of the plants planted between the hedgerows subtracted by the costs needed for the agribusiness and the loss of soil nutrients caused by the feed biomass.

In order to compare the revenues and costs of the two types of land, conserved and unconserved, in one year, the Gross Margin analysis was conducted. According to Kennon (2010), the Gross Margin is the revenue subtracted by the variable cost which is calculated with the following equation:

\[ \text{Gross Margin} = \text{Revenue} - \text{Variable cost} \]

This study’s hypothesis is that vegetative conservation agribusinesses are more profitable than ones without conservation efforts. If the t-count > t-table, H0 is rejected at a certain level of error, meaning that the revenue from the land where vegetative conservation is conducted is higher than that of unconserved land. On the other hand, if t-count < t-table, H0 is accepted at a certain level of error, meaning that the revenue from land where vegetative conservation is conducted is similar or lower than that of unconserved land.

To test this hypothesis, an independent sample t-test with one way rejection criteria. To compare the efficiency of land usage between monoculture (corn) and intercropping (corn + feed), the analysis of land equivalent ratio/LER was conducted. Nuryadi (1978) stated that the intercropping pattern was to be proclaimed efficient if the LER was greater than one (> 1), which was calculated using the following equation:
\[ NSL = \sum_{i=1}^{n} \left( \frac{h_i}{H_i} \right) \]

\( h_i \) = the yield of the intercropping of the i-th plant species
\( H_i \) = the yield of the monoculture of the i-th plant species
\( i = 1, 2, 3, \ldots, n \) the species of plants in the intercropping

The total economic value of vegetative conservation was calculated using the following equation:
NET = x1 + x2
NET: Total economic value
\( X_1 \) : the economic value of the production feed biomass planted as hedgerows
\( X_2 \) : the economic value of corn planted between the hedgerows

The costs calculated for land which had undergone soil conservation were the cost for the labor used to construct the hedgerows, the cost for maintaining the hedgerows, and the agribusiness costs for the corn plants planted between the hedgerows. The revenue for land which had not undergone soil conservation efforts was the revenue from the corn agribusiness. The costs calculated for land which had not undergone soil conservation were the costs for the corn agribusiness.

RESULTS AND DISCUSSION

The Effect of Conservation on the Hedgerow Biomass Production

There were some dissimilarities in the method of planting the hedgerows in the three locations observations. Conservation vegetation which was commonly planted by the farmers in North Mollo Sub-district, TTS Regency elephant grass (Pennisetum purpureum) together with corn in the first year, whereas the farmers in West Miomafo Sub-district, TTU Regency usually planted calliandra (Calliandra calothyrsus). Farmers in North Mollo Sub-district usually planted elephant grass at the same time as corn in the first year of cultivation using the graft method. In contrast, the farmers in West Miomafo Sub-district planted the calliandra seeds in the second year. The planting was commonly done in stages in different years.

The capital needed for planting was very little. The seeds or seedlings usually originated from the farmers’ own fields or from their relatives’ fields. They relied on family for the labor for planting. The farmers rarely patched their fields.

Results of the interviews demonstrated that 80% of the farmers owned cattle, ranging between 1 - 5 heads per head of household and the average was 1.97 heads per head of household. The results of the t-test of cattle ownership between land owners who conducted soil conservation and those who did not was insignificant. This means that there was no relationship between cattle ownership and vegetative conservation efforts. Not conducting vegetative conservation efforts did not automatically mean these farmers did not own any cattle, but they usually had more than one plot of land and one of them was planted with fodder crop, either planted as hedgerows or around the perimeter of their field, lawn, or on the part of their land which had steep slopes. Some farmers who did not have livestock conducted vegetative conservation by planting elephant grass as hedgerows because elephant grass was easy to market and they were sold as bulk.

Elephant grass can be harvested 2-3 months after planting, whereas calliandra, which is a leguminous tree, can only be harvested after the second year.

Farmers usually harvested the feed biomass in stages, 2-3 times a day at around 15-20 kg per harvest, and the biomass can only be harvested 4-6 times per year. Roughage collection is usually done by family members and not a single farmer paid for labor from outside the family. The harvested biomass was fed to the cattle; however, the manure was not returned to the field but used on separate vegetable plots, sold, or not utilized at all.
The results of the observation of wet biomass weight per meter in rows was that it increased as the age of the plants progressed. The production stabilized after the fourth year of cultivation when the production reached 25 tons ha\(^{-1}\) year\(^{-1}\).

If the biomass was valued in cash, the revenue was IDR 500 per kg wet biomass. If the need for elephant grass seed was calculated from the distance between rows, 7.21 meters, and the distance between plants, 15 cm, 9242 stek were needed per hectare and the price of the seedlings was IDR 100 per graft then the cost of elephant grass seedlings was IDR 924,200. On the other hand, for calliandra, the need for seed was 7 kg per hectare at a price of IDR 50,000 per kg. The cost for planting and harvesting labor was valued at IDR 20,000 per man day. The cost of the soil nutrients contained in the biomass was measured by converting dry biomass to 2% N, 0.25% P\(_2\)O\(_5\), and 4% K\(_2\)O (Manglayang Farm Online, 2005); therefore, the farmers’ total income from vegetative conservation was IDR 18,100,000 ha\(^{-1}\) (Tables 1, 2 and 3).

Table 1. Revenue from Hedgerow Biomass in Vegetative Conservation

<table>
<thead>
<tr>
<th>Cultivation Year</th>
<th>Wet biomass production per m (kg)</th>
<th>Distance between rows (m)</th>
<th>Harvest frequency per year (times)</th>
<th>Wet biomass production (kg/ha/year)</th>
<th>Revenue from biomass (IDR)*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.67</td>
<td>10.65</td>
<td>4</td>
<td>8,774</td>
<td>4,387,000</td>
</tr>
<tr>
<td>2</td>
<td>2.17</td>
<td>10.65</td>
<td>5</td>
<td>14,117</td>
<td>7,058,500</td>
</tr>
<tr>
<td>3</td>
<td>1.67</td>
<td>6.97</td>
<td>6</td>
<td>17,353</td>
<td>8,676,500</td>
</tr>
<tr>
<td>4</td>
<td>6.33</td>
<td>6.77</td>
<td>4.33</td>
<td>28,391</td>
<td>14,195,500</td>
</tr>
<tr>
<td>5</td>
<td>5.83</td>
<td>8.13</td>
<td>4.67</td>
<td>26,522</td>
<td>13,261,000</td>
</tr>
</tbody>
</table>

Note: *) The price of biomass was calculated at IDR 500/kg

Table 2. The Cost of Seed/Seedlings for Hedgerow Plants in Vegetative conservation

<table>
<thead>
<tr>
<th>Cultivation Year</th>
<th>Seed/seedling cost</th>
<th>Planting cost (man days)</th>
<th>Harvesting cost (man days)</th>
<th>Total cost Seed+ labor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Material Value (IDR)</td>
<td>Material Value (IDR)</td>
<td>Material Value (IDR)</td>
<td>Material Value (IDR)</td>
</tr>
<tr>
<td>1</td>
<td>6,161 (graft*)</td>
<td>7</td>
<td>133,333</td>
<td>2,433,333</td>
</tr>
<tr>
<td>2</td>
<td>2.33 kg**)</td>
<td>3.33</td>
<td>66,667</td>
<td>2,433,333</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3,650,000</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3,650,000</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3,650,000</td>
</tr>
</tbody>
</table>

*) Commodity: elephant grass. The distance between rows was 7.21 m, planted in rows at a distance of 15 cm, the price per pols IDR100

**) Commodity: calliandra. Seven kg of seed was needed per ha at IDR 50,000/kg
The hedgerow production and economic value increased as time progressed. The relationship between biomass production and cultivation time formed a linear relationship (Figure 3) with the following equation:

\[ Y = 6,032.63x - 592.63 \]

Where:
- \( Y \) = Hedgerow wet biomass production (kg ha\(^{-1}\)year\(^{-1}\))
- \( x \) = Cultivation year

Whereas the relationship between the revenue from biomass and time formed a linear relationship with the following equation:

\[ Y = 2,021,458.37x - 2,444,254.57 \]

Where:
- \( Y \) = revenue from hedgerow plant biomass (IDR ha\(^{-1}\)tahun\(^{-1}\))
- \( x \) = Cultivation year

![Figure 3. The Regressive Equation for Hegde Row Biomass Production and Revenue on Land Where Soil Conservation Efforts were Conducted for Five Years](image)

**Table 3. The Cost of Soil Nutrients Lost through Feed Biomass in Vegetative Conservation**

<table>
<thead>
<tr>
<th>Cultivation year</th>
<th>Production of dry biomass (kg/ha/yr)</th>
<th>N content of dry biomass (2%*) (kg/ha)</th>
<th>P2O5 content of dry biomass (0.25%*) (kg/ha)</th>
<th>K2O content of dry biomass (4%*) (kg/ha)</th>
<th>Loss of urea at IDR2400/ kg (IDR)</th>
<th>Loss of SP36 at IDR3000/ kg (IDR)</th>
<th>Loss of KCl at IDR3600/ kg (IDR)</th>
<th>Cost of nutrient loss (IDR/ha/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2,193</td>
<td>29</td>
<td>4</td>
<td>58</td>
<td>155,975</td>
<td>30,464</td>
<td>457,752</td>
<td>644,191</td>
</tr>
<tr>
<td>2</td>
<td>3,529</td>
<td>47</td>
<td>6</td>
<td>94</td>
<td>250,971</td>
<td>49,018</td>
<td>736,546</td>
<td>1,036,535</td>
</tr>
<tr>
<td>3</td>
<td>4,338</td>
<td>87</td>
<td>11</td>
<td>174</td>
<td>462,741</td>
<td>90,379</td>
<td>1,358,044</td>
<td>1,911,165</td>
</tr>
<tr>
<td>4</td>
<td>7,098</td>
<td>142</td>
<td>18</td>
<td>284</td>
<td>757,092</td>
<td>147,869</td>
<td>2,221,899</td>
<td>3,126,861</td>
</tr>
<tr>
<td>5</td>
<td>6,631</td>
<td>133</td>
<td>17</td>
<td>265</td>
<td>707,261</td>
<td>138,137</td>
<td>2,075,656</td>
<td>2,921,054</td>
</tr>
</tbody>
</table>

*) Source: Manglayang Farm Online (2005)

Hedgerow biomass is an organic matter supplier. The production of wet biomass in the fourth and fifth year was 25 tons or equivalent to 6 tons dry biomass. If it is assumed that the contents of elephant grass biomass is 2%N, 0.25% P\(_2\)O\(_5\) and 4% K\(_2\)O (Manglayang Farm Online, 2005), the
biomass produced would contain 120 kg N, 15 P\textsubscript{2}O\textsubscript{5} and 240 kg K\textsubscript{2}O.

The hedgerow plant biomass is potential cattle feed. If it is assumed that 50% of the biomass could be consumed by livestock, the vegetative conservation could potentially produce 25 tons of fodder per year. Wirdahayati et al. (1999) stated that Balinese cattle consume between 10% and 15% of their body weight. If it is assumed that a 200 kg cow needs 20 - 30 kg per day, for cattle fattening that lasts six months (for a single fattening period), the need for one cow would be 3,600 – 5,400 kg per per 6 months. The fodder supply potential is 25 tons per year; therefore, the potential for six months would be 12.5 tons. This pattern would supply the needs of 2-3 heads of cattle per 6 months fattening or 4-6 heads of cattle per year.

The introduction of grass as hedge plants was a vegetative conservation technique that was readily accepted by the farmers because not only could it control erosion, it could also solve the problem of fodder shortages for the ruminants they raised (Soelaeman, 1999). Haryati et al. (1991) stated that the terrace strengthening plants on bench terraces could support between 21-59 heads of sheep ha\textsuperscript{-1}year\textsuperscript{-1}. This included the waste products of food crops planted on arable land that could be given to livestock. The terrace strengthening plants’ contribution to fodder supply was between 51% and 60%.

Better soil conservation efforts are hoped to increase land productivity and the revenue from food crop. However, pertaining to the relationship with terrace strengthening plants in the form of livestock feed (especially grass), not all of the farmers could accept them due to a variety of reasons, for example, the presence of grass would reduce the size of arable land available for food crops, their grass was harvested by other farmers, the farmers do not own ruminant livestock, grass could become a nesting site for rats and other pests, and the grass would compete with the cassava plants the farmers were accustomed to planting (Dariah et al., 1998).

Soelaeman (1999) stated that the presence of grass as terrace strengthening plants had a positive impact on cattle and goat raising, at 6% and 8% respectively.

According to the study conducted by Sudharto et al. (1994) in South Sulawesi, vetiver (Vetiveria zizanioides) and Guatemala grass (Tripsacum laxum) hedgerows could contribute 7.2 – 13.3 t ha\textsuperscript{-1} fodder and control erosion between 15.6 and 85% better compared to land where no conservation efforts were made in shifting agriculture locations.

**Land Use Efficiency**

The presence of hedgerows which incorporate the fodder crop component into field cultivation is a form of multiple cropping because there are more than two kinds of crops on one tract of land in one year. It has been explained in the previous sections that the presence of hedgerows had a better impact on the resource conservation compared to single cropping. In the economic point of view, the hedgerows have additional economic value from the fodder crop produced; however, the value of the corn production is reduced until the fourth year due to reduced plot size.

In Table 4 it is shown that the income (revenue - cost) from land where conservation efforts were done (intercropping of corn + fodder hedgerow) was higher than that of unconserved land (corn monoculture) from year one to year five. The results of the analysis of land equivalent ratio/LER was > 1 and the value continued to increase as cultivation time progressed. In the first year of cultivation the LER was 1.63 which meant that the income from conserved land was 1.63 times higher than that of unconserved land, whereas in the fourth year the income was 6.74 times higher; moreover, in the fifth year, the income from unconserved land was minus. Therefore, conserved land was much more efficient than unconserved land.
The 6th International Seminar on Tropical Animal Production
Integrated Approach in Developing Sustainable Tropical Animal Production
October 20-22, 2015, Yogyakarta, Indonesia

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**Table 4. The Land Equivalent Ratio for Conserved and Unconserved Land**

<table>
<thead>
<tr>
<th>Cultivation Year</th>
<th>Income from unconserved land</th>
<th>Income from conserved land</th>
<th>LER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4,604,444</td>
<td>4,600,843</td>
<td>1.63</td>
</tr>
<tr>
<td>2</td>
<td>4,382,222</td>
<td>4,594,165</td>
<td>1.71</td>
</tr>
<tr>
<td>3</td>
<td>2,931,111</td>
<td>5,416,754</td>
<td>2.79</td>
</tr>
<tr>
<td>4</td>
<td>1,613,333</td>
<td>8,185,899</td>
<td>6.74</td>
</tr>
<tr>
<td>5</td>
<td>-146,032</td>
<td>7,169,751</td>
<td>∞</td>
</tr>
<tr>
<td>Total</td>
<td>13,385,079</td>
<td>29,967,413</td>
<td>3.27</td>
</tr>
</tbody>
</table>

**The Total Economic Value**

The total income from land where vegetative conservation was conducted during the five years of cultivation was IDR 62,510,048 ha⁻¹, whereas from land without conservation was IDR 20,265,079 ha⁻¹. The total cost for vegetative conservation for five years was IDR 32,542,635 ha⁻¹, while for land without conservation was IDR 6,880,000 ha⁻¹. Therefore, the total gross margin vegetative conservation during the five years of cultivation was IDR 29,967,413 ha⁻¹ and without conservation was IDR 13,385,079 ha⁻¹ (Table 5).

The relationship between cultivation and income from conserved land during the five years of cultivation showed an increasing trend and formed a power regression line with the equation \( y = 4E+06e^{0.146x} \), while on unconserved land it showed a decreasing trend and formed a linear regression line with the equation \( y = -1E+06x + 6E+06 \) (Figure 6).

**Table 5. The Gross Margin Analysis of Conserved and Unconserved Land**

<table>
<thead>
<tr>
<th>Cultivation Year</th>
<th>Biomass Revenue (Rp)</th>
<th>Food crops</th>
<th>TRK</th>
<th>Conserved Biomass</th>
<th>Food crops</th>
<th>TCK</th>
<th>Gross margin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2,924,528</td>
<td>6,333,333</td>
<td>9,257,862</td>
<td>3,217,019</td>
<td>1,440,000</td>
<td>4,657,019</td>
<td>4,600,843</td>
</tr>
<tr>
<td>2</td>
<td>4,705,708</td>
<td>4,864,994</td>
<td>9,570,702</td>
<td>3,536,537</td>
<td>1,440,000</td>
<td>4,976,537</td>
<td>4,594,165</td>
</tr>
<tr>
<td>3</td>
<td>8,676,395</td>
<td>3,681,524</td>
<td>12,357,919</td>
<td>5,561,165</td>
<td>1,380,000</td>
<td>6,941,165</td>
<td>5,416,754</td>
</tr>
<tr>
<td>4</td>
<td>14,195,469</td>
<td>2,107,291</td>
<td>16,302,760</td>
<td>6,776,861</td>
<td>1,340,000</td>
<td>8,116,861</td>
<td>8,185,899</td>
</tr>
<tr>
<td>5</td>
<td>13,261,137</td>
<td>1,759,668</td>
<td>15,020,805</td>
<td>6,571,054</td>
<td>1,280,000</td>
<td>7,851,054</td>
<td>7,169,751</td>
</tr>
<tr>
<td>Total</td>
<td>43,763,237</td>
<td>18,746,811</td>
<td>62,510,048</td>
<td>25,662,635</td>
<td>6,880,000</td>
<td>32,542,635</td>
<td>29,967,413</td>
</tr>
<tr>
<td>Unconserved</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>6,044,444</td>
<td>6,044,444</td>
<td>6,044,444</td>
<td>1,440,000</td>
<td>1,440,000</td>
<td>4,604,444</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>5,822,222</td>
<td>5,822,222</td>
<td>5,822,222</td>
<td>1,440,000</td>
<td>1,440,000</td>
<td>4,382,222</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4,311,111</td>
<td>4,311,111</td>
<td>4,311,111</td>
<td>1,380,000</td>
<td>1,380,000</td>
<td>2,931,111</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2,953,333</td>
<td>2,953,333</td>
<td>2,953,333</td>
<td>1,340,000</td>
<td>1,340,000</td>
<td>1,613,333</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1,133,968</td>
<td>1,133,968</td>
<td>1,133,968</td>
<td>1,280,000</td>
<td>1,280,000</td>
<td>-146,032</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>20,265,079</td>
<td>20,265,079</td>
<td>20,265,079</td>
<td>6,880,000</td>
<td>6,880,000</td>
<td>13,385,079</td>
<td></td>
</tr>
</tbody>
</table>

593
Figure 6. The Regression Equation for the Effect of Cultivation Time on Revenue from Land where Vegetative Conservation Efforts Have and Have not been done

CONCLUSION

Conclusion

a) Vegetative conservation generated IDR 18,100,602 extra cash from the fodder crop planted as hedgerows during the five years of cultivation, whereas unconserved land did not generate any extra cash.

b) The amount of cash generated by the food crop planted between the hedgerows on land where vegetative conservation was conducted for five years was IDR 11,866,811, whereas on unconserved land it was IDR 13,385,079.

c) The total gross margin land with vegetative conservation during the five years of cultivation was IDR 29,967,413 ha⁻¹ and that of unconserved land IDR 13,385,079 ha⁻¹.

Suggestions

Vegetative conservation could be optimized by: (a) utilizing hedgerow biomass as a source of organic matter by periodically trimming and spreading the biomass onto the land, (b) integrating crops and livestock, (c) altering the habit of not fertilizing the land to fertilizing with manure, and (d) not burning the biomass from food crops when preparing the land.

REFERENCES


Analysis of Champion of Milk Cluster Industry in the Province of Central Java-Indonesia

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ABSTRACT: Development of milk cluster industry could promote regional economic development, by optimizing “diamonds” factors, which one of them are firm strategy, structure and rivalry leading to high competitiveness (championship). This study was to analyze 18 small milk industries distributed through main regions of milk production in the province of Central Java-Indonesia. The capacity of districts to supply raw materials, implementation of GMP of each factory as well as championship factors were detected by a survey using multistage and multiphase sampling methods. The results indicated that 8 of them have rouled off and on industry, due to uncertainly supply of raw milk materials at the affordable price as well as lack of market place. From 10 enterprises, only 6 have presented the score of GMP implementation > 2.5/4. Among them have the score of championship values which are based on: added value, portion of local material supply, absorption of manpower and marketing system as well as four determinants of competitive advantage as followed: 1). Milk Cooperative Inderakila at Boyolali (cheese producer) 79/100, followed by Farmer group Tani Mukti-Wonosobo (pasteurized ice milk producer) 59/100 and Ent. Hongkong-Kudus (Ice cream maker) 57/100. It has concluded that among small milk industries could be promoted as a locomotive for regional economic development, while at once to improve their capacities.

Keywords: Milk Cluster Industry, Small Processors, GMP, Champion

INTRODUCTION

Livestock provides rural farmers with a way to increase assets. It is therefore, a method to diversify, and income proven pathway out of poverty and nutrition. Families familiar with cows and value cow ownership and productivity. Even, in the most conservative of societies, cows and milk often managed by women and income from milk is managed by women. Milk is a familiar food. The market for milk (and meat) already exists. Milk makes positive contributions to the diet of children, pregnant and nursing mothers, the elderly and persons with health challenges.

Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g., universities, standards agencies, trade associations) in a particular field that compete but also cooperate. (Porter,1998). The cluster industry could contribute to the regional economic development and social welfare, especially by improving productivity of industry, innovation and jobs opportunity. There are at least four factors or known as “diamond factors” that contribute to industrial productivity which link to business environment i.e: factor (inputs) condition, demand condition, related supporting industries and firm strategy and rivalry.

The purpose of this paper is to highlight key performances in the dairy value chain with a particular focus on the small dairy processors sector which could generate the competitiveness for regional economic development in the province of Central Java, Indonesia.
MATERIALS AND METHODS

The main objective of the study was to undertake an in-depth assessment of the value chain of milk and products marketing through identifying actors (operators and facilitators), factors and relationships. Moreover to identify the challenges, possible opportunities and threats of the subsector, and to analyze the underlying causes for the dwindling of the supply of milk in the study area. What is the current potential of milk production in the study area and what are the different factors and actors that affect milk value chain in small holder dairy farmers in the study area. The materials used in this research were 18 small and medium milk enterprises in the province of Central Java-Indonesia.

In order to find the objectives, information and data from desk review was triangulated with interviews and discussions with key stakeholders and then scored it in 5 scales of score on 3 steps and then analyzed them:

- The spreading of small and medium dairy enterprises and support area as well as its competitiveness to seek of raw milk and materials
- Analysis of the implementation of Good Manufacturing Practices, GMP based on 13 criteria implementation (Quality management systems, Personal, Building, Hygiene and sanitation, Production system, Control of quality, Documentation, Internal audit, Storage system, Contract of production or analysis, Treatment of consumers complaint and Evaluation) explaining provision and compliance to trade and regulatory standards in the food processing sector
- The championship values which are based on: added values and technology utilization, portion of local material supply, absorption of manpower and marketing system as well as 4 determinant of competitive advantages model of Porter as in (Fesser, 2001), i.e: firm strategy (innovation, marketing, added value, skill, IT, R & D, Financial access, planning), Demand condition (diversity, acceptability, special purpose, responsiveness, packaging, trouvability), Factor condition (price, numbers in market, sensorial) as well as supporting condition (school milk program, awards, contract) completed with some information on added value choice of products and marketing distance as well as machine utility.

RESULTS AND DISCUSSION

Value chain analysis is essential to an understanding of markets, their relationships, the participation of different actors, and the critical constraints that limit the growth of livestock production and consequently the competitiveness of smallholder farmers. Value chain analysis does not require highly detailed insight into the problems in order to develop an intervention strategy for value chain improvement. The main issues of concern are easily discovered in actors and stakeholders meetings and most urgent interventions can be designed already in general terms after a very brief analysis of the situation.

There were 18 small and medium dairy enterprises, included milk cooperatives (Coop), farmer unity, FU (KTT), or private enterprise (Ent.), distributed over 9 districts in the province of Central Java-Indonesia i.e: Banyumas, Boyolali, Klaten, Kudus, Semarang, Magelang, Salatiga, Purworejo and Wonosobo. The enterprises received raw milks materials either from internal district or external, lead to for some uncertain supply of raw milk and other materials with affordable prices.
There were only 10 enterprises of them produced regularly and in the proper term of milk products, while the others were lacked on raw milk materials and real process technology. These enterprises were objects of analysis of GMP implementation using 13 criteria on 5 scale of score, as well as Production capacity and Local manpower absorption and level of worker knowledge (Table 2).

Table 2. Score of GMP implementation and worker condition

<table>
<thead>
<tr>
<th>No</th>
<th>Enterprises</th>
<th>Capacity/d, lt</th>
<th>Score of GMP (/65)</th>
<th>Man power</th>
<th>Knowledge of worker</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Milk Cooperatives Pesat-Banyumas</td>
<td>300 lt/d</td>
<td>42</td>
<td>7</td>
<td>Low-medium</td>
</tr>
<tr>
<td>2</td>
<td>KTT tani Mukti-Wonosobo</td>
<td>800 lt/d</td>
<td>42</td>
<td>40</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>Sumber Rezeki-Kudus</td>
<td>800 lt/d</td>
<td>38</td>
<td>100</td>
<td>Medium-High</td>
</tr>
<tr>
<td>4</td>
<td>Rini Yoghurt</td>
<td>100 lt/d</td>
<td>16</td>
<td>2</td>
<td>Medium</td>
</tr>
<tr>
<td>5</td>
<td>Budi Mix farming-Purwodadi</td>
<td>100 lt/d</td>
<td>21</td>
<td>3</td>
<td>Low</td>
</tr>
</tbody>
</table>
For these reason, 6 of them which have product capacity > 100 lt/day, GMP score more than 50%, absorption of local worker >5 which have medium knowledge have been considered to be a locomotive for regional economic development. They were: Milk Cooperatives Pesat in Banyumas, KTT Tani Mukti in Wonosobo, Sumber Rezeki Ent.(Hongkong) in Kudus, Milkuma Ent. in Muntilan, Cita Nasional Ent. In Getasan-Semarang and Milk Cooperatives Inderakila in Boyolali.

**Competitive advantage (championship):**

The real indication of championship to empowering regional economic development are the utility of machine utility, usage of local raw milk materials, choice of added value of products, marketing management(Table 3).

<table>
<thead>
<tr>
<th>No</th>
<th>Enterprises</th>
<th>Machine utility, %</th>
<th>% local source of raw milk material</th>
<th>Added value of products, %</th>
<th>Market distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Milk cooperatives Pesat</td>
<td>12.5</td>
<td>100</td>
<td>75</td>
<td>Short</td>
</tr>
<tr>
<td>2</td>
<td>Ent. Milkuma</td>
<td>100</td>
<td>100</td>
<td>75</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>KTT Tani Mukti</td>
<td>200</td>
<td>100</td>
<td>150</td>
<td>Medium</td>
</tr>
<tr>
<td>4</td>
<td>Milk Coop Inderakila</td>
<td>200</td>
<td>100</td>
<td>1000</td>
<td>Long</td>
</tr>
<tr>
<td>5</td>
<td>Ice cream Hongkong</td>
<td>75</td>
<td>100</td>
<td>800</td>
<td>Medium</td>
</tr>
<tr>
<td>6</td>
<td>Ent. Cita Nasional</td>
<td>60</td>
<td>40</td>
<td>300-500</td>
<td>long</td>
</tr>
</tbody>
</table>

It should be included four determinant of competitive advantage which support the competitiveness of firm (firm strategy, structure and rivalry, sophisticated of demand condition of local customers, factor condition in quantity, quality and cost of products as well as related and supporting industries in cluster milk industries and of factor determinant of competitive advantage (Table 4).

**Table 4.** Scores of factors which major determinants of competitive advantage

<table>
<thead>
<tr>
<th>No</th>
<th>Enterprises</th>
<th>Firm strategy and rivalry</th>
<th>Demand condition</th>
<th>Factor condition</th>
<th>Related and supporting industries</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Milk cooperatives Pesat</td>
<td>19</td>
<td>17</td>
<td>10</td>
<td>6</td>
<td>52</td>
</tr>
<tr>
<td>2</td>
<td>Ent. Milkuma</td>
<td>23</td>
<td>14</td>
<td>6</td>
<td>3</td>
<td>46</td>
</tr>
<tr>
<td>3</td>
<td>KTT Tani Mukti</td>
<td>25</td>
<td>19</td>
<td>10</td>
<td>4</td>
<td>59</td>
</tr>
<tr>
<td>4</td>
<td>Milk Coop Inderakila</td>
<td>35</td>
<td>23</td>
<td>10</td>
<td>11</td>
<td>79</td>
</tr>
<tr>
<td>5</td>
<td>Ice cream Hongkong</td>
<td>25</td>
<td>15</td>
<td>10</td>
<td>4</td>
<td>57</td>
</tr>
<tr>
<td>6</td>
<td>Ent. Cita Nasional</td>
<td>24</td>
<td>17</td>
<td>7</td>
<td>3</td>
<td>52</td>
</tr>
</tbody>
</table>
CONCLUSIONS

It was concluded that 3 of 18 small and medium enterprises (Coop. Inderakila, FU Tani Mukti and Ent. Hongkong) could be used as a locomotive for regional economic development in the province of Java Central after regarding what the current potential of milk production in the study area is and what the different factors and actors are, that affect not only milk value chain in small holder dairy farmers in the study area but also their competitiveness as an agent to strengthen or empowering regional economics.

REFERENCES

Small Scale Livestock Farmers’ Disincentives for Animal Disease Prevention and How Incentives Can be Improved: A Case of Uganda

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ABSTRACT: Small scale livestock farmers in Uganda are faced with animal disease as one of the major production constraints. There are low levels of disease prevention and this could be partially attributed to the fact that small scale producers do not have the right incentives to prevent animal disease. In this paper we use existing literature to highlight the disincentives that exist among small scale farmers to not prevent animal disease and solutions that could improve their incentives. Among others we note that farmers have low incentives to prevent animal diseases due to the nature of their production systems, keeping livestock as part of a diversification strategy, lack of financial incentives and the weak institutional structures in place. As possible solutions, we suggest the use of the new tripartite cooperative model to implement incentives such as a quality based payment scheme and use social monitoring to ensure compliance, compartmentalization, product differentiation and certification aiming at local and regional markets.

Keywords: Livestock, disease prevention, incentives, Uganda

INTRODUCTION

Background

In Uganda, animal diseases are the major constraint to animal production and trade, (Uganda Programme for Trade Opportunities & Policy -UPTOP, 2006), (Nalubwama et al., 2011). Several studies have focused on viability and assessment of disease control strategies, availability and provision of veterinary services (eg (McDermott et al., 1999). To our knowledge, there has only been one study (by Rich and Perry 2011) on small scale farmers’ disincentives and solutions to improve incentives. They look at incentives for stakeholders in agriculture to prevent livestock disease in developing countries through the value chain lens. The difference here is the focus on only farmers to motivate disease prevention at farm level.

METHODOLOGY

A discussion of disincentives and possible solutions to improve incentives is derived from a narrative literature review. Existing peer reviewed papers and reports are used in the discussion.

DISCUSSION

Disincentives for animal disease prevention Production systems.

Livestock keeping in Uganda is dominated by small scale farmers but their production systems do vary according to agro ecological zones and human population densities. Small scale livestock farming systems in Uganda can be categorized into three classes: pastoral and nomadic / semi nomadic system, mixed crop livestock production or intensive dairy, poultry and pig farming. (Nalubwama et al., 2011).

Pastoralism is the most prevalent and efficient low cost livestock production system in arid and semi - arid parts of Uganda. Under pastoralism, the issue of trans- boundary animal diseases is important as livestock keepers move with their animals during the dry season and utilize communal
grazing and watering points, (Ministry of Agriculture, Animal Industry and Fisheries 2010).

Furthermore, there is disease risk from wildlife. Most pastoralists herd their animals at boundaries with wildlife that are a reservoir or host of several animal diseases that could introduce disease to their animals unless they have fencing, which most cannot afford, (Kock et al., 2002). This is a disincentive for disease prevention as pastoralists have limited control over wildlife movement.

Informal marketing

Sub Saharan Africa’s livestock and livestock product market is majorly characterized by an informal marketing structure and could most likely remain so, with most of the livestock products are sold to low income local consumers. (McDermott et al., 2010), (Perry and Dijkman, 2010). In the meat sector for most developing countries, meat is still sold in traditional markets or at meat stalls. Meat regulations are in place in order to provide safe meat to consumers but implementation varies, (FAO, 2011). The predominance of low quality products in the informal market in Uganda can be attributed to the fact that consumers have a low per capita consumption of livestock products, low incomes, and low purchasing power and are not sensitized about eating quality food, (UPTOP, 2006). The informal market makes traceability and inspection impossible and doesn’t provide incentives for farmers to prevent animal diseases.

Financial disincentives.

Price signals are an important source of information to producers as they drive behavior of actors, (Rich and Perry, 2011). In a comparison of incentives in the Ugandan Nile Perch market versus the livestock product market, it can be seen that that the Nile Perch market has financial incentives from high prices obtained from export to the high value EU market, (Jaffe et al. 2006). These financial incentives have led to investment in hygiene and higher quality but are much weaker in the livestock sector as there is no high quality market for Ugandan livestock products and livestock product prices are not incentivizing farmers to prevent disease, (UPTOP, 2006).

Profit maximization is not the major production objective.

Optimizing behavior of small scale farmers may run contrary to economic principles, (Rich and Perry, 2011) and this could be attributed to the fact that small scale farmers do have different economic objectives and are not exclusively concerned about simple profit maximization, (McDermott et al., 1999), (UPTOP, 2006). Livestock keeping is often a part of a diversification strategy and livestock is reared for several purposes such as home milk consumption, emergency financial purposes, prestige, bride wealth, and other social activities and a social status indicator, (Perry, 2002), (UPTOP, 2006). This means small scale farmers’ investment in bio-security measures is limited, as they do not expect to obtain monetary returns that offset costs incurred in disease prevention measures thus reducing their incentive for livestock disease prevention. For those keeping animals for example for prestige, it could be more important to have large numbers of animals irrespective of their productivity or herd health status.

Public disincentives and institutional structure.

As noted by Rich and Perry (2011), developing countries such as Uganda are often characterized by institutional environments with little enforcement of rules and regulations, low compliance and low trust of government institutions. Many national institutions have focused more on responding to disease crises rather than on prevention of disease and disease containment, (Raney et al., 2009).

For Uganda in particular, the lack of set standards considering the consumers’ ability to pay, predominance of the informal markets and institutional capacities or there lack of has led to the private sector, donors and NGOs being the primary driving forces in most livestock initiatives. “There are weak internal control systems and overall, Uganda has only limited private and public sector capacity to promote good practices for agri-food safety and agricultural health”, (Jaffe et al.
The weak institutional structure, governance and low trust in government institutions provide weak incentives for small scale farmers to prevent livestock diseases.

**Ways to improve incentives**

**Utilizing cooperative marketing.**

In the Ugandan livestock industry especially the dairy sector, farmers have been organized at the producer level in cooperatives and are registered with the government. Under the new cooperative model- the tripartite cooperative model, “the agricultural cooperatives focus on promoting cooperatives as viable, financially independent organisations with proper management and increased member participation and empowerment”, (Kwapong 2013 pp 7). The fact that the farmers are organized as groups could be a starting point for improving incentives and enforcing livestock disease prevention compliance. However as already known in classic economic theory, working in groups could be characterized by free riding and moral hazard but this could be avoided or reduced by the social capital in the cooperative. Cooperative marketing not only relies on social capital, it also breeds social capital. A strength of the cooperative lies in its ability to build and maintain trust among members and leaders, proper management and strong membership and member loyalty among others, (Kwapong and Korugyendo, 2010), these elements of trust and social capital, fear of social sanctions on trust breach are important for contract monitoring and enforcement, (Catelo and Costales, 2008).

**Quality based payment schemes.**

A possible way to improve incentives for livestock health prevention could be through payment schemes under which farmers with better quality products are rewarded for their efforts. This could be particularly important in the prevention of endemic diseases for example mastitis. The current payment schemes in both the formal and informal sector are the payment according to volume. However, a move from payment according to volume to payment according to quality needs to be gradual and is possible as long as it is endorsed by group members. An example of a successful payment scheme is one from Mongolia. (Draaiyer *et al.*, 2009) provide guidance on how payment schemes can be made for farmer groups dealing with milk. They acknowledge the use of penalties or bonuses but argue that if there is high level of trust among the farmer group, penalties might not be necessary.

**Use of compartments.**

Compartmentalization is an aspect that enables countries trade in disease free products even though the whole country does not have a disease free status for a specific disease. Animal products from this subpopulation can be certified safe even if the rest of the country is not disease free, (Raney *et al.*, 2009). Included in the principles of compartmentalization is among others: surveillance, reporting mechanisms and bio-security which involve cooperation between the industry and veterinary providers, (OIE, 2010), (Ratananakorn and Wilson, 2011). Bio-security plans should be made in collaboration with those who implement them and should not be too complex for them to understand. This calls for involvement of small scale farmers that are involved in implementation of bio-security on their farms1, (Ratananakorn and Wilson, 2011)). The cooperative set up could also be vital in the startup and implementation phase.

**Product differentiation and certification.**

Although the livestock market is largely characterized by an informal market, there is a small market for certified value added products marketed through the formal marketing systems, (Perry and Dijkman, 2010). (McDermott *et al.*, 2010). There is growing demand for niche products in urban centers, supermarkets and export trade. The target to a niche market (which could be domestic, regional or international) could focus on production of organic products, welfare
enhanced products, fair trade products or products with a low carbon print. Small holder farmers could have a better opportunity at targeting domestic and regional markets than international markets in relation to 1 For details on principles and procedures of establishing a compartment, see (OIE 2010), (Ratananakorn and Wilson 2011).

3 standards and requirements, (Perry and Dijkman, 2010) and the fact that most of the developing countries are net importers of meat products. For a more detailed view on how (not) exporting livestock products will alleviate (not) poverty in Africa, see (Perry and Dijkman, 2010). This will depend on the competitiveness of the product, the country’s capacity to supply these products and the institutional set up to be able to do export.

CONCLUSION

From the discussion above we note that disincentives could stem from the production systems such as pastoralism where disease control is more of a public good, and animals could be affected by wildlife as hosts or vectors of animal diseases. Livestock being part of a diversification strategy where they have to distribute the scarce resources among the existing enterprises, lack of financial incentives due to low quality products and low income consumers and informal marketing under which it is almost impossible to monitor the safety of products. Utilizing the new tripartite cooperative structure could be vital in providing incentives for animal disease prevention. The social capital and social monitoring embedded in cooperatives could help alleviate the issue of very costly monitoring. Another possibility could be using quality payment schemes, product differentiation and certification aimed more at the higher class domestic markets than international markets and sensitizing the population on importance of consuming better quality animal products to improve the incentives from the demand side. Implementing solutions to improve incentives needs the participation of farmers and building trust between farmers and government or non-government institutions.

REFERENCES


Cost Production Evaluation and Effect of Lactic Acid Bacteria (*Lactobacillus plantarum*) as Starter with Different Molasses Addition

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ABSTRACT: This research aims to determine the level of molasses addition to the quality of lactic acid bacteria (LAB) as starter and to calculate cost production of the starter for silage fermentation. By conducting this study, it will be a feasible consideration in utilization of the LAB production by farmers. The variables of the starter quality were the change of pH, lactic acid production, total carbohydrates, total dry matter, total organic matter, and fermentation weight during fermentation. This research used the lactic acid bacteria (*Lactobacillus plantarum*) which inoculate as much as 5% of the rice bran media. It incubated the bacteria at room temperature for seven days. The treatments were the addition of molasses with concentration of 0% (T0M), 1% (T1M), and 2% (T2M). The result of the study shows that the addition of molasses at different levels and fermentation time are significant (P<0.05) for the pH and weight of fermented rice bran, but it does not give significant effect on lactic acid production, total carbohydrate, levels of dry matter, and levels of organic matter. The treatment of 2% molasses and five days fermentation were the best treatment due to the lowest pH obtained was 3.81. The cost production of the starter is Rp 11,780 per kilogram, thus it increases the total cost production at 24.06%. Starter production by farmers is not yet feasible because farmers are only able to anticipate the increase in the total livestock cost production of 18.47%.

Keywords: *Lactobacillus plantarum*, starter, molasses, production cost

INTRODUCTION

Forage preservation by silage method aims to keep availability of forages for ruminant throughout the year (Hanafi, 2008). Various number and total number of microbe, substrate, temperature, pH, air, toxic compound, and fermentation time affect fermentation process (McDonald *et al*., 2002). Lactic acid bacteria (LAB) which are added to silage aims to reach critical pH (pH 4) as earlier as possible, so that they produce good quality silage (Lamid, 2008).

Feed cost percentage of feedlot in South Minahasa Regency is about 50.20% from total cost of production (Tumober *et al*., 2014). Production cost is utilized by production factors that are converted to appropriate money with valid market cost (Gilarso, 2003).

This research aims to determine the level of optimal molasses addition in order to get LAB as good quality starter and to find out cost production of per unit starter of LAB based on rice bran as a consideration of feasibility of the starter production by farmers.

MATERIALS AND METHODS

Materials

Lactic acid bacteria that was used is *Lactobacillus plantarum* from Laboratory of Nutritional Biochemistry Gadjah Mada University’s collection. The medium for LAB growth used rice bran (*Oryza sativa*) as medium. Additional material in the inoculation of LAB used sugarcane molasses (*Saccharum officinarum*). Acetate buffer solution with pH 4.5 was used to regulate water content and to make pH of growing media become acidic.
Methods

This research was started by further inoculation of bacteria in a solid growing medium (MRS gel). The bacteria were incubated in an oven at 37°C for 24 hours. Production of LAB used liquid medium (MRS broth) as starter. The research was continued by inoculating bacteria by using medium based on 4.5 kg rice bran. Addition of starter to rice bran medium is 5%. Buffer solution with pH 4.5 was added to make water content become 45% and to reduced pH value to be acid. Molasses given in each treatment was as much as 0% (T0M), 1% (T1M), and 2% (T2M). Medium which was inoculated with bacteria anaerobicallay and incubated for 7 days at room temperature.

The variables observed in this study were pH and weight changes which were conducted on day 0, 1, 3, 5, and 7. While lactic acid contents was observed when rice bran fermented reaches the lowest pH value. Total of carbohydrate, dry matter, and organic matter were observed at day 0 and when rice bran fermented reaches the lowest pH value. The data from the study, then, was analyzed to determine the best treatment, and, then, which was used for starter on the next culture.

The value of pH observation was conducted every day. Rice bran as medium fermentation that was reached in the critical pH was used as a starter to grow bacteria in the next stage. By utilisation of the best treatmant, bacteria then grows in 20 kg of rice bran as growing medium in which their products are used for the calculation of the cost of production of rice bran based starter. The pH value and weight were designed with completely randomized factorial design with different levels of molasses factor and fermentation time and mean different due to the treatments compared by Duncan’s new Multiple Range Test (DMRT). While Lactic acid levels, total of dry matter, total of organic matter, and total of carbohydrates were analyzed using ANOVA and mean different due to the treatments compared by Duncan’s new Multiple Range Test (DMRT) (Astuti, 2007). Calculation of production cost per kilogram LAB as starter was formulated according to Gilarso (2003).

RESULT AND DISCUSSION

The addition of different molasses level and fermentation time gives significant change (P<0.05) in pH value. LAB lactic acid production during fermentation, according to Tamang (2010), can decrease pH level of feed. The 2% molasses level gives the lowest pH value due to high lactic acid production. The treatment of 2% molasses produces highest lactic acid level up to 411.93 mg/100g. However different molasses level did not affect lactic acid level (P<0.05) due to other organic acid production in addition of lactic acid production. Soluble carbohydrate was higher due to the addition of 2% molasses. It caused better growth of lactic acid bacteria and higher lactic acid production. Supriyanto et al. (2012) stated that L. plantarum which is incubated in medium with addition of 2% molasses has higher total cell at the end of incubation time.

The addition of different molasses level did not give significant effect (P<0.05) on total carbohydrate in 5 days fermented rice bran, but there was a decrease of total carbohydrate in each treatment. Total decrease of carbohydrate affected decrease of lactic acid bacteria quality. Addition of different level of molasses did not affect total dry matter of rice bran. However, total dry matter decreases in each treatment. Treatment of 0% molasses gives the lowest dry matter weight. Ridwan et al. (2005) stated that percentage of weight loss is assumed as dry matter weight loss. Percentage of dry matter weight loss under 10% is normal range.

The addition of different level of molasses did not give a significant influence in the decrease of total organic matter (OM) rice bran. Reduced content of OM showed that LAB utilizes content of rice bran. The decrease of OM content was caused by utilization carbohydrates by LAB to produce lactic acid. Rif’an (2009) stated that overhauled of soluble carbohydrates by LAB into organic acids are useful to decrease pH.

Each addition of molasses in a different level and time of fermentation gave significant effect (P <0.05) against the decrease of rice bran weight during fermentation, while interaction between
those two factors did not have a significant influence. The average of highest percentage of weight loss occurred in the fermentation day 1 by 0.28%, and, then, was always decreased thorough day 7 by 0.11%.

Weight loss in rice bran produces gas during fermentation. Molin (2008) stated that, *L. plantarum* could convert 1 mol of pentose into 1 mol of lactic acid, acetic acid, and CO$_2$. Percentage of weight loss occurs until the seventh day of fermentation. Duncan test resulted in the addition level of molasses indicates that addition of 2% molasses gave a significant different (P <0,05) with 0% molasses, but not gave a significant different from 1% molasses. Treatment with 2% molasses addition had the greatest average weight loss.

Starter cost production calculation was performed to determine cost of per unit starter production or per kilogram. Total cost (TC) or the total cost was the sum of fixed costs and variable costs (Boediono, 2008). Total cost incurring for production within a month is IDR 10,413,613. Total cost (TC) to produce a number of stuff, if divided by a number of production (Q), obtains average total cost (AC) (Sukirno, 2005). The average of total cost production for starter LAB is IDR 11,780. Praharsa *et al.* (2014) stated that beef cattle business is only able to anticipate the increase in livestock production costs at most 18.47%. The cost of livestock production at the beginning was IDR 563,017,97 per month. Additional fee for a starter which was IDR 135,470 in every month will increase the cost of livestock production into 24.06%. The percentage of increase livestock production costs was higher than the ability of farmers to anticipated increased production costs. Starter production at a price of IDR 11,780 per kilogram is not feasible to implement.

### CONCLUSION

Treatment with 2% molasses with fermentation time for five days was set as the most optimal treatment because it produces the lowest pH at 3.81. Production cost of rice bran based starter is IDR 11,780 per kilogram, increasing the total cost of livestock production amount by 24.06%. Production starter was not feasible, because it exceeds the ability of farmers to anticipate the increase of total costs of livestock production by 18.47%.

### REFERENCES


ABSTRACT: The aim of this study is to see how big the contribution of the livestock sector to give effect to the structure of farm household income. The assessment carried out in the village of Catur, in 2012, was involving 30 farmers respondent. Data collected through survey method using a questionnaire interview. Data were analyzed by descriptive qualitative analysis of benefit cost ratio. The results showed: the dominant livestock grown/reared and impact on household income of farmers in the location assessment, is; cattle and free-range chicken. The average tenure of cattle farmer cooperator for Bali cattle breeding is one head with a composition of 33% ownership interest and 67.67% owned by farmers Ngadas (for results). The bulls were cultivated for fattening are 2 heads with only 50% ownership composition, 50% revenue sharing system. While the average number of domestic poultry farmer cooperator ownership is 21 heads. From the structure of farm household income in rural Catur per year total revenue received by the farmer cooperator IDR 11,047,841 which consists of income from the agricultural sector 78.64% (IDR 8,688,056) from outside of the agricultural sector as much as 16.40% (USD 1,812 million). Income from outside agriculture, such as traders or kiosk (11.46%), others (4.94%). In the agricultural sector of 78.64% of income, livestock sub-sector contributed the most as many as 39.18%, followed by oranges (26.34) and coffee (12.12).

Keywords: contributions, livestock, income, farm

INTRODUCTION

The importance of the role of livestock in farming system is getting more noticed in the last decade not only by researchers and the agricultural economy in Indonesia, but also in various Asian countries. Various types of livestock have long been used in farming activities in rural areas, among others, for plowing, transport agricultural produce, and as a provider of fertilizer for the production of crops. Besides, cattle also has the function as a provider of food (protein source) and a life savings. Because that livestock contribute so significantly to the welfare of farmers. However, until now the role of livestock in the farming system can not be utilized in the maximum level by the majority of the farming community. Although, farmers have the experience of generations, the principle of maximizing output with maximum profit, has not been widely applied. This may be caused by a low level of education and the influence of social factors-culture.

Agricultural sector, especially the livestock sector is a sector that plays an important role in economic development in the village of Catur. This sector has several important roles, namely as a provider of food needs of the community, was instrumental in the formation of Gross Domestic Product (GDP), employment in rural areas, play a role in generating foreign exchange and foreign exchange savings, and function in controlling inflation. The livestock sector is indirectly instrumental in creating a climate conducive to the development of other economic sectors.

Thus the livestock sector holds a very important role in the overall economy, because it has extensive connections with other economic sectors. The aim of this study was to see how big the contribution of the livestock sector in rural farm income in Catur, so capable as a sector / commodity dominant GCC has a very high tipping point for the local farmers’ household income.
RESEARCH METHODOLOGY

Locations assessment carried out in the village of Catur, Kintamani, Bangli regency determined intentionally (purposive sampling) which is the location of the development of integration cattle with coffee plants. The data collected in this study include primary data and secondary data. Primary data, the data obtained by visiting the respondents in the study site and conduct interviews directly by using a list of questions that had been prepared in advance (including the identity, number and type of livestock are dominant grown/reared and impact on household income of farmers in the study locations). To determine the level of farm income and revenue analysis is further described descriptively (Adnyana, 1989).

RESULTS AND DISCUSSION

Ownership of livestock in the village Catur.

The average tenure of cattle farmer cooperator for Bali cattle breeding is one heads with a composition of 33% ownership interest and 67.67% owned by farmers Ngadas (for results). The bulls were cultivated for fattening is 2 heads with only 50% ownership composition while 50% revenue sharing system. For non cooperator farmer average mastery of cattle for cattle breeding 1 heads with the composition of the farmers owned 62% and 38% revenue share, while the average feedlot cattle are maintained as much as two heads with a mastery of composition is 100% owned by farmers. While for most poultry is reared free-range chicken, generally are owned by farmers.

Contribution in kind Livestock and Household Income

Cattle.

Cattle in the village of Catur maintained for the purpose of 1) fattening and 2) to produce children (nursery). The number of cattle that are an average of three animals per farmer. Specifically, the three of them, two for fattening and the other heads for breeding.

a) Fattening

Fattened seeds generally weighs around 257 kg beginning at 2 years of age 1.5 (incisors on 1-2 pairs). They generally fatten Bali for eight months (35 days in a month), or 280 days (10 months) to reach slaughter weight of 360 kg. If this location is calculated cattle grow 0.35 kg/day. Supplemental feeding as a pro biotic, mineral vitamin likewise never given. In accordance with the results of a study conducted by Guntoro (2002) said that the maintenance of fattening cattle with a traditional pattern, for example feed consists of grass and sometimes added potatoes or other forage depending on existing inventory at the site, only able to provide increased weight 0.2 to 0.3 kg/head/day. Further explained that the low productivity in Bali cattle caused by lack of maintenance and management focus, where farmers do not pay attention to the quality of the feed, the age-sales, maintenance procedures, stables and disease prevention. Another common feed provided include cassava leaves in the form of fresh, fruit squash and leaves dadem. Dadem is a kind of forage that is commonly found in this area including in other highland areas, but hardly found in the lowlands. This area dadem plants functioned as a hedge plant. Budiari. (2009) reported that the average dadem production per tree/year is 200 kg. More (Sumantra, 2004) reported dadem used as a hedge plant and its leaves as feed cattle especially in the dry season when grass supplies are insufficient. Judging from the nutritional content dadem has a high protein content 15.65%. Budiari research results and Parvati (2012) reported that cattle fed 70% dadem can increase daily gain of 0.43 kg/head/day.

From the economic analysis obtained net income of farmers fattening cattle business cooperator is IDR 2,958,647 with B/C ratio of 0.17 means cattle farmers do not benefit or less efficient in terms of labor released. The most rapid growth phase meat cows if the initial weight is at least 300 kg, so as to achieve weight maintenance time sale like this now only need six
months of the calendar. That the net income of farmers calculated after repayment cost of the purchase of seeds by the investors (owners of cattle) is IDR 3,798,494, further divided to preserver the difference in value of 55% (farmer cooperator) and investors as much as 45. The outpouring of manpower required more maintenance than feedlot cattle farmer cooperator. Net income of farmers receive non cooperator was IDR 2,368,494. Generally cooperator and non-cooperator farmers was minimal use of feed the amplifier in triggering growth of fattened cattle. With the right dose of weight gain of cattle in the area of assessment can be further improved. Cattle to feed an additional 2 kg of waste bran fermented coffee growing faster than cows given only forage alone (Parvati et al., 2009).

b) Cattle Breeding

Maintenance to sell puppies on average takes about 18 months, where the seeds were cultivated are still relatively young. Of the effort farmers earn net income in a year is as much as IDR 731,004 with B / C ratio of 0.28 which indicate that businesses do not benefit farmers (Table 4). This is supported by Krishna, R., et al. (2006) and Riszqina, L. et al. (2011) which states that based on the analysis of the B / C ratio, BEP for beef cattle breeding business, the business scale of 4-5 2-3 heads or the heads was still a loss. This is due to fixed costs (consisting of feed, seed, labor, medicine, herbal medicine, marketing, cost of insemination) were great and the price of cattle is low. The biggest component is the cost of feed, seed and labor, reinforced by Krishna, R., et al. (2006)

While in the non cooperator farmer average of cattle raising breeding is one heads, but the composition of ownership is smaller than the farmer cooperator is 62% owned and 38 percent are Ngadas (belonging to someone else). The analysis of non-cooperator farmers farming seen in Table 18. Average net revenue received in one year is IDR. 379,703 with a long maintenance of up to 20 months. B/C obtained was 0.18, which means breeding cattle farmers non cooperator was not worth continuing or unfavorable.

Chicken

The average number of native chicken ownership cooperator and non-cooperator farmers is 21 and 22 heads with a composition different sires and males. Chickens that are reared naturally produce farmer respondents estimated in one year occurred 2 times the production. Feed given quite varied between rice, leftover rice, corn flour or potato yam.

Net income received by the farmer cooperator and non-cooperator farmers is IDR. 638,500, - and IDR 530,000 with B / C <1, means of free-range poultry farmers are still in unfavorable circumstances. This is due to the maintenance of domestic poultry only as a sideline, farmer cooperator and non-cooperator either do not pay attention on the correct chicken farming, both in terms of housing, animal health and in terms of the feed is still very conventional. Local chicken farming when properly maintained will give maximum results. This is supported by some of the results of economic studies on local chicken farming in semi-intensive system and intensive maintenance turned out to provide a higher yield than in extensive maintenance. Results of the study Affandhy, et al. (2000) on a 15-25 ownership scale chicken breeding in Pacitan and Bondowoso generates an average profit of farmers in Pacitan between IDR 71,000 - 450,000 per 6 months with the B / C from 1.3 to 2.1; whereas in Bondowoso profit between IDR 223,000 - 353,000 per 6 months with the value of B / C 1.7 - 2. Meanwhile Subiharta, et al. (1994) from the study stated that the highest income earned on the maintenance of local chickens followed intensive semi-intensive and extensive systems.

Farmers’ Income

From Table 1 looks total income received by the farmer cooperator per year is IDR. 11,047,841, - which consists of income from the agricultural sector 78.64% (IDR 8,688,056) as well as from outside of the agricultural sector as much as 16.40% (USD 1,812 million). Income from outside agriculture, such as trader/stalls (11.46%), others (4.94%). In the agricultural sector
which contributes most is from cattle farming as many as 26.78%, followed by oranges at 26.34%. Contributions from the coffee less when compared with revenue contribution of oranges, it is because coffee plants that are owned by farmers produce most of the 5-year-old (young) so that production is not maximized (potential / tree ± 12 kg).

**Table 1. Sources of income Respondents farmers in the district of Kintamani, Bangli Regency**

<table>
<thead>
<tr>
<th>No.</th>
<th>Farmers Business Activities</th>
<th>Cooperator farmers</th>
<th>Non Cooperator Farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>IDR</td>
<td>Percentage</td>
</tr>
<tr>
<td>1</td>
<td>Farming (on-farm)</td>
<td>8,688,056</td>
<td>78.64</td>
</tr>
<tr>
<td></td>
<td>- Crops</td>
<td>231,808</td>
<td>2.10</td>
</tr>
<tr>
<td></td>
<td>- Plantations (coffee)</td>
<td>1,218,125</td>
<td>11.03</td>
</tr>
<tr>
<td></td>
<td>- Horti (Orange)</td>
<td>2,909,976</td>
<td>26.34</td>
</tr>
<tr>
<td></td>
<td>- Livestock</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fattening cattle</td>
<td>2,958,647</td>
<td>26.78</td>
</tr>
<tr>
<td></td>
<td>Breeding cattle</td>
<td>731,000</td>
<td>6.62</td>
</tr>
<tr>
<td></td>
<td>Native Chicken</td>
<td>638,500</td>
<td>5.78</td>
</tr>
<tr>
<td>2</td>
<td>off-farm businesses</td>
<td>547,785</td>
<td>4.96</td>
</tr>
<tr>
<td></td>
<td>- Agricultural worker</td>
<td>547,785</td>
<td>4.96</td>
</tr>
<tr>
<td></td>
<td>- Post harvest</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>- Orion</td>
<td>-</td>
<td>3,000,000</td>
</tr>
<tr>
<td>3</td>
<td>Foreign Agricultural EnteIDR</td>
<td>1,812,000</td>
<td>16.40</td>
</tr>
<tr>
<td></td>
<td>rises non-farm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Trade</td>
<td>1,266,000</td>
<td>11.46</td>
</tr>
<tr>
<td></td>
<td>- Employees</td>
<td>-</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>- Off farm labour</td>
<td>-</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>- Other</td>
<td>546,000</td>
<td>4.94</td>
</tr>
<tr>
<td></td>
<td>Total Revenue</td>
<td>11,047,841</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: Primary Data Analysis

Non cooperator farmers earn net income of IDR 18,756,142 which consists of income from the agricultural sector, 44.02% and from outside the agriculture sector as much as 29.32%. Income from outside agriculture, such as traders (10.66%), work outside agriculture (13.33%), village office employees (5.33%), the agricultural sector is contributing most of the coffee farming as many as 12.63%, more fully shown in Table 1.

**CONCLUSION**

1. Livestock dominant cultivated/reared and impact on household income of farmers at the site assessment, is; cattle and free-range chicken. The average tenure of cattle farmer cooperator for Bali cattle breeding is one head with a composition of 33% ownership interest and 67.67% owned by farmers Ngadas (profit sharing). For non cooperator farmer average mastery of cattle for cattle breeding 1 head with the composition of the farmers owned 62% and 38% revenue share, while the average feedlot cattle are maintained as much as two heads with a mastery of composition is 100% owned by farmers.
2. In terms of feasibility is obtained that the activities of the farm in the Catur Village in terms
of feasibility is still very low with B / C ratio on average from 0.13 to 0.17 this means breeding or fattening activities that do not benefit farmers or less efficient than In terms of labor released.

expected to be able to increase farmers’ income from the livestock sector.

3. When viewed from the structure of the income of farm households in the Catur Village, the livestock sector contributed most, because most of the basic work of farmers in the village is cattle ranchers are integrated with coffee trees. So that the income from the livestock sector is bigger and deserves to be developed, the introduction of technology and thinking patterns towards agribusiness farmers should be encouraged and maximized, so that the role of researchers and extension is needed.

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Assessment of the Calorie-Protein Consumption Pattern among Rural and Low-Income Urban Households in Indonesia

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ABSTRACT: The study assessed the calorie-protein consumption pattern from livestock products food among rural and low-income urban households in Indonesia. National household survey data were used in this study, particularly households in DI Yogyakarta Province (hereafter DIY Province). The data collected were analyzed using descriptive statistics and nutrient (calorie-protein) estimation technique. The results showed that their average monthly expenditure was 1,533,481.38 IDR for the rural and 2,870,942.48 IDR for the low-income urban households. Food was almost the major item in their consumption-expenditure. Rural household spent 53.6% of their income for food while low-income urban household spent only 41.4% from their monthly income. The low-income urban households had higher calorie intake than that of the rural household. This situation was not different with the protein consumption pattern. As to the recommended minimum daily calorie-protein intake, households in both areas consumed significantly less than the government recommendation.

Keywords: Calorie, Protein, Livestock products, Indonesia

INTRODUCTION

Human dietary pattern now concerns to high-value food to meet nutritional adequacy such as animal protein food. Per capita food expenditure on high-quality food such as dairy products, and meat and poultry has sharply increased. Livestock products are important source of animal protein in Indonesia. Consumption of animal protein from livestock products increase about 11.84% while only 4.77% from fish during 1999-2004.

Livestock products have generally higher responsiveness than do cereals. Hence, consumption of these food groups is responsive to the change of income, particularly for low-middle income country like Indonesia (Seale et al., 2003). Block et al. (2004) noted during crisis, households in rural Java substantially reduced their consumption of micronutrient-rich foods. Beside rising incomes, socioeconomic characteristics of household have impact to the consumption of food. Residential locations also appear to be an important determinant of food consumption.

This study highlights the consumption expenditure pattern of households in the rural and low-income urban areas total food intake and assessed the calorie-protein consumption pattern from livestock products food among rural and low-income urban households in DIY Province, Indonesia.

MATERIALS AND METHODS

National Household Expenditure Survey (SUSENAS) data were used in this study. The 2012 SUSENAS survey for DIY Province was involving household expenditure on food and non-food and socio economic characteristics. Data were also collected on the demographic/socio-economic characteristics of household members (such as household size, sex, age, occupation, education level, religion, income, marital status, etc.). In this study we analyzed animal protein...
food from livestock product such as meat, egg, and milk products (Table 1). The data collected were subjected to descriptive analysis (frequency, percentages, mean, etc.), nutrient (calorie and protein) estimation and test of difference between means.

**Table 1. Description of livestock products**

<table>
<thead>
<tr>
<th>Commodity group</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Red Meat</td>
<td>Fresh meat (beef, buffalo)</td>
</tr>
<tr>
<td>(2) Egg</td>
<td>Chicken egg, native-chicken egg</td>
</tr>
<tr>
<td>(3) Milk</td>
<td>Fresh milk, powdered milk.</td>
</tr>
</tbody>
</table>

**RESULTS AND DISCUSSION**

Total household expenditure as a proxy of income is given which divided household are reported in Table 2. The share of expenditure on cereals (rice) in the total food expenditure was 17.9% and 11.8% for rural and low income-urban household, respectively. Rural household spent their income on food 53.6% which are above average households in DIY Province (42.5%), while low income urban household only 41.4% among livestock products. Food expenditures covered all food items included in the survey such as rice, pulses, eggs and milk products, vegetables, fruits and nuts, fish and meat. Food expenditure per month in the low-income urban and rural areas was 1,188,010.52 IDR and 821,604.72 IDR, respectively. This shown that low-income urban households expended on food exceeded the average total population of household in DIY Province and this good implication of food security.

**Table 2. Consumption expenditure pattern per month in study area**

<table>
<thead>
<tr>
<th>Food item</th>
<th>Rural</th>
<th>Low-income Urban</th>
<th>Aggregate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red meat</td>
<td>70,354.29</td>
<td>106,320.32</td>
<td>97,473.88</td>
</tr>
<tr>
<td>Chicken meat</td>
<td>165,678.31</td>
<td>185,670.89</td>
<td>176,794.28</td>
</tr>
<tr>
<td>Egg</td>
<td>49,505.61</td>
<td>62,045.04</td>
<td>55,115.62</td>
</tr>
<tr>
<td>Fresh milk</td>
<td>75,400.00</td>
<td>76,678.26</td>
<td>72,496.55</td>
</tr>
<tr>
<td>Powder milk</td>
<td>98,141.75</td>
<td>121,646.37</td>
<td>111,255.96</td>
</tr>
<tr>
<td>Rice</td>
<td>146,831.63</td>
<td>140,129.91</td>
<td>134,584.04</td>
</tr>
<tr>
<td>Food Expenditure</td>
<td>821,604.72</td>
<td>1,188,010.52</td>
<td>974,102.60</td>
</tr>
<tr>
<td>Non-food expenditure</td>
<td>711,876.65</td>
<td>1,682,931.95</td>
<td>1,320,579.24</td>
</tr>
<tr>
<td>Total expenditure</td>
<td>1,533,481.38</td>
<td>2,870,942.48</td>
<td>2,294,681.84</td>
</tr>
</tbody>
</table>

Note: 1 USD = 9,679 IDR

The largest share of monthly expenditure goes for food for rural households but not for low-income urban households. Some food items expenditure showed that rural households expended more than that of low income urban. Urban household spent huge in other food. Urban people (as well as men) depend more on cooked, processed, ready to eat and fast foods for consumption. In the urban areas provide accessibility to ready-to-eat chicken and egg dishes e.g. fast food restaurants, 24-hour coffee shops and convenience stores. Furthermore, the price is considered affordable by the urban.

The result in Figure 1 showed a marked variation in the eating habits between rural and the
The diet of household members at rural and low-income urban locations was dominated by rice (39.05% and 33.5%, respectively) which is mainly carbohydrate. Calorie intake from all livestock products in this study is higher in low-income urban households, while rural area got huge calorie from staple food (rice). Calorie intake for both locations is still below of calorie requirement (2000Kcal/day) per day (KEMENKES, 2013).

Protein consumptions from selected food are presented in Figure 2. The result showed protein consumption from livestock products and staple food. In line with calorie consumption, low-income urban households consumed more protein than that of rural households. Protein consumption derived from meat, fish and other animal protein source such as livestock products, study concerned. Rural household consumed protein form red meat protein was only half of urban. Chicken meat and egg protein consumption for both locations are mostly similar. Chicken meat accounted 17.8% and 18.9% for low-income urban and rural household, respectively, while only 5.0 % and 3.2% from red meat for both location. Poultry meat and eggs represent one of the largest potential sources of dietary animal protein in Indonesia(INSTATE, 2004; Bond et al, 2007), and are acceptable to all ethnic and religious groups. Daily protein intake in both locations reached below far from national standard protein requirement (52g).

CONCLUSIONS

Household in rural area spent their income on food more than that of urban households. Rural household spent 53.6 % of their income for food while low-income urban household spent only 41.4% from their monthly income. The low-income urban households had higher calorie...
intake than that of rural household, as well as protein consumption pattern. As to the recommended minimum daily calorie-protein intake, households in both areas consumed significantly less than the government recommendation.

REFERENCES


Constraints of Value Chain in Dairy Industry in Central Java

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ABSTRACT: Dairy value chain is a sequence of dairy production, processing and marketing activities: products pass through all activities of the chain in a certain order and, with each activity, the product gains value. The Objective of the study is to analyze the constraints of value chain in dairy industry in Central Java. The respondents were 90 dairy cattle farmers, and three heads of cooperative as informants. The data were analyzed using descriptive statistical analysis, and explanation. The results showed that formal education level, lack of credit/financial, low of skill, knowledge and quality, weakness in bargaining power, different access to extension service, farm size/number of animal owned, gender constraints risk and uncertainty, low level of technology, service and infrastructure, and market became the value chain constraints in dairy industry in Central Java. Even though livestock keeping among smallholders offers a promising opportunity to combat poverty specially as the demand for animal products such as milk continues to rise, most livestock policies and services tend to favour large-scale production. In order to take advantage of emerging market demands and reduce their poverty, small farmers need access to basic services and technologies as well as policies that take account of their needs and interests.

Keywords: value chain, dairy industry, dairy farmer

INTRODUCTION

Value chain approaches have been utilized by development practitioners and researchers alike to capture the interactions of increasingly dynamic (and complex) markets in developing countries and to examine the inter-relationships between diverse actors involved in all stages of the marketing channel (Bolwig et al., 2010). They have alerted us to inequities in power relationships based on the governance of the supply chain and have highlighted potential points of entry (and exclusion) for smallholders (Dolan and Humphrey 2000; Hess, 2008). Value chain approaches play an important role in characterizing the complex networks, relationships and incentives that exist in livestock systems. They further provide a framework for mobilizing pro-poor development in the context of agri-food networks that feature livestock across a range of livelihood-improving roles for the rural poor (Richa et al., 2010). These chains involve farmers, companies (processors), middlemen, big and small retailers, home-industries and consumers. The components of value chain in dairy cattle. In this value chain, milk from dairy smallholder farmers are brought by a collector who check the quality of the milk and then send it to the cooperative. Dairy cooperatives may also be established as an umbrella as a bridge between dairy farmers and milk processing plant. Cooperatives may help the farmer to ensure quality standard control and provide enhanced opportunities to gain market access. The objective of this study is to analyze the constraints of value chain in dairy industry.
METHODOLOGY

This study was conducted in Central Java, Indonesia, using survey methods. A number of 90 dairy farmers was used as respondents. While the key informants were the head of cooperatives, i.e. KUD Cepogo, KUD Mojosongo and KUD Getasan, each cooperative was selected for 30 dairy farmers. Using semi-structured interview, the data were gathered such as reproduction data, production data, demographics characteristic of the farmers, rate of adoption as well as the constraints overall of value chain in dairy industry. The data were analyzed using descriptive statistical analysis.

RESULTS AND DISCUSSION

There are many marketing channels in dairy products. The longer chain, the higher price margin is there typically between the farmer (primary production level) to the consumer. There may necessary for these farmers to change their mindset. More value added livestock products one of their chances to enhance their income for livestock production. The main objective of a value chain is to produce value products and services for market by transforming resources and by the use of infrastructures – within the opportunities and constrains of its institutional environment (Trienekens, 2011). Important issues in understanding the framework of value chain are value chain constraints, value chain governance, value added, chain/network structure and upgrading options.

Value Chain Constraints

Value chain constraints can be related to lack of ability and infrastructure (usually roads or transportation tools) to fulfill quality requirements. All barriers or constraints mean that a certain market exists, but that the smallholder farmer is constrained in some way to sell produce on that market. In Indonesia, especially Central Java there are typically many value chain constraints today. Some constraints cannot be change immediately such as the formal education of farmers and the low adaptation of technology. It needs more training and highly awareness to adopt the new technologies. Other constraints can be solved by other partners chain such as lack of credit, low prices, access to extension service, farm size (number of animal owned), and dealing with risk and uncertainty. Table 1 shows the cattle status (productivity and reproductivity), adoption rate, and farmer’s formal education.

Table 1. Cattle Production and reproduction data and adoption rate of the farmer in Central Java Province

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk production (liter)</td>
<td>8.1±4.5</td>
</tr>
<tr>
<td>Average of lactation period (day)</td>
<td>10.75±1.98</td>
</tr>
<tr>
<td>Calving interval (day)</td>
<td>16.0±6.40</td>
</tr>
<tr>
<td>Age of first partus (day)</td>
<td>27.88±4.73</td>
</tr>
<tr>
<td>Service per Conception (S/C)</td>
<td>2.0±1.3</td>
</tr>
<tr>
<td>Number of cattle owned</td>
<td></td>
</tr>
<tr>
<td>Dairy cows (head)</td>
<td>2.74</td>
</tr>
<tr>
<td>Heifer</td>
<td>0.56</td>
</tr>
<tr>
<td>Calves</td>
<td>1.3</td>
</tr>
</tbody>
</table>
Production and reproduction. The production and productivity influential to the income of the farmers. Productivity such as milk production is still low (8.1±4.5 liters), while reproduction status such as calving interval and service per conception also still (Table 1).

Formal educational level. Low formal education is a major constraint in dairy production. Generally, the livestock farmer has only got elementary school level, primary school and an eventually high school (see Table 1). This major constraint influences the ability to adoption new technology opportunities. As example, Guntoro’s study (2009) found that more than 60% of the cattle farmers in Central Java had just primary school level or below and among them about 14% were not graduated from an elementary school. The farmers with low education, tended to have lower rate of adoption. Majja and Bahdur (2008) found that education plays a prominent and differential role across low-return and high-return non farm activities. Higher educational levels of both males and females enable participation in the more remunerative non farm employment opportunities.

Credit/financial. Since the farmers who live in rural and remote area, and their animal ownership only for small size and not for single source of income, it makes their business financially do not get profit. The integration into the farming system was the main purpose for maintaining the animal. This condition become the challenge of farmers to get the financial support from the commercial institution, such as bank, investors, and other business oriented persons.

Skill, knowledge, and quality. Lack of business management skills (e.g. production planning and control) and, in particular, inadequate access to the knowledge and technologies needed to meet rising sanitary standards, making it extremely difficult for smallholders to gain certification of compliance with marketing requirements. Little understanding of processors’ requirements, lack of laboratories and instruments for quality control as well as price and quality the veterinary services are important barriers.

Bargaining Power. Bargaining power is strongly related to access to information, to alternative options, to dependency relationships as well as to the perishable character of the product (Bijman et al., 2007). The bargaining power of small farmers is especially low since they have poor access to market information and limited access to financial resources that prevent them from selling their (non-perishable) products at the most profitable time. It may cause the selling price the farmer’s to be low. Their lack of bargaining power may lead them to under-value their production and obtain a smaller share of the added value created in the commodity chain. Smallholders have particularly low bargaining power when they operate in processed supply chains where the economies of scale in the product transformation stage lead to the creation of oligopsony (Bijman et al., 2007). According to Thompson (2002), mostly the third world governments reduce incentives for farmers to produce and therefore reduce the availability of food from indigenous sources.

Different access to extension service. In agricultural office, the extension unit may cover several fields such as livestock, crop, forestry, etc. depending on the actual area. Unfortunately, often several area of expertises have to be handled by one extension worker. Therefore, it is no
surprise if an extension worker cannot cover all of the farmers’ problems in various farm business activities. The needs of many farmers are ignored by the extension services due to those kind of expertise problems among extension workers.

**Farm size/number of animal owned.** The animals are integrated in multi-objective farming system, characterized as technological extensive but labor intensive, which partly explains the small size of animal number per farm unit. The result shows that the average of cows ownership was 2.74 heads (Table 1). While the previous studies in Yogyakarta, average number of ownership of dairy cattle is 3.64 AU (Guntoro and Sulastri, 2011). Therefore, it is difficult to obtain loans and credit from commercial bank institutions.

**Gender constraints.** In comparison to men, women face generally higher disadvantages. This is particular the case in terms of mobility, access to assets and to productive resources, and access to market information. The result is that they find it more difficult to access and maintain profitable market niches and capture a larger size of incomes from marketing activities.

**Risk and uncertainty.** Institutions that can mitigate risks (such as insurance companies) are missing or weakly developed. In the past, the government often reduced market risks by market interventions (e.g. through price stabilization), but these policies were often not very efficient. There are many different sources of risks in livestock farming, ranging from price and yield risks to the personal risks associated with injury or poor health, and moreover natural disasters such as flood, mount eruption and earthquake. According to Bijman *et al.* (2007) smallholders in developing countries, because of their low resource endowment, tend to be highly vulnerable to production risks due to natural conditions and climatic shocks, as well as to the market risks due to price fluctuation and opportunistic buying behaviour, etc.

**Level of technology.** This constraint is the reality of many small farmer in Indonesia. Due to the small number of animals, adaptation of new technological is very costly (see Table 1). It is not surprized that adoption rate is not high. It supports other researchs that average of adoption rate in goat farmers was 64.5% (Guntoro *et al.*, 2009), and in cattle farmer was 33.5% (Guntoro, 2009).

**Service and Infrastructure.** Lack or inadequacy of roads, electricity, and processing facilities etc. may raise transaction costs, exacerbates information asymmetries between producers and traders and discourage investment in production and processing.

**Market constraints.** The dairy retail market is largely controlled by milk intermediaries who procure milk over large distances. The agents operate without oversight and therefore sometime adulterate milk by adding water to increase volumes. Other market constraints are lack of a ready market for fresh (full) milk and lack of modern technology for processing milk into milk products as well as information asymmetry between producers and marketers. This leads to overpriced inputs and under priced output, and also discourage increased production.

**Chain/Network Structure.** Small scale farmers have a low bargaining position. Middlemen, on the other hand, are often in a very strong the position to determine the local price because they have strong connecting position between the farmers and the market. Anyway the high risks associated with the products are still in the hands of farmers. The farmers do not care how much the price of the beef is in the traditional market or supermarket. The reason is that they do not account the difference in margin between the farm gate price and the price in the market/supermarket.

**CONCLUSION**

In this respect, the government should play a much stronger role in determining and regulating the market conditions. The price of animal products are determined by the interaction of many different stakeholder including feed plants, the feed industry, processing companies
and retailers and small holder farmers do not have any bargaining power to really influence this interactions. Goverment as the policy maker can make better make the regulations that ensure a fair and transparent competition among the stakeholders. The government could collaborate with research institutions, universities, and industries to support the development of appropriate farm technology and to enhance the quality of animals and their products, knowledge which should be disseminate and applied by local farmers. A better market guarantee for the small scale farmers may also be very important. Improved market guarantees are one way to enhance bargaining position of farmers.

ACKNOWLEDGEMENTS

This study was funded by the Directorate of Higher Education, the Ministry of Research, Technology and Higher Education, Republic of Indonesia (through PUPT Grant 2015), and Universitas Gadjah Mada.

REFERENCES


The Agricultural Technology Transfer Agencies Role on Transferring the Biogas Technology to Farmers: A Study Case of Dairy Farmer’s Network Analysis in Umbulharjo Village, Yogyakarta Province, Indonesia

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ABSTRACT: This paper aims to describe the process of biogas technology transfer to mixed crops and livestock farmers in Indonesia. The relationship between a formal mechanism model and a farmer to farmer communication network is examined to identify the effectiveness of biogas technology transfer. A case study of dairy farmers in Umbulharjo village, Yogyakarta Province, Indonesia was conducted. A Social Network Analysis (SNA) was employed to identify the group of network centrality—which consists of the Degree of Centrality, Eigenvector, and Betweenness Centrality—and individual farmer attributes. In a network centrality perspective, the formal mechanism model of biogas technology transfer initially selects the elite group of farmers in the core of network as an “injection point” of the biogas technology diffusion into a society. The farmers in the core position within a network may decide to be early adopters of biogas technology which indicates an effective biogas technology transfer at an early diffusion stage. Nonetheless, the biogas technology diffusion acceleration through indigenous farmer to farmer communication is not an easy process. Individual farmers should have better understanding on the complexity of the technology and the capacity to persuade their neighboring farmers.

Keywords: Network analysis, Biogas technology, Technology transfer, Dairy farmers

INTRODUCTION

With respect to the limited resources of smallholder farmers, the slow rate technology diffusion becomes problems especially those are characterized by relatively complexity and relatively high risk technology (Batz et al., 1999). Therefore, the acceleration of technology diffusion to smallholder farmers becomes a great effort for stakeholders of technology transfer in Indonesia (Kadir et al., 2002). In the farming system, the technology transfer has been promoted as a linear model linkage which transferring the innovation from researchers to farmers through extension system (FAO, 2000). The Indonesian government has implemented the policy of top-down streaming technology transfer of researcher-extension-farmer relationship model before expanded to adopt a working partnership model. It is an extended model of the linear technology transfer by involving the public-private partnership in which the research institutes, universities, and extension agencies as public institutions cooperate with NGO and farmer organization as private institutions in disseminating the technology to farmers (Rahman, 2002). This partnership actually forms a formal mechanism model in knowledge diffusion and information dissemination network to farmers as recipients of technology (Contado, 2002; FAO, 2000). In the technology transfer context, the formal mechanism model assumes that technology can be effectively disseminated to farmers by more involvement of stakeholders from private and public sectors (Kormawa et al., 2004; Rogers, 2003).
On the other hand, knowledge exchange and innovation transfer networks have been indigenously existed through a farmer to farmer communications network model in which a new technology can be diffused and spread out at a farming society (Alene and Manyong, 2006). In a farmer to farmer communication network model, the communication among the member of society have created a social network within neighborhood in a particular geographical area which may promote the speed of technology diffusion (Banerjee et al., 2013; Grisley, 1994). The knowledge exchange and technology transfer are embedded in the social network and available through the social interaction among the farmers (M. E. Isaac et al., 2007). This paper aims to describe the process of biogas technology transfer to mixed crops and livestock farmers in Indonesia. A case study of the dairy farmers’ network was conducted to show how the formal mechanism model plays a role in the network and how biogas technology is disseminated among the network. This study is particularly relevant in the light of a slow rate of biogas technology diffusion among the farmers in Indonesia.

**MATERIALS AND METHODS**

The case study about farmer’s network took place in Umbulharjo, Sleman, Yogyakarta Province during November to December 2014. This study involved nine neighboring farmers as participants. This study also employed an ordered pairs of farmers as a data collection technique which is commonly used to gather the data to estimate the point of network centrality (Galaskiewicz, 1991). With nine farmers participated in the research, this study employs a 9 × 9 matrix as a sample set in the analysis which is able to take advantage of some aspects on explaining the phenomena based on network theory and technique (Costenbader and Valente, 2003).

![Figure 1. Map of the Umbulharjo Village and the sub-village survey area](image)

Every response of farmers, represented by alphabet nodes from A to I, was entered into the the 9 × 9 matrices in UCINET 6, a social network analysis software package (S.P. Borgatti et al., 2002). The graphic network (socio-gram) presents a network of information flow of biogas technology diffusion stages of the farmers based on their information sharing in the society. The formal mechanism model is attributed to the nodes by acquiring the respondent information about first information source of biogas technology and time of firstly getting information about biogas. To fulfill the objective of this study, we specifically asked “with whom do you share the biogas technology information?” and “from whom do you receive the biogas technology information?”. A farmer, then, put a sign to the eight neighboring farmer’s name list, as if they share to or receive from, to answer those four questions. The farmer’s responses were coded as binary variables indicating the presence (1) or absence (0) of a tie and tabulated into a matrix (Hanneman and Riddle, 2005). Data were analyzed by descriptive approach by considering the analysis of social network results.

With the respect to information flow of biogas technology through the farmer’s network,
The network centrality approach was used as a network feature to study the structure of information flow network in relation to biogas technology diffusion at farm level. The network centrality can be expressed as a concept that structuralizes the network in accordance to the importance roles of a node in its position (Stephen P Borgatti et al., 2013). The network centrality may usually be defined by its degree of core centrality, its closeness to other nodes, and its shortest path to other nodes. This study employed the degree of centrality and eigenvector value as indicator of closeness centrality (Hanneman and Riddle, 2005). Those measurements may show the actor’s role on knowledge and information exchange about biogas technology among the neighbors.

**RESULTS AND DISCUSSION**

The dairy farmers are characterized by an age average of 49.5 years old which ranges from 30.92 to 72.92 years old. There are four farmers who are older than the average while the rests are younger than average. The MCL farmers mostly have finished primary and secondary level while only one farmer who attained the high secondary level. Meanwhile, the farm household income level is mostly at lower income while only one farmer has higher level income and three farmers have medium level income. Regarding to farm characteristics, the average of land tenure among nine farmers is 0.24 Ha which range from 0.1 Ha to 0.5 Ha. The cattle ownership shows that the average of cattle ownership is 4.6 TLU which ranges from 1 TLU to 10 TLU at farm households. The table 1 also shows that the information about biogas initially diffused to the MCL farmer network in 2009 supported by the initial information injected to the society and the first farmer adopted the technology. The information about biogas technology was transferred by NGO and Government agency within a formal mechanism model and neighboring farmers within a farmer to farmer communication network.

![](image)

**Figure 2.** The diffusion process of biogas technology among the DAIRY farmers

In a connection to the network centrality, the socio-gram of diffusion process shows that the biogas adopters have advantages from their position in the networks (Figure 2). The biogas...
adopters are more in the core position of the network while the biogas non-adopters are more in
the periphery of the farmer’s network. The tendency of centralized position of biogas adopters in
the network confirm that information of technology is more likely to flow from the central of the
network to the periphery (Spielman et al., 2011). With the core position in the network, potential
farmers can be the earlier adopters of biogas technology. It support the previous finding that the
knowledge transfer among the farmers and the technology adoption can be identified from the
social network relationship which is indigenously structuralized in the agrarian networks (Marney
E. Isaac, 2012).

The results in table 2 show that the score of centralities in the network indicates the centrality
roles among individual farmers in the networks when share biogas technology knowledge. There
are, at least, two farmers, D and F, with higher score of centralities in the networks. Those farmers
are considered as early adopters of the biogas technology in the network by receiving information
through formal mechanism model of biogas technology transfer from both NGO and Government
Project (see figure 2). It may indicate that farmers with more central position have better opportunity
to interact with the stakeholder of technology transfer. From network perspective, individual farmer
with higher degree of centrality with more ties in the network have better information access even
beyond the farmer network.

<table>
<thead>
<tr>
<th>Actors</th>
<th>Degree of Centrality</th>
<th>Eigenvector Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3</td>
<td>0.348</td>
</tr>
<tr>
<td>B</td>
<td>3</td>
<td>0.348</td>
</tr>
<tr>
<td>C</td>
<td>1</td>
<td>0.034</td>
</tr>
<tr>
<td>D</td>
<td>7</td>
<td>0.519</td>
</tr>
<tr>
<td>E</td>
<td>2</td>
<td>0.245</td>
</tr>
<tr>
<td>F</td>
<td>5</td>
<td>0.466</td>
</tr>
<tr>
<td>G</td>
<td>4</td>
<td>0.417</td>
</tr>
<tr>
<td>H</td>
<td>1</td>
<td>0.129</td>
</tr>
<tr>
<td>I</td>
<td>2</td>
<td>0.137</td>
</tr>
<tr>
<td></td>
<td>Centralization Index</td>
<td>62.50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>55.45%</td>
</tr>
</tbody>
</table>

**CONCLUSIONS**

A case study of DAIRY farmer’s network in Umbulharjo village has shown that, in a network
perspective, the formal mechanism of biogas technology transfer specifically target the elite group
of farmers in the network to be selected as an “injection point” of the biogas technology diffusion
among the farmers. This indicates that the farmers with more ties and well-connected to each
other in the network have better information access about biogas technology beyond the network
boundary. At the early stage of new technology diffusion, the biogas technology is effectively
diffused at mixed crops and livestock farm through the elite group of farmers in the network.
Another finding shows that speeding up the biogas technology diffusion through indigenous farmer
to farmer communication network is not an easy process. Individual farmers should have better
understanding on the complexity of the technology and the capacity to persuade their neighboring
farmers.
REFERENCES


Combined Effect of Message Framing and Endorser Credibility on Buying Interest of Yoghurt Product

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ABSTRACT: This study aimed to determine the effect of message framing, the credibility of endorser and the combination of message framing with endorser credibility on advertising for consumer buying interest on yoghurt products. This study was an experimental design that involved students as participants. Students were chosen because they are considered as the yoghurt consumer segment and to facilitate homogenization. While the number of students who participated in this study were 275 people. This research used 11 advertising design as treatment, which consisted of 1) a positive message framing, 2) negative message framing, 3) celebrity endorser, 4) expert endorser, 5) expert celebrity endorser, 6) positive message framing and celebrity endorser, 7) positive message framing and expert endorser, 8) message framing and expert celebrity endorser, 9) negative message framing and celebrity endorser, 10) negative message framing and expert endorser, 11) message framing and expert celebrity endorser. This research analysis used paired samples t-test, one way ANOVA and two-ways ANOVA. The results showed that there was a significant difference between the positive message framing and negative message framing on advertising for consumer buying interest in yoghurt. As well as the uses of expert endorser, celebrity endorser and expert celebrity endorser for buying interest of yoghurt. Using of negative message framing and expert endorser in advertising was more effective to create consumers buying interest of the yoghurt products.

Keyword: Message framing, Endorser Credibility, Yoghurt, Buying interest

INTRODUCTION

The increment of society incomes resulting in raising awareness to consume functional food from processed livestock. Society consumption of livestock product increased. It can be seen at table 1.

Table. 1 Consumption of Indonesian people

<table>
<thead>
<tr>
<th>Years</th>
<th>Energy</th>
<th>Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grains</td>
<td>Tubers</td>
</tr>
<tr>
<td>1996</td>
<td>57.1</td>
<td>2.9</td>
</tr>
<tr>
<td>1999</td>
<td>57.7</td>
<td>3.3</td>
</tr>
<tr>
<td>2002</td>
<td>52.3</td>
<td>2.8</td>
</tr>
<tr>
<td>2005</td>
<td>50.3</td>
<td>2.8</td>
</tr>
<tr>
<td>2008</td>
<td>47.5</td>
<td>2.6</td>
</tr>
<tr>
<td>2011</td>
<td>48.2</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Source: SUSENAS

Functional food according to BPOM is food that scientifically and has been through the process, containing one or more compounds based on scientific studies deemed to have certain physiological functions that are beneficial to health (Silalahi, 2006).

Livestock processed products which also includes in functional food is yoghurt. Yoghurt
is the product obtained from milk that has been pasteurized and then fermented by bacteria to obtain the degree of acidity, smell and taste that is typical with or without the addition of other ingredients.

In Indonesia, yoghurt industry grows very rapidly. This can be seen with the appearance of yoghurt brands on the market. Some of them are Cimori, Biokul, Heavenly blush and Sour Sally etc. Seeing the growth of the yoghurt industry, many companies were interested to enter this market. To be able to compete in this market, manufacturers need create a good advertisement. A good advertising is an ads that can make a people interest in their product.

For an advertisement to be successful, Kotler (2005) asserts that information appeal has two parts: (1) rational appeal, which informs consumers of the core values of the product such as practicability, function, and quality; and (2) emotional appeal, which is aimed at stimulating a purchase based on an emotional response to context and image. According to Kotler (2005), the formulation of advertising requires four issues: what to say (message), how to say logically (message structure), how to say it symbolically (message format), and who should say it (the source of the message). In other words, the ads are aspects of message framing and endorser credibility.

Message framing is how a message was designed that can be distinguished in the positive message framing and negative message framing. The positive message framing is defined as a message that emphasizes the benefits of the brand communication or potential benefits of consumer in a given situation. While the negative framing is defined as message that indicate communication brand disadvantage or potentially harm consumers in a situation (Grewal et al., 1994). In addtion to message framing, also required endorser credibility.

Information from credible endorser that affect the beliefs, opinions, attitudes, and/or behavior through a process called internalization, which occurs when consumers adopt the opinion of commercials that credible since he believed that the information provided is accurate enough. Source credibility has three dimensions: expertise, trustworthiness, and physical attractiveness (Ohanian, 1990). Seeing that message framing and endorser was important in causing the consumer buying interest in a product, the researchers are interested in doing research on the effect of message framing, endorser credibility and combined of both factors. This study attempts to examine differences in the perceived consumer buying interest on advertising by using various types of endorser and the positive and negative message framing.

**Research model**

![Research Model Diagram](image)

Source : Modified from Soliha (2014)

**MATERIALS AND METHOD**

Materials required in this study are students as participants and manipulated advertising. Participants consist of undergraduate and graduate student. The amount of participants is 275 persons. It contains of 25 persons each treatment. While the ads are manipulated total is 11 advertising and consisting of 1) ads with positive message framing, 2) ads with negative message framing, 3) ads with celebrity endorser, 4) ads with expert endorser, 5) ads with expert celebrity endorser, 6) ads with positive message framing and celebrity endorser, 7) ads with positive message framing and expert endorser, 8) ads with positive message framing and expert celebrity endorser, 9) ads with negative message framing and celebrity endorser, 10) ads with negative message framing and expert endorser and 11) ads with negative message framing and expert celebrity endorser. All of manipulated advertising pamphlets printed in A4.

**Method**

Research strategy used by researchers is the experimental method. Researchers used an
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October 20-22, 2015, Yogyakarta, Indonesia

experimental method for experimental research approach is a research approach that aims to identify causal relationships between variables. The analysis used in this study is t-test, one-way and two-ways ANOVA.

Research procedure

Participant choose the advertising and read it around 3 minutes. After that the manipulated advertising withdrawn by researcher and participant fill the questionnaire.

RESULT AND DISCUSSION

In this study selected participants were adults. Participants were voluntarily chosen. In the selection of groups experiments with randomized assignment. The characteristics of participants seen by age, gender and allowance per month as follows:

In table 2 can be seen participants characteristic based on age. Most Participant aged 17-22 years were 228 persons or 82.91%. While aged 23-28 y.o were 42 persons or 15.27%, aged 29 – 34 y.o are 2 persons and more than 34 y.o are 3 persons or 1.1%

Table 2. Participant characteristics based age

<table>
<thead>
<tr>
<th>No</th>
<th>Age</th>
<th>Amount</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>17 – 22 y.o</td>
<td>228 persons</td>
<td>82.91</td>
</tr>
<tr>
<td>2</td>
<td>23 – 28 y.o</td>
<td>42 persons</td>
<td>15.27</td>
</tr>
<tr>
<td>3</td>
<td>29 – 34 y.o</td>
<td>2 persons</td>
<td>0.72</td>
</tr>
<tr>
<td>4</td>
<td>&gt; 34 y.o</td>
<td>3 persons</td>
<td>1.1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>275 persons</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Primary data processed (2015)

Table 3 shows participant characteristic by gender. Most of participant is a woman amounted to 150 persons or 54.55% and man amounts to 125 persons or 45.45%. Table 4 shows participant by allowance per month. Most of participants have allowance less than IDR 1,000,000 were 138 persons or 50.18%. Participant that have allowance IDR 1,000,000 – 2,000,000 were 116 persons or 42.18%, that have allowance IDR 2,000,000 – 3,000,000 were 13 persons or 4.73% and participant that have allowance more than IDR 3,000,000 were 8 persons or 2.91%.

Table 3. Participant characteristic based gender

<table>
<thead>
<tr>
<th>No</th>
<th>Gender</th>
<th>Amount</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>125 persons</td>
<td>45.45</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>150 persons</td>
<td>54.55</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>275 persons</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4. Participant characteristic based allowance

<table>
<thead>
<tr>
<th>No</th>
<th>Allowance per month</th>
<th>Amount</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt; IDR 1,000,000</td>
<td>138 persons</td>
<td>50.18</td>
</tr>
<tr>
<td>2</td>
<td>IDR 1,000,000 – 2,000,000</td>
<td>116 persons</td>
<td>42.18</td>
</tr>
<tr>
<td>3</td>
<td>IDR 2,000,000 – 3,000,000</td>
<td>13 persons</td>
<td>4.73</td>
</tr>
<tr>
<td>4</td>
<td>&gt;IDR 3,000,000</td>
<td>8 persons</td>
<td>2.91</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>275 persons</td>
<td>100</td>
</tr>
</tbody>
</table>

Validity and realibility test

Based on the validity test, it showed that the amount of the questionnaire were 0.724, 0.885 and 0.922 that were higher than 0.5 so it’s valid. The result of reliability test showed that Cronbach's
According to Hair et al (2006), Cronbach’s Alpha must be greater than 0.60.

**Manipulation check**

The results of the endorser credibility manipulation check showed that there were significant differences in the advertising appeal for celebrity, expert and expert celebrity (table 5). Message framing manipulation check results showed that there are significant differences in the advertising with positive and negative message framing (table 6). From these test results can be concluded that the ads with positive and negative message framing also celebrity, expert and expert celebrity can be distinguished.

**Table 5. Average of endorser’s manipulation check**

<table>
<thead>
<tr>
<th>No</th>
<th>Endorser</th>
<th>Mean of attractiveness</th>
<th>Mean of expertise</th>
<th>Mean of trustworthiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Celebrity</td>
<td>3.03</td>
<td>2.65</td>
<td>2.8</td>
</tr>
<tr>
<td>2</td>
<td>Expert</td>
<td>3.27</td>
<td>3.74</td>
<td>3.69</td>
</tr>
<tr>
<td>3</td>
<td>Expert celebrity</td>
<td>2.96</td>
<td>3.81</td>
<td>3.5</td>
</tr>
</tbody>
</table>

**Table 6. Average of message framing manipulation check**

<table>
<thead>
<tr>
<th>No</th>
<th>Message framing</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Positive (+)</td>
<td>4.39</td>
</tr>
<tr>
<td>2</td>
<td>Negative (-)</td>
<td>2.51</td>
</tr>
</tbody>
</table>

**Hypothesis test**

H1: Using negative message framing in advertising has a better influence than positive message framing on buying interest in yoghurt product.

**Table 7. Result of T-test buying interest based on message framing**

<table>
<thead>
<tr>
<th>Message framing</th>
<th>Mean</th>
<th>Standart deviation</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>3.11</td>
<td>0.65</td>
<td>0.000</td>
</tr>
<tr>
<td>Negative</td>
<td>3.30</td>
<td>0.52</td>
<td>0.000</td>
</tr>
</tbody>
</table>

The results of a test of the hypothesis 1 with the dependent variable is buying interest and independent variable are positive and negative message framing showed significant results (Table 7). This suggests that there are significant differences in buying interest on advertising use positive and negative message framing. Consumers feel the buying interest is higher in the advertising with a negative message framing that positive message. In this case, the message turned out to be more negative framing affects consumers. Thus, it can be concluded that the yoghurt ads more effective using negative message framing. This result is similar to the studies that have been conducted by Soliha (2014), in the functional food product advertising, framing the message that more effective is framing a negative message.

H2: Using expert endorser in advertising has a better influence than celebrity and expert celebrity endorser on buying interest in yoghurt product.

**Table 8. Result of one way anova buying interest based on endorser**

<table>
<thead>
<tr>
<th>No</th>
<th>Type of endorser</th>
<th>Mean</th>
<th>Standart Deviation</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Celebrity</td>
<td>2.67</td>
<td>1.01</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Expert</td>
<td>3.21</td>
<td>0.45</td>
<td>0.021</td>
</tr>
<tr>
<td>3</td>
<td>Expert Celebrity</td>
<td>3.15</td>
<td>0.64</td>
<td></td>
</tr>
</tbody>
</table>

Source: Primary data processed (2015)
The results of a test of the hypothesis 2 with the dependent variable is buying interest and independent variable are celebrity, expert and expert celebrity endorser showed significant results (Table 8). This suggests that there are significant differences in buying interest on advertising use celebrity, expert and expert celebrity. Consumers feel the buying interest was higher in the advertising with a expert endorser than using celebrity and expert celebrity. In this case the message that delivered by expert endorser was more affected on consumer. Thus, it can be concluded that the yoghurt ads more effective using expert endorser. This result is similar to the studies that have been conducted by Soliha (2007), which said that the use of expert endorser is more effective than the celebrity endorser in advertising.

H3 : Using negative message framing and expert endorser in advertising has a better influence than the other combination of message framing and endorser.

<table>
<thead>
<tr>
<th>No</th>
<th>Treatment</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Endorser celebrity message (+)</td>
<td>3.04</td>
<td>0.69</td>
<td>0.108</td>
</tr>
<tr>
<td>2</td>
<td>Endorser expert message (+)</td>
<td>3.01</td>
<td>0.76</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Endorser expert celebrity (+)</td>
<td>3.16</td>
<td>0.74</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Endorser celebrity message (-)</td>
<td>3.03</td>
<td>0.40</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Endorser expert message (-)</td>
<td>3.48</td>
<td>0.49</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Endorser expert celebrity (-)</td>
<td>3.16</td>
<td>0.57</td>
<td></td>
</tr>
</tbody>
</table>

The result of a test of the hypothesis 3 showed not significant difference result (Table 9). Consumers do not feel any significant difference regarding buying interest based advertising that have been combined. This is because the combination of these advertising generates buying interest is almost the same.

CONCLUSION

This research conclude that, using negative message framing is more effective than positive message framing to induce buying interest of yoghurt products, and expert endorser effect is more effective than using celebrity endorser and expert celebrity endorser to induce buying interest on yoghurt products.

REFERENCE


The Alternative Livestock and Sustainability of Farmers in Mexico

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ABSTRACT: Farming in Mexico for more than 12 years ago suffers stagnation due to the high costs of inputs to production, this added to global climate change has led to high mortality of animals (more than 3 million animals), and disease, on the other hand, the establishment of livestock basins in areas not conducive proof of this we have livestock since 2004-13 has grown only 0.4%, dairy cattle population decreased from 2004-13 -6.8 % and meat production increased in the same period by 1.7%. In rural and peri-urban traditional farming focuses on raising cattle, pigs, sheep and goats, mainly; these activities have been developed since the Spaniards brought the first animals to America. For years in many areas are implementing a livestock system, known as alternative livestock and that it relates in part to the introduction of Bubalus bubalis or water buffalo, this animal has been very attractive for its adaptive profitability. These same areas are flooded during the rainy season, hampering the development of traditional farming, where the average annual rainfall is estimated between 2850-3200 mm / year, average high temperatures between 32-37°C, with moisture 89.2±3.2%; besides high prevalence parasitic (ecto- and endoparasites) and the inability of many species of ruminants and pseudoruminants in feeding diseases since the lowlands are flooded. The aim of this study was to determine the physiological adaptive features of Bubalus bubalis, in areas where other animals of economic importance cannot be reared; Today its population is estimated at over 65,000 animals in 9 states of the country, for this study a population of 5,000 animals Bubalus bubalis where fertility ranged from 86.4 to 92.5%, was used milk production is estimated at 6.24 ± 0.35 liters daily, with average weight gain of 24.7 ± 2.7 kilos per month, but there is a high prevalence of parasites such as: Coccidiosis (91.2%), Schistosomiasis (72.9%), Fascioliasis (52.1%). Metabolic profiles are mostly kept within normal parameters, making animals with high resistance to diseases and high productive and reproductive capacity in these tropical and subtropical regions of Mexico.

Keywords: adaptive capacity, parasites and physiological parameters.

INTRODUCTION

The areas used for agriculture, in Third World countries, not covered usually Zoogeographic environmental characteristics, much less soil type, rainfall etc. This has allowed many production systems have failed for lack of professional advice, in this study the adaptive capacity of water buffalo Vs Creole cattle was determined. Today in Mexico there are many agricultural areas where agriculture unable to develop because of the lack of technology and introduction of animals highly adapted to survive in waterlogged areas, where rainfall varies between 2800-3200 mm of rain annually; this on the one hand and on the other the lack of rain during the years 2012-14, where the north is more than 4 million dead animals produced by the lack of water and thus the high incidence of diseases such as the influence who declined poultry avian productivity with more than 35 million birds culled; in livestock a lot of food additives used also declining reproductivity, as many young animals cattle are exported live to the US, this stimulates the high cost of meat prices in many geographic areas, on the other hand, diseases that are increasingly more frequent and resistant to treatment, such as the high presence of parasites. In regions with tropical climate,
ruminant production in extensive systems is a good alternative; however, based grazing husbandry
practices are responsible for some parasitic problems (Cordero et al. 1999; Aguirre et al. 2001).
Gastrointestinal parasites threaten ruminants around the world, causing anorexia, reduced the
amount ingested in food, loss of blood and plasma proteins in the gastrointestinal tract, alterations
in protein metabolism, reduced minerals, depression in the activity of some intestinal enzymes
and diarrhea. These conditions may be reflected in the decrease of production indicators such as:
daily gain, milk production, feed conversion, among others (Rodriguez et al. 2001). Important
parasitic diseases in cattle are identified as: cestodes, nematodes, trematodes, arthropods (Quiroz,
2002). Among the gastrointestinal nematodes we have that cause gastroenteritis and processes are
generally chronic course, which are characterized by decreased production, susceptibility to other
diseases and sometimes death (Cordero et al, 1999; Quiroz., 2002). In introduced species such as
water buffalo “Bubalus bubalis” studies on adaptability, more common diseases, reproductive
rates are unknown, which is why this study is confined to study this species as a new animal
production, as adaptability in areas where Bos indicus X Bos taurus is not adaptable and where the
parasites that adaptability prevent any species of economic importance in Mexico.

MATERIALS AND METHODS

Ecological Zone: Gulf of Mexico (south of the state of Veracruz, Puebla Upstate and
“Mixteca Poblana”). Animals: are proposed to study a population of 5000 animals, however,
only it took 10% of this population and those animals that were productive and reproductive
problems. Sampling and analysis of field and laboratory test: tubes were used to empty the first
tube without anticoagulant, for the blood serum to determine the metabolic profile and another
tube with EDTA, to perform blood smears and determine complete blood count. Copro-parasitic
test: To parasitic diagnosis three different methods were used in the search for gastrointestinal
parasites. a) Direct smear b) sedimentation technique and c) flotation technique. Breeding
parameters: to obtain this information the productive and reproductive parameters between buffalo
and cattle in the region compared these parameters were: % calving, % mortality in calves, % of
adult mortality, birth intervals, lactation, milk production, birth weight, weaning weight, first birth
age, slaughter weight, among others. Statistical Analysis: The data obtained was performed an
analysis of variance (ANOVA) with Stat-2 (Olivares, 1994) statistical program and to determine
the significance between averages Duncan New multiple range test was used. They plotted the
graph Cricket (Macintosh) program.

RESULTS AND DISCUSSION

Characterization of the system:

Herd structure: 4978 animals of the 32.47% are male and 67.53% are female, of which
41.45% are active reproductive females, 12.09% females reach puberty and 13.99% females under
one year. On the other side are 24.78% and 2.47% adult males developing males and 5.22% males
under one year.

Health management: farmers assumed wrongly that the Bubalus bubalis is an animal
resistant, rustic and which not need any preventive disease management. There is a general lack of
vaccination plan and very few animals are dewormed, but the buffalo suffer from the same diseases
and parasitic infections in cattle, there is a difference in the symptoms and the susceptibility of
animals (Annonimus, 1981). Pipaon and emphasize (2000), stated that the buffaloes are very
susceptible to hemorrhagic septicemia (buffalo calves) and internal parasites, considered one of
the leading causes of death of these animals.

Food “fodder” Operation: the grass used for animal handling 40% of the study animals are
in area where grass prevails Echinocloa polistachya and Brachiaria spp., 36% in African Star grass
Integrated Approach in Developing Sustainable Tropical Animal Production

Reproductive Management: no farm has a well-established system registry, which made farmers is a collection dates childbirth: In case of holdings with a large number of cows, stallions are used in continuous mating systems, this form of management, brings male prolonged use without genealogical control linked to a very small population because inbreeding. The bubillos (young males) are castrated and sold for human consumption. The period of anoestrus and acyclicity in buffaloes are related to the stress of lactation (duration and level of production), inadequate nutrition, poor body condition, the time of year, and in less proportion abnormal offspring and uterine infections. (El-Wishy, 2007).

Metabolic profile: In determining the different metabolic parameters based antiparasitic treatment of animals detected that the first samples had values much lower than control animals, however the animals showed higher prevalence of parasitic parameters well below the controls, as the parasite load animals decreased metabolic reaching values very similar to those obtained values they increased controls. On the other hand, when comparing the metabolic profiles with cattle located in the same ecological zone was determined that Bos indicus X Bos taurus have metabolic parameters so low and that this will drastically affect reproductive behavior as ethyl productive. The incidence (parasite load) parasites in cattle is very high compared with the buffalo, as disease prevalence is higher in cattle as vesicular disease and vesicular stomatitis in certain seasons it affects livestock areas of the Gulf of Mexico and whose prevailing is estimated at 16.3% in cattle and 0% in bubalis buffalo, like cattle trypanosomiasis prevalence is estimated at 2.3% and 1.05% in buffaloes but this parasite causes deaths in cattle Bubalus bubalis not. We emphasize in this study is the first work of comparative research between Bos indicus X Bos taurus Vs Bubalus bubalis in this part of North America.

Parasitic diagnosis: in this study appears to be the first parasitological studies that undergo these animals thus determined perform three sampling the first to establish incidence once established it was decided to have a follow treatment with Triclabendazole, since the prevalence of fascioliasis was very high.

Zootechnical parameters: Bos taurus X Bos indicus and Bubalus bubalis data from very reliable jurisdiction cattle in relation to buffalos, recent data were not in all animals thus devote ourselves to present data that could be obtained 1) Average age to benefit (year): Bb: 2-2.5, in Bt X Bi 3.3-5; 2) Life of breeding females (year) 18-20 Bb in Bt X Bi 2-10; 3) average pregnancy (year) was Bb Age: 1.5-2, on Bt X Bi was 2.5-3; 3) average pregnancy (year) was Bb Age: 1.5-2, on Bt X Bi was 2.5-3; 4) average weight gain (kg) in Bb 0.75-1.5 in Bt X Bi daily is 0.5-1.2; 5) carcass yield (%) Bb is 48-54 in Bt X Bi was 50-55; 6) Bb workability is excellent in Bt X Bi is scarce; Bb disease resistance is higher in Bt X Bi is less; 7) Adjustment natural pastures in Bb is efficient in Bt X Bi is poor; 8) adapted to poor soils and poorly drained Bb is efficient and Bt X Bi is poor and 9) Adjustment lake ecosystems is the total Bb and Bt X Bi is any. (Bb = Bubalus bubalis and Bt X Bi = Bos taurus X Bos indicus).

CONCLUSIONS

Despite the lack of adequate information records and improper handling, it was determined that the Bubalus bubalis is the animal species with more adaptive relevance in tropical and sub-tropical areas of México (flooded areas), and that the cattle in these same areas connot adapt, and where scarcity of grass with a high nutritional value does not exist, buffalo if it fits and has greater productive and reproductive performance. Based on the information obtained can be the Bubalus bubalis is the species that have greater adaptive capacity than any other ruminant, and this is mainly because it is more resistant to parasitic diseases as the infection with Fasciola hepatica, the tick (Bebesiosis and Anaplasmosis) and vesicular diseases. It is considered as the alternative in animal production in areas of difficult access and because of its location within the Mexican territory.
The 6th International Seminar on Tropical Animal Production
Integrated Approach in Developing Sustainable Tropical Animal Production
October 20-22, 2015, Yogyakarta, Indonesia

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Farmers’ Perception of Etawah Grade Goat Productivity
Based on the Hair Color Differences

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ABSTRACT: In recent year, there is a tendency that farmers prefer to keep Etawah grade goat with black head color instead of brown or mixed colors, therefore the study was conducted to identify the farmers’ perception in regard with the effect of hair color differences on the productivity of Etawah grade goats. Sixty farmers were interviewed deeply on their perception using a semi structured questionnaire; farmers were selected randomly from two districts, Sleman and Kulonprogo, which have been known as the centre of Etawah grade goats in Yogyakarta Province. The interviews were conducted for three months using “door to door” method, including farmers characteristics, the reason to select different hair color, mating systems, the kid produced, the price of goats based on different hair color, and the effect of different hair color on feed intake and productivity. Data was tabulated and analyzed descriptively. The result indicated that the majority reason of farmers kept the specific hair color of goats due to the expensive prices (40.00%), excellence exterior characteristics (38.33%), and a few farmers stated that they select different hair color because the goats had high performance, i.e. high milk production (13.33%) and rapid growth rate (8.33%). Farmers mostly (85.00%) mated their Etawah grade doe using a buck which has the same color with the doe, while the rest (15.0%) mated their doe sometimes with different hair color of buck. In addition, farmers also believed that the kids will have the same colors with their parents (76.67%), however, some of 23.33% farmers had experience that mating between doe and buck which has the same color will not automatically produce kid with the same hair color. The difference hair color between the kids and their parents was found relatively small, less than 25%. There was a significant difference of price between black head color hair and brown or mixed color according to more than 86% farmers, the different price approximately IDR 399,000,00. The different price of goats seem to be based on their excellent exterior characteristic (66.67%) and high demand (21.67%) rather than high milk production (6.67%) and rapid growth rate (5.00%). Majority of farmers did not agree (68.33%) and only a few farmers (21.67%) stated that productivity was related to different hair color, while 10% of the farmers did not know whether it will affect the productivity or not. It can be concluded that expensive prices and exterior characteristics was the main reason for the farmer to select and keep Etawah grade goats. Kids produced will not automatically have similar color with their parent. Farmers believed that color differences will not have impact on the productivity of goats, however goats with black head color remain have the most expensive price for excellent exterior performance reason.

Keywords: Etawah grade goat, Productivity, Hair color differences, Farmers’ perception

INTRODUCTION

Indonesia has an abundance and potential asset of animal genetic resources and germ plasm that can be used to develop new animal breeds. Amongst the local breeds, goats are the most popular animal kept by farmers. Goats are an important asset for small farmers, but the existence is often ignored. Farmers prefer to raise goats, but the numbers of goats kept are generally small and under
traditional management. One of the goats breed kept by farmer is Etawah grade goat. Originally, Etawah grade goats produced from the crossing of male Etawah goats with female Kacang goats, the native goats in Indonesia. Etawah-grade goats are distinctly different from Kacang goats with a larger body frame, long hanging ears, convex face and larger horns (Budisatria, 2009). Etawah grade goats can be found in all agro-ecological zones, although preferences of farmers and policy makers for goats differ between zones, Etawah-grade goats are said to be more suitable for farming systems in the middle zone and uplands, because of the abundant availability of tree leaves (Budisatria, 2006; Budisatria et al., 2012).

In recent years, there is a tendency that farmers prefer to keep Etawah grade goat with black head color instead of brown or mixed colors. Farmers perceived that keeping black head color will gain more benefitted, because they have relatively higher prices than the others. Those perceptions supposed to be the kind of local wisdom that need to be justified, the farmers rely on their past experience of keeping goats and concluded that black head goats had better performances than the others. Based on the scientific reason, those perception could be caused by the variation of their ancestor, the blood composition of Etawah grade was dominated by pure Etawah, while the contribution of Kacang goat was relatively low, therefore the productivity of Etawah grade almost similar with the productivity of pure Etawah goat. However, there was little information available in regard with farmers, perception and also quantitative data on the productivity of Etawah grade based on their differences hair colors. That information is necessary required, so the stakeholders have the right information in order to select or keep the Etawah grade goat. Based on the background, the research was conducted to identify farmer’s perception and the reason for selecting specific hair color of Etawah grade goats.

MATERIALS AND METHODS

The study was conducted in Sleman and Kulonprogo district, Yogyakarta province. Those two districts have been known as the centre of Etawah grade goats in Yogyakarta Province. Farmers in Kulonprogo district mostly keep black head goats, while farmers in Sleman district keep black, brown or mixed color of Etawah grade goats. The main objects of the research were 60 Etawah grade goats’ farmers. The farmers were selected randomly. The semi structured questionnaire was used to assist in collecting data required.

The participatory approaches consisted of interviewing 60 small ruminant farmers according to different color of goat they kept to identify perceptions of farmers. Farmers were asked a specific question regarding their perception on the differences between goats which has black, brown or mixed color. The interviews were conducted for three months using “door to door” method, to avoid the intervention of the answer from one to other farmers. Discussion was also conducted with a group of farmers. Some of questions were related to farmers’ background (age, education, farmers experiences, numbers of goats), the reason to select different hair color, mating systems, the kid produced, the price of goats based on different hair color, and the effect of different hair color on feed intake and productivity. Data was tabulated and analyzed descriptively.

RESULTS AND DISCUSSION

The result of this study showed that the majority of farmers kept the specific hair color of goats due to the expensive prices (40.00%), while other perception argued that they had select specific color because the excellence exterior characteristics (38.33%), and a few farmers stated that they select different hair color because the goats had high performance, for example rapid growth rate (8.33%) and high milk production (13.33%), as presented in Table 1.
Table 1. Farmers reason to select different hair of goats

<table>
<thead>
<tr>
<th>Perception</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>The reason to select different hair color (%)</td>
<td></td>
</tr>
<tr>
<td>Expensive price</td>
<td>40.00</td>
</tr>
<tr>
<td>Excellent exterior characteristic</td>
<td>38.33</td>
</tr>
<tr>
<td>High milk production</td>
<td>13.33</td>
</tr>
<tr>
<td>Rapid growth rate</td>
<td>8.33</td>
</tr>
</tbody>
</table>

Those perception might be caused by the fact that in recent years, general opinion stated that the best Etawah grade goats was the goats which has black color in their head and white color in the whole body. However, it is in contrast with the origin of Etawah (or usually called as Jamunapari) goat, which the characteristic of Etawah is hair color predominantly by white with brown patches on neck and face (Thiruvanikan, 2014).

Table 2. Farmers’ perception on reproduction aspect of goats

<table>
<thead>
<tr>
<th>No.</th>
<th>Perception</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The doe was mated with the buck which has the same hair color (%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Always mated with the same hair colors</td>
<td>85.00</td>
</tr>
<tr>
<td></td>
<td>Sometimes</td>
<td>15.00</td>
</tr>
<tr>
<td></td>
<td>Never</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>The kid born had the same hair color with their parents</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The color was always the similar with their parent</td>
<td>76.67</td>
</tr>
<tr>
<td></td>
<td>Sometimes differ</td>
<td>23.33</td>
</tr>
<tr>
<td></td>
<td>Different hair color</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td>The percentage of different hair color between the kids and their parents</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;25%</td>
<td>73.33</td>
</tr>
<tr>
<td></td>
<td>25-50%</td>
<td>26.67</td>
</tr>
<tr>
<td></td>
<td>&gt;50%</td>
<td>0</td>
</tr>
</tbody>
</table>

There was a significant differences price between black head color hair and brown or mixed color acoding to more than 86% farmers, the different price was approximately IDR 399,000.00 (Table 3). The different price of goats seem to be based on their excellent exterior characteristic (66.67%) and high demand (21.67%) rather than they consider on the performance of goats, such as high milk production (6.67%) and rapid growth rate (5.00%).

Table 3. Farmers perception on different prices of goats

<table>
<thead>
<tr>
<th>No.</th>
<th>Perception</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The price of goats based on the different hair color</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Different prices</td>
<td>86.67</td>
</tr>
<tr>
<td></td>
<td>No different prices</td>
<td>13.33</td>
</tr>
</tbody>
</table>
2. The highest price of goats based on the hair color
   1. Black head
   2. Brown head
   3. Mixed color

3. Different price of black head color of Etawah grade goats 399,000.00 compared to other hair color (IDR)

4. Factors affecting different prices (%)
   - Excellent exterior characteristic
     66.67
   - High demand
     21.67
   - High milk production
     6.67
   - Rapid growth rate
     5.00

When the farmers were asked their perception on the effect of different hair color on the productivity of Etawah grade doe, majority farmers did not agree (68.33%), only a few farmers (21.67%) stated that productivity was related to different hair color, while 10% of the farmers did not know whether different of hair color will affect the productivity or not. Farmers were also confirmed that high feed and nutrient intakes did not affected by the different hair color (91.67%), however, 8.13% of farmers were agreed that high intakes caused by the different hair color, primarily on the black head color of Etawah grade goats.

Table 4. Farmers perception on the effect of different hair color on productivity of goats

<table>
<thead>
<tr>
<th>No.</th>
<th>Perception</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The different hair color will affect the productivity of Etawah grade goats (produce milk, etc.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Completely agree</td>
<td>21.67</td>
</tr>
<tr>
<td></td>
<td>Disagree</td>
<td>68.33</td>
</tr>
<tr>
<td></td>
<td>Did not know whether it was different or not</td>
<td>10.00</td>
</tr>
<tr>
<td>2.</td>
<td>The different hair color will affect feed intakes of Etawah grade goats</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Agree</td>
<td>8.13</td>
</tr>
<tr>
<td></td>
<td>Disagree</td>
<td>91.67</td>
</tr>
</tbody>
</table>

Baskoro (2014) found that farmers perception on the black head color of Etawah grade goats was significantly high, some of 68% of farmers interested in keeping black color of Etawah grade goats instead of brown or mixed head colors. High perception of farmers in regard with the black head color of Etawah grade goats might be accelerated by a routine contest and show event held by government or association, which in the contest, the winner was dominated Etawah grade goat which has black head color. Especially in Java island, local government is continuously conduct Etawah grade contest with the specific criteria (Bondan, 2009), including the color condition. This statement supporting the fact that in Indonesia, the preferences of black head color of Etawah grade goats is merely based on its expensive price and their exterior characteristics rather than production aspects. In India, according to Uttar Pradesh State Biodiversity Board (2014), the predominant coat color of Etawah or Jamunapari goat is white with occasional brown patches on the ears, neck and head.
CONCLUSIONS

Based on the study, it can be concluded that expensive prices and exterior characteristics was the main reason for the farmer to select and keep Etawah grade goats. Kids produced will not automatically have similar color with their parent. Although the farmers believed that color differences will not have impact on the productivity of goats, goats with black head color remain have the most expensive price for excellent exterior performance reason.

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Regional Development for Beef Cattle Farming Based on Agricultural by Product in Serdang Bedagai District, North Sumatra Province, Indonesia

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ABSTRACT: Serdang Bedagai is one district in North Sumatra Province, which potential as a producer of livestock and agricultural products. The purpose of this study was to determine the potential by product of food crops and regions that can be used as a development region of beef cattle in Serdang Bedagai. This type of research is a descriptive study to illustrate the potential of crop by product and zoning development of beef cattle using the LQ method, combined with the density and capacity increase in the region of livestock cattle population (KPPTS) by product food crops. The results showed that the region of the development of beef cattle is based on the potential by product of food crops is divided into groups of Deployment Region (WS) the District Tebing Tinggi. Group Stabilization Region (WM) the District Pantai Cermin, Dolok Masihul, Serbajadi, Sipispis and Pegajahan. Group Development Aregion (WP) the District of Kotarih, Silinda, Bandar Khalifah, Tanjung Beringin, Sei Rampah, Sei Bamban and Teluk Mengkudu. Group Support Region (WT) the District Perbaungan. It was concluded that from 17 districts, there are 14 districts have the potential as an region-based development of beef cattle and crop by product, 3 districts must use sources other than the by product feed crops to meet the needs of livestock such as planting grass or farm by product. It is expected for the formation of neighborhood beef cattle breeding business should be conducted in regions that have the potential of the region in terms of suitability, and the carrying capacity of livestock feed crops in the form of by product.

Keywords: Potential of feed, food crop by product, beef cattle, development region

INTRODUCTION

Business Region of beef cattle is an region that is specifically used for beef cattle farming activities; or beef cattle farming integrated as a component based on food crops, plantation, horticulture, and fisheries-oriented economy with sustainable agribusiness system is access to the upstream and downstream industries. Serdang Bedagai is one of the districts in the province of North Sumatra potential as a producer of livestock and agricultural products, and is a region that has a cattle population that is bigger than the other districts in North Sumatra that for the year 2012 range from 47 325 individuals (Dinas Peternakan Kab. Serdang Bedagai, 2013). The total region of Serdang Bedagai in 2012 is 1900.22 km2 and approximately 43.17% or 82.036 ha of the region is cropland (BPS Serdang Bedagai, 2013). Thus, there is by product food crops such as rice straw, corn straw, straw sweet potato, peanut straw, soybean straw and hay green beans, and cassava.
shoots that can be used as cattle feed. Until now there is no accurate data and information on the development of the farm region to be stated and can provide an enormous boost to the people who chose the livestock sector as a leading sector in spurring an increase in income and welfare of the people, especially farmers as well as a major driver of economic development of the Serdang Bedagai District. Seeing the potential and carrying crops by product as a source of feed, seems to meet the needs in the provision of food for the number of cattle population.

In order for the development of beef cattle in this region be optimized so that the necessary studies and research in the region of business development programs beef cattle farms in the centers of growth (agribusiness region) is an region that can be selected based agribusiness beef cattle farms, and after it was known then arranged strategy and the development of better models.

**MATERIALS AND METHODS**

**The location and design of the study**

The research was conducted in Serdang Bedagai District, North Sumatra Province from April to August 2014. This type of research is a descriptive study conducted to assess the potential of agricultural by product, especially food crops by product to support the development of business regions of beef cattle farms in Serdang Bedagai.

**Population and sample**

Samples of the population in this study is sub-districts in Serdang Bedagai. The survey was conducted to determine the potential for beef cattle and forage, fodder and forage crops by product (rice straw, corn straw, straw of sweet potato, cassava shoots, peanut straw, soybean straw, hay and green beans) were analyzed by results of field studies and secondary data.

**Methods of data collection**

Data collected in the form of primary and secondary data. Primary data obtained by conducting surveys and direct observation and interviews spaciousness, while the secondary data obtained from the results of previous studies related to the conversion rate of cattle population and by product production of food crops.

**Analysis of the data**

**Population Analysis and Comparative Advantage**

**Location Quotation Methods (LQ).** This method is used to analyze the state of the territory, whether an region is a sector basis or non-base, especially in the case of cattle population. Thus it can be known whether the region balanced or not in livestock production activities. To see the comparative advantage of livestock (LQ) according to the formula used by Budiharsono (2001)

\[
LQ = \frac{SI}{NI}
\]

SI = Comparison between the number of beef cattle populations (ST) of a particular region with a population in the same subdistrict

NI = Comparison between the cattle population by the number of residents in the District of Serdang Bedagai

The criteria used are:

- LQ> 1 means cattle ‘i’ in a region already has a comparative advantage (population exceeds the needs in the region that can be sold or exported outside the region).
- LQ = 1 means cattle ‘i’ in a region does not have a comparative advantage (population just
enough for their own consumption).
• LQ <1 means cattle 'i' in a region can not meet the needs of its own that need supplies from outside the region.

Analysis of Production Potential and Carrying Capacity of Agricultural By Product
To calculate the Yield Potential of Agricultural By products can be obtained from agricultural by product potential sources of fodder kg / ha. While carrying capacity of agricultural by products (DDLDP) is the ability of a region to produce feed mainly in the form of forage that can accommodate the number of ruminant livestock population in fresh or dried form (dry matter = DM), without any treatment. Feed Capability Index (IDDP) is the ratio between the amount of by product feed crops available (ST) with a population of ruminants (ST) in a region. Index carrying capacity of agricultural by products (IDDP) This value is calculated from the total feed of each of the available agricultural by product to feed the need for a number of beef cattle population in the region. Assuming one livestock unit (1 ST) can consume as much as 2,555 kg of fresh straw / year (Haryanto et al., 2002), then by using the following formula:

$$\text{IDDP} = \frac{\text{Total production of agricultural by product}}{(population \times \text{average of fresh consumption} \text{1 ST / year})}$$

The assumption used is that one livestock unit (1 ST) to ruminants require dry matter (DM) of 6.25 kg / day (NRC, 1984). Then the carrying value of crop by product (DDLTP) can be calculated by the formula:

$$\text{DDLTP based on DM} = \frac{\text{DM Production (Ton/Year)}}{\text{Needs of DM 1 ST (Ton/year)}}$$

(Syamsu et al., 2006).

Analysis of Location Capacity
Analysis of the suitability of the location is done by looking at the capacities of the region development of beef cattle in Serdang Bedagai. For the calculation formula used Cattle Population Increased Capacity (KPPTS) refers to the method of Nell and Rollinson (1974) in (Syamsu et al., 2006), which calculates the capacities of ruminants, as follows: Potential development of ruminants in a region is calculated through Effective Livestock Development Potential method (PPE), refer to the guidelines of the Directorate General of Livestock and Livestock Research Center (1995) as follows:

$$\text{PMSL} = a \text{LG} + b \text{KK} + c \text{KS}$$

where:

PMSL = maximum potential by land resources (ST) based on land Resources
a = Capacity Beef cattle on arable land (a = 1.52 ST / ha of land field).
LG = region of arable land (ha).
b = Capacity cattle in Rubbe plantation (b = 0.5 ST / ha).
KK = region of rubber plantation (ha).
c = Capacity Beef cattle in Palm Oil plantation (1 ST / Ha)
KS = region of Palm Plantation (ha).

To calculate the capacity Improvement of Beef Cattle Population land resources used by the following formula:
The base regions of the development of beef cattle

Table 1 shows the development of the base region of beef cattle in Serdang Bedagai, is the value of \( LQ > 1 \) including Sub district of Bintang Bayu, Dolok Masihul, Serbajadi, Sipispis, Dolok Merawan, Pegajahan and Pantai Cermin.

**Table 1. Regional base of beef cattle with \( LQ > 1 \) in Serdang Bedagai**

<table>
<thead>
<tr>
<th>No</th>
<th>Sub-District</th>
<th>LQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bintang Bayu</td>
<td>1.98</td>
</tr>
<tr>
<td>2</td>
<td>Dolok Masihul</td>
<td>1.71</td>
</tr>
<tr>
<td>3</td>
<td>Serbajadi</td>
<td>1.27</td>
</tr>
<tr>
<td>4</td>
<td>Sipispis</td>
<td>1.95</td>
</tr>
<tr>
<td>5</td>
<td>Dolok Merwan</td>
<td>3.22</td>
</tr>
<tr>
<td>6</td>
<td>Pegajahan</td>
<td>2.02</td>
</tr>
<tr>
<td>7</td>
<td>Pantai Cermin</td>
<td>1.99</td>
</tr>
</tbody>
</table>

Source: results of primary data processing (2014)

Sub district other than those shown in Table 1 as many as 9 subdistricts be regarded as non-base region of the development of cattle with a value \( LQ <1 \) including District of Kotarih, Silinda, Tebing Syahbandar, Bandar Khalifah, Tanjung Beringin, Sei Rampah, Sei Bamban, Teluk Mengkudu and Perbaungan (Table 2).

**Table 2. Non-Base region of cattle with a value \( LQ <1 \) in Serdang Bedagai**

<table>
<thead>
<tr>
<th>No</th>
<th>Sub-District</th>
<th>LQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kotarih</td>
<td>0.36</td>
</tr>
<tr>
<td>2</td>
<td>Silinda</td>
<td>0.40</td>
</tr>
<tr>
<td>3</td>
<td>Tebing Syahbandar</td>
<td>0.68</td>
</tr>
<tr>
<td>4</td>
<td>Bandar Khalifah</td>
<td>0.88</td>
</tr>
<tr>
<td>5</td>
<td>Tanjung Beringin</td>
<td>0.13</td>
</tr>
<tr>
<td>6</td>
<td>Sei Rampah</td>
<td>0.36</td>
</tr>
<tr>
<td>7</td>
<td>Sei Bamban</td>
<td>0.35</td>
</tr>
<tr>
<td>8</td>
<td>Teluk Mengkudu</td>
<td>0.27</td>
</tr>
<tr>
<td>9</td>
<td>Perbaungan</td>
<td>0.62</td>
</tr>
</tbody>
</table>

Source: results of primary data processing (2014)
Carrying capacity of crops by product as a source of feed

Table 3 shows that the carrying capacity of the by product of food crops in Serdang Bedagai can accommodate and provide fodder for cattle production needs based on the calculation needs of dry matter (DM) in the amount of 161 505 ST. The sub-district which has the highest value of the carrying capacity of 25 887 ST is Perbaungan sub-District.

Based on the amount of dry matter by product carrying capacity of 161 505 ST crops associated with cattle population as much as 47 325 ST, then in Serdang Bedagai still allows for the addition of cattle population or capacity increase cattle population as much potential 75161.76 ST. The value KPPTS that we can see in Table 3 shows that of the 17 districts in Serdang Bedagai, 14 districts have a positive value and 3 districts KPPTS is negative.

Table 3. The carrying capacity of crop by product as a source of feed and Capacity Improvement of Ruminant Livestock Population (KPPTTR) cattle in Serdang Bedagai

<table>
<thead>
<tr>
<th>Sub-District</th>
<th>Total DM of Crops By product (Ton/Year)</th>
<th>DDLTP (ST)</th>
<th>Real Population (ST)</th>
<th>KPPTS (ST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kotarih</td>
<td>3,652</td>
<td>1,601</td>
<td>226</td>
<td>1,375</td>
</tr>
<tr>
<td>Silinda</td>
<td>2,865</td>
<td>1,256</td>
<td>266</td>
<td>990</td>
</tr>
<tr>
<td>Bintang Bayu</td>
<td>1,199</td>
<td>526</td>
<td>1,666</td>
<td>-1,140</td>
</tr>
<tr>
<td>Dolok Masihul</td>
<td>17,874</td>
<td>7,835</td>
<td>6,555</td>
<td>1,280</td>
</tr>
<tr>
<td>Serbajadi</td>
<td>6,156</td>
<td>2,698</td>
<td>1,983</td>
<td>715</td>
</tr>
<tr>
<td>Sipispis</td>
<td>14,119</td>
<td>6,189</td>
<td>4,904</td>
<td>1,285</td>
</tr>
<tr>
<td>Dolok Merwan</td>
<td>761</td>
<td>333</td>
<td>4,366</td>
<td>-4,033</td>
</tr>
<tr>
<td>Tebing Tinggi</td>
<td>23,938</td>
<td>10,493</td>
<td>3,513</td>
<td>6,980</td>
</tr>
<tr>
<td>Tebing Syahbandar</td>
<td>3,212</td>
<td>1,408</td>
<td>1,734</td>
<td>-326</td>
</tr>
<tr>
<td>Bandar Khalifah</td>
<td>32,172</td>
<td>14,103</td>
<td>1,737</td>
<td>12,366</td>
</tr>
<tr>
<td>Tanjung Beringin</td>
<td>29,052</td>
<td>12,735</td>
<td>371</td>
<td>12,364</td>
</tr>
<tr>
<td>Sei Rampah</td>
<td>30,035</td>
<td>13,166</td>
<td>1,838</td>
<td>11,328</td>
</tr>
<tr>
<td>Sei Bamban</td>
<td>52,033</td>
<td>22,809</td>
<td>1,204</td>
<td>21,605</td>
</tr>
<tr>
<td>Teluk Mengkudu</td>
<td>27,198</td>
<td>11,922</td>
<td>898</td>
<td>11,024</td>
</tr>
<tr>
<td>Perbaungan</td>
<td>59,055</td>
<td>25,887</td>
<td>4,966</td>
<td>20,921</td>
</tr>
<tr>
<td>Pegajahan</td>
<td>27,303</td>
<td>11,969</td>
<td>4,315</td>
<td>7,654</td>
</tr>
<tr>
<td>Pantai Cermin</td>
<td>37,213</td>
<td>16,312</td>
<td>6,783</td>
<td>9,529</td>
</tr>
<tr>
<td>Total</td>
<td>368.432</td>
<td>161,505</td>
<td>47,325</td>
<td>114,180</td>
</tr>
</tbody>
</table>

Source: results of primary data processing (2014)

Region density of Livestock

Table 4 shows that the sub District of Pantai Cermin is the only region that has a density criteria are very dense region that has a value of livestock density> 50 ie 84.47. Region has a value of dense region density criteria namely Sub Dolok Masihul, Serbajadi, Sipispis, Dolok Merawan, Perbaungan and Pegajahan, because it has a density value of livestock 20 - 50. The region with the criteria moderate are sub district of Bintang Bayu, Tebing Tinggi, Tebing Syahbandar, Bandar Khalifah, Sei Bamban and Teluk Mengkudu. Region of sparse criteria are sub district of Kotarih, Silinda, Tanjung Beringin and Sei Rampah.
Table 4. Region Density of Beef Cattle in Serdang Bedagai

<table>
<thead>
<tr>
<th>Sub District</th>
<th>Beef Cattle Population (ST)</th>
<th>Regions (Km²)</th>
<th>Density of Beef Cattle Value</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kotarih</td>
<td>226</td>
<td>78.02</td>
<td>2.90</td>
<td>spare</td>
</tr>
<tr>
<td>Silinda</td>
<td>266</td>
<td>56.74</td>
<td>4.69</td>
<td>spare</td>
</tr>
<tr>
<td>Bintang Bayu</td>
<td>1,666</td>
<td>95.59</td>
<td>17.43</td>
<td>modest</td>
</tr>
<tr>
<td>Dolok Masihul</td>
<td>6,555</td>
<td>237.42</td>
<td>27.61</td>
<td>populous</td>
</tr>
<tr>
<td>Serbajadi</td>
<td>1,983</td>
<td>50.69</td>
<td>39.12</td>
<td>populous</td>
</tr>
<tr>
<td>Sipispis</td>
<td>4,904</td>
<td>145.26</td>
<td>33.76</td>
<td>populous</td>
</tr>
<tr>
<td>Dolok Merwan</td>
<td>4,366</td>
<td>120.60</td>
<td>36.20</td>
<td>populous</td>
</tr>
<tr>
<td>Tebing Tinggi</td>
<td>3,513</td>
<td>182.29</td>
<td>19.27</td>
<td>modest</td>
</tr>
<tr>
<td>Tebing Syahbandar</td>
<td>1,734</td>
<td>120.30</td>
<td>14.41</td>
<td>modest</td>
</tr>
<tr>
<td>Bandar Khalifah</td>
<td>1,737</td>
<td>116.00</td>
<td>14.97</td>
<td>modest</td>
</tr>
<tr>
<td>Tanjung Beringin</td>
<td>371</td>
<td>74.17</td>
<td>5.00</td>
<td>spare</td>
</tr>
<tr>
<td>Sei Rampah</td>
<td>1,838</td>
<td>198.90</td>
<td>9.24</td>
<td>spare</td>
</tr>
<tr>
<td>Sei Bamban</td>
<td>1,204</td>
<td>72.26</td>
<td>16.66</td>
<td>modest</td>
</tr>
<tr>
<td>Teluk Mengkudu</td>
<td>898</td>
<td>66.95</td>
<td>13.41</td>
<td>modest</td>
</tr>
<tr>
<td>Perbaungan</td>
<td>4,966</td>
<td>111.62</td>
<td>44.49</td>
<td>populous</td>
</tr>
<tr>
<td>Pegajahan</td>
<td>4,315</td>
<td>93.12</td>
<td>46.34</td>
<td>populous</td>
</tr>
<tr>
<td>Pantai Cermin</td>
<td>6,783</td>
<td>80.30</td>
<td>84.47</td>
<td>Very populous</td>
</tr>
<tr>
<td>Total</td>
<td>47,325</td>
<td>1,900.22</td>
<td>24.91</td>
<td>populous</td>
</tr>
</tbody>
</table>

Source: results of primary data processing (2014)

Region Development of beef cattle

Table 5 shows the regions of animal growth and development status in Serdang Bedagai, ie cattle development regions including Dissemination Region (WS) the sub District of Tebing Tinggi. Stabilization Region (WM) the Subdistrict Pantai Cermin, Dolok Masihul, Serbajadi, Sipispis and Pegajahan. Development Region (WP) namely Subdistrict Kotarih, Silinda, Bandar Khalifah, Tanjung Beringin, Sei Rampah, Sei Bamban and Teluk Mengkudu. The last is Supporting Region (WT) is Perbaungan sub District.

Table 5. Mapping of the development of beef cattle in Serdang Bedagai based LQ value, livestock region density and KPPTS of crops by product

<table>
<thead>
<tr>
<th>Sub District</th>
<th>KPPTS (ST)</th>
<th>LQ</th>
<th>Region Density</th>
<th>Status of Beef Cattle Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kotarih</td>
<td>1,375</td>
<td>0.36</td>
<td>spare</td>
<td>WP</td>
</tr>
<tr>
<td>Silinda</td>
<td>990</td>
<td>0.40</td>
<td>spare</td>
<td>WP</td>
</tr>
<tr>
<td>Bintang Bayu</td>
<td>-1,140</td>
<td>1.98</td>
<td>modest</td>
<td>-</td>
</tr>
<tr>
<td>Dolok Masihul</td>
<td>1,280</td>
<td>1.71</td>
<td>populous</td>
<td>WM</td>
</tr>
<tr>
<td>Serbajadi</td>
<td>715</td>
<td>1.27</td>
<td>populous</td>
<td>WM</td>
</tr>
<tr>
<td>Sipispis</td>
<td>1,285</td>
<td>1.95</td>
<td>populous</td>
<td>WM</td>
</tr>
<tr>
<td>Dolok Merawan</td>
<td>-4,033</td>
<td>3.22</td>
<td>populous</td>
<td>-</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Subdistrict</th>
<th>LQ</th>
<th>Density</th>
<th>KPPTS</th>
<th>Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tebing Tinggi</td>
<td>6,980</td>
<td>1.10</td>
<td>modest</td>
<td>WS</td>
</tr>
<tr>
<td>Tebing Syahbandar</td>
<td>-326</td>
<td>0.68</td>
<td>modest</td>
<td>-</td>
</tr>
<tr>
<td>Bandar Khalifah</td>
<td>12,366</td>
<td>0.88</td>
<td>modest</td>
<td>WP</td>
</tr>
<tr>
<td>Tanjung Beringin</td>
<td>12,364</td>
<td>0.13</td>
<td>spare</td>
<td>WP</td>
</tr>
<tr>
<td>Sei Rampah</td>
<td>11,328</td>
<td>0.36</td>
<td>spare</td>
<td>WP</td>
</tr>
<tr>
<td>Sei Bamban</td>
<td>21,605</td>
<td>0.35</td>
<td>modest</td>
<td>WP</td>
</tr>
<tr>
<td>Teluk Mengkudu</td>
<td>11,024</td>
<td>0.27</td>
<td>modest</td>
<td>WP</td>
</tr>
<tr>
<td>Perbaungan</td>
<td>20,921</td>
<td>0.62</td>
<td>populous</td>
<td>WT</td>
</tr>
<tr>
<td>Pegajahan</td>
<td>7,654</td>
<td>2.02</td>
<td>populous</td>
<td>WM</td>
</tr>
<tr>
<td>Pantai Cermin</td>
<td>9,529</td>
<td>1.99</td>
<td>very populous</td>
<td>WM</td>
</tr>
</tbody>
</table>

Source: primer data processing (2014)

Note:
WP: Development Region; WM: Stabilization Region; WS: Dissemination Region; WT: Supporting Region

To improve the farm, the first attempt was made in the development of beef cattle is increasing livestock population, so that selected regions of by product KPPTS value crops positive, because of the potential for an increase in livestock population and still have a supply of forage crops in the form of by product. This implies that the capacity increase ruminant livestock population that has a positive value means that the availability of food crop by product as feed for ruminants is sufficient and can be added a number of beef cattle population. From 17 subdistricts in Serdang Bedagai, as much as 14 districts have positive value of KPPTS crops by product and potentially as region development, while other 3 sub District 3 namely Bintang Bayu, Dolok Merawan and Tebing Syahbandar have KPPTS negative value. KPPTS negative value means an overpopulation of cattle in terms of the availability of agricultural by product as a source of food, so had to use sources other than by product feed crops to meet the needs of livestock such as planting grass or farm by product. This is in accordance with the opinion Matitaputti (2008) that the region in a state of negative KPPTS can utilize by product of food sources other than food crops to meet the needs of livestock in the region.

The region with the status of the development of beef cattle in Serdang Bedagai based on the regional potential Dissemination Region (WS) where LQ> 1, low livestock density regions and positive KPPTS is Tebing Tinggi sub District. This region meant that the region has been an region of beef cattle production with high levels of cattle population is relatively more in other districts appeal. This is in accordance with the opinion Hendayana (2003) which states that the LQ> 1 means that the region has a comparative advantage, where the population exceeds the needs of its region that can be sold or exported outside the region. In addition, the region still has the ability to increase the cattle population view of an region of great support to undertake the development of beef cattle, and the value of crop by product KPPTS positive indicates the amount of feed from by product food crops still available. Stabilization Region (WM) which is the value of LQ> 1, the high-density region and KPPTS livestock by product positive crops consisted of the sub District of Pantai Cermin, Dolok Masihul, Serbajadi, Sipispis and Pegajahan. When viewed from the value of LQ and its KPPTS then still support for the addition of the population, but the value of high-density livestock regions means that the productivity of cattle maintained, do not increase the population. This is in accordance with the opinion of Sumanto and Juarini (2004) that the consolidation region is the development of the districts that livestock can not be added.
Development of beef cattle business regions in Serdang Bedagai based on food crops by product carrying capacity can be done through zoning scenarios of beef cattle into several categories region, namely: 1) Dissemination Region (WS) is District Tebing Tinggi. 2) Consolidation Region (WM), sub District of Pantai Cermin, Dolok Masihul, Serbajadi, Sipispis and Pegajahan. 3) Regional development (WP) namely Subdistrict of Kotarih, Silinda, Bandar Khalifah, Tanjung Beringin, Sei Rampah, Sei Bamban and Teluk Mengkudu. and 4) Supporting Region (WT), is Perbaungan Sub district.

Expected for the formation of the business region of cattle, should be done in regions that have the potential aspects of location and the carrying capacity of livestock feed in the form of food crops by product.

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ABSTRACT: The objective of the study was to analyze farmers motivation including some motives that encouraged the farmers to raise dairy goats in the slope area of Merapi Volcano. Sixty dairy goat farmers at Turgo Sub-village were randomly selected as respondents. Data were collected by interviewing directly to the respondents using a good prepared questionnaire that was tested its validity and reliability. Descriptive analysis was used to describe the motives of the farmers. The results showed that there were a high level of motives including use of land motives (81.6%), economics motives (76.7%), and use of family labor motives (83.4%). But, most of the farmers (56.6%) were in medium level for safety motives.

Keywords: Dairy Goats Farmers, Motives, Merapi Volcano

INTRODUCTION

The slope area of Merapi mountain was the place where there were potentially developed for dairy farming. Most of farmers in this area kept their dairy cows as the main of their animal farming activities. But, on the other hand, the slope area of Merapi Mountain is also a hazard prone area caused of the activity of the Merapi volcano, especially when the eruption happened. The experience of the big eruption in 2010, the farmers got the high loss income, especially in dairy cow farming caused of the death cows and the decrease of milk production. In response to the effect of the eruption and to avoid the possibilities of higher loss in one of the main income source from dairy farming, some farmers have changed part or all of their commodities in dairy farm by rearing dairy goats. And the decision to change into dairy goats based on some considerations and particularly motives of the farmers to sustain their livelihood. This paper explained some motives which encouraged the farmers to keep dairy goat although they lived in the place, where was the disaster prone area of Merapi volcano.

MATERIALS AND METHODS

The research was a case study at Turgo Sub-village in the slope area of Merapi volcano. The respondents were 60 dairy goat farmers who were selected randomly. Data including safety, land use, economics, and family labor use motives were collected by interviewing using a good prepared questionnaire which had been tested its validity and reliability. The level of motive was measured using 5-point Likert Scales from strongly agree to strongly disagree. Descriptive quantitative was used to analyze the data.

RESULTS AND DISCUSSION

Most of farmers had high category levels for land use motives (81.6%), as well as family labor use (83.4%) and motives of economics (76.7%) in dairy goats farming (Table 1.). But, most of farmers (56.6%) were in the middle category level for safety motives.
Table 1. Percentage of farmers’ distribution based on motives categories levels

<table>
<thead>
<tr>
<th>Kinds of Motives</th>
<th>High</th>
<th>Middle</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Motives</td>
<td>40.0</td>
<td>56.6</td>
<td>3.4</td>
</tr>
<tr>
<td>Land Use Motives</td>
<td>81.6</td>
<td>15.0</td>
<td>3.4</td>
</tr>
<tr>
<td>Economics Motives</td>
<td>76.7</td>
<td>23.4</td>
<td>-</td>
</tr>
<tr>
<td>Family Labor Use Motives</td>
<td>83.4</td>
<td>16.6</td>
<td>-</td>
</tr>
</tbody>
</table>

Safety motive was not the strong reasons to encourage farmers to raise dairy goats at the slope area of Merapi volcano that was a disaster prone area. Table 2 showed that although most of farmers (>50%) were agree and even strongly agree with the items of safety motives, but some of farmers gave the uncertain response for some items. Some farmers (30%) were uncertain that dairy goats were easier to be evacuated than other big ruminants when the eruption happened, as well as the response that it could be relied on facing farming safety problems. Moreover, some farmers (26.7%) was disagree that the others ruminant were difficult to be evacuated comparing with dairy goats when disaster happened. The decision to evacuate livestock was in the hands of individual farmers and dependent on their financial means (Wilson, et al., 2012).

Table 2. Percentage distribution of the farmers’ response to the items of safety motives

<table>
<thead>
<tr>
<th>Items</th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>DA</th>
<th>SDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy goats are relatively easier to be evacuated than other big ruminants when disaster happened</td>
<td>8.3</td>
<td>46.7</td>
<td>30.0</td>
<td>15.0</td>
<td>-</td>
</tr>
<tr>
<td>The others ruminant except dairy goat is relatively difficult to be evacuated when disaster happened</td>
<td>5.0</td>
<td>50.0</td>
<td>16.7</td>
<td>26.7</td>
<td>1.7</td>
</tr>
<tr>
<td>By raising on dairy goat farming at the slope area of Merapi make me more comfortable than other dairy animals farming when the evacuation should be done</td>
<td>5.0</td>
<td>51.7</td>
<td>30.0</td>
<td>13.3</td>
<td>-</td>
</tr>
<tr>
<td>By rearing dairy goat, It could be relied on facing farming safety problems when the eruption happened</td>
<td>6.7</td>
<td>53.3</td>
<td>30.0</td>
<td>8.3</td>
<td>1.7</td>
</tr>
<tr>
<td>By rearing dairy goat, It is a long term purpose for my old age</td>
<td>11.7</td>
<td>58.3</td>
<td>18.3</td>
<td>11.7</td>
<td>-</td>
</tr>
<tr>
<td>By rearing of dairy goat. It could be a saving for my children education purpose</td>
<td>15.0</td>
<td>60.0</td>
<td>10</td>
<td>11.7</td>
<td>3.3</td>
</tr>
</tbody>
</table>


Table 3 showed that land use motives were a highly reason encouraging farmers to raise dairy goats at the slope area of Merapi volcano. Although the area was a hazard prone, but there was a pull factor, regarding the land, for farmers to live and to do some activities at this area. According Sagala, et al. (2012), while a disaster normally brings negative impacts, there are positive impacts from disaster that can be used for economic development such as livestock farming. Soil of the land fed by volcanic ash is highly fertile and become an arable land. This condition indicated that it was a potential as a source of animal feeding.
Table 3. Percentage distribution of the farmers’ response to the items of land use motives

<table>
<thead>
<tr>
<th>Items</th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>DA</th>
<th>SDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>I keep dairy goats for making use of my own land</td>
<td>25.0</td>
<td>65.0</td>
<td>3.3</td>
<td>6.7</td>
<td>-</td>
</tr>
<tr>
<td>I keep dairy goats because of I don’t want to let my land be unused</td>
<td>21.7</td>
<td>65.0</td>
<td>6.7</td>
<td>5.0</td>
<td>1.7</td>
</tr>
<tr>
<td>I become more enthusiasm in rearing dairy goats by using my land resources</td>
<td>21.7</td>
<td>68.3</td>
<td>8.3</td>
<td>1.7</td>
<td>-</td>
</tr>
<tr>
<td>I use my land resources to plant feeding crops for my dairy goats</td>
<td>26.7</td>
<td>51.7</td>
<td>13.3</td>
<td>8.3</td>
<td>-</td>
</tr>
<tr>
<td>Wider my land area, more chance to increase my scale of dairy goats</td>
<td>21.7</td>
<td>60.0</td>
<td>11.7</td>
<td>6.7</td>
<td>-</td>
</tr>
</tbody>
</table>


Table 4 indicated that most of farmers had a high economics motives in raising dairy goats. Nofrita and Krol (2014) found that economic value is higher than the risk and the people who lived at slope area of Merapi volcano focused on the most beneficial livelihood resource. Based on the experience from the big eruption in 2010, farmers had to lose their previous jobs as dairy cow owners since many cows dead. To maintain livestock farming, as one of the main family income generating source (Nofrita and Krol, 2014), the farmers tried to find an alternative dairy animals, that was dairy goats. And this decision also could be a form of risk management related to avoid high loss in dairy farming exertion.

Table 4. Percentage distribution of the farmers’ response to the items of economics motives

<table>
<thead>
<tr>
<th>Items</th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>DA</th>
<th>SDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>By rearing dairy goat, It will be an additional income generating for my family</td>
<td>31.7</td>
<td>58.3</td>
<td>6.7</td>
<td>3.3</td>
<td>-</td>
</tr>
<tr>
<td>By rearing dairy goat, It will increase my family welfare</td>
<td>25.0</td>
<td>53.3</td>
<td>16.7</td>
<td>5.0</td>
<td>-</td>
</tr>
<tr>
<td>By rearing dairy goat, It could be a saving purpose</td>
<td>13.3</td>
<td>53.3</td>
<td>21.7</td>
<td>11.7</td>
<td>-</td>
</tr>
<tr>
<td>By rearing dairy goat, It could earn the income every month</td>
<td>13.3</td>
<td>66.7</td>
<td>13.3</td>
<td>6.7</td>
<td>-</td>
</tr>
<tr>
<td>It needs small investment for carrying on dairy goat farming</td>
<td>11.7</td>
<td>61.7</td>
<td>23.3</td>
<td>3.3</td>
<td>-</td>
</tr>
<tr>
<td>By rearing dairy goat, It will be avoided from poverty</td>
<td>8.3</td>
<td>78.3</td>
<td>10.0</td>
<td>3.3</td>
<td>-</td>
</tr>
<tr>
<td>By rearing dairy goat is better than unemployed which could not give an income</td>
<td>40.0</td>
<td>56.7</td>
<td>1.7</td>
<td>1.7</td>
<td>-</td>
</tr>
<tr>
<td>The income earned from dairy goat farming could be use to meet my family needs</td>
<td>16.7</td>
<td>63.3</td>
<td>13.3</td>
<td>6.7</td>
<td>-</td>
</tr>
</tbody>
</table>


The use of family labor was the other high motive of farmers to raise dairy goats at the slope area of Merapi volcano. The size of family related to potency and availability of labor (Nofrita and Krol, 2014). Haryadi, et al. (2008) found that most of family labor time allocation in integrated farming was allocated to dairy goats farming exertion. Table 5 also indicated that some farmers (30%) responded uncertain to the item related the entrepreneurship by involving family members in dairy goat farming. It had just been needed in easing the work of farming activities as an effort for gaining a better life, and reducing cost.
Table 5. Percentage distribution of the farmers’ response to the items of family labor use

<table>
<thead>
<tr>
<th>Items</th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>DA</th>
<th>SDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>By rearing dairy goat, my family labor could be involved for</td>
<td>21.7</td>
<td>61.7</td>
<td>15.0</td>
<td>1.7</td>
<td>-</td>
</tr>
<tr>
<td>useful activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By using family labor, It could minimize the input cost in dairy</td>
<td>21.7</td>
<td>68.3</td>
<td>10.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>goat farming exertion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would be more enthusiasm when more of my family labors were used</td>
<td>26.7</td>
<td>65.0</td>
<td>8.3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>for carrying on dairy goat farming</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By using family labor for dairy goat farming, It means that my family</td>
<td>18.3</td>
<td>71.7</td>
<td>10.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>is responsible for my livelihood</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By using family labor for dairy goat farming, I could spend my</td>
<td>13.3</td>
<td>75.0</td>
<td>11.7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>quality time with my family</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The leisure time of my family labor is better to be used for dairy</td>
<td>18.3</td>
<td>63.4</td>
<td>13.3</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>goat farming</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By involving my family labor to dairy goat farming, I could teach</td>
<td>13.3</td>
<td>46.7</td>
<td>30.0</td>
<td>10.0</td>
<td>-</td>
</tr>
<tr>
<td>my family to be entrepreneurship</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By involving my family labor to dairy goat farming, I could transfer</td>
<td>15</td>
<td>73.3</td>
<td>11.7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>my knowledge relating with dairy goat exertion to my family members</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SA: Strongly Agree, A: Agree, U: Uncertain, DA: Disagree, SDA: Strongly Disagree

CONCLUSIONS

The farmers had the high category motives level of land use, economics, and family labor use in raising dairy goat at the slope area of Merapi volcano. But, it was a medium category level for safety motives. The highest motives for most farmers raising dairy goats at the slope area, the hazzard prone area, in Merapi volcano was family labor use, followed by land use and economis motives respectively.

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Enhancing Farmer’s Creativity in Dairy Goat Farming  
(A Case Study in Banyumas District)

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ABSTRACT: Dairy goat farming has played a vital role in maintaining economic and production dynamic of family in rural areas of Banyumas District. Financial capital, human capital and technology have supported growth of dairy goat farming. Creativity enables farmers to develop competitive advantage especially to provide the basis for innovation, productivity and business growth. A total of 50 dairy goat farmers were randomly selected from 5 villages of Gumelar Sub district of Banyumas. Data were collected using questionnaire and personal interviewing. Based on descriptive statistic, dairy goat farmers have low educational attainment (6.6 years). However, the farmers were categorized in productive age (59.4 years), they were involved longer in dairy farm (12.7 years) and farmers’ organization (6.3 years). The creativity of dairy farmers in Banyumas District was moderate (71.7). The data depicted that farmers have moderate capacity to generate more idea in solving the problem of their business. Based on Spearman rank Correlation Test, creativity of farmers was significantly related to age of farmers (P<0.01), educational attainment (P<0.01) and their experience in farmers’ organization (P<0.05). Improving education of farmers, knowledge of farmers, and their experience in organization would enhance creativity of dairy goat farmers.

Keywords: dairy goat, creativity, education, organizational experience

INTRODUCTION

Entrepreneurship development in rural areas is an alternative to strengthen the growth of rural economic. Dairy goat farming as a form of entrepreneurship needs to be maintained and developed towards better economic growth in rural areas. Increasing competitiveness of livestock commodity which having a superior specification will be able to boost the economy and welfare of the farmer’s family. Creativity and innovation as key principles of entrepreneurship should be encouraged to create a competitive business atmosphere. Briefly explained that the development of dairy goat farming based on the principles of entrepreneurship will be able to compete and secure the farming sustainability. Fadaee and Haitham (2014) stated that the concept of entrepreneurship is merged largely with concepts such as creativity and innovation. The relationship between creativity and entrepreneurship is so necessary and interdependent.

Dairy goats farming in the Gumelar Sub District grew rapidly started in 2008 and until 2014 had reached a population 4,565 heads goats of Etawah Cross (PE) and 507 farmers of Etawah Cross (PE). Dairy goat farming is intended for the main production of goat’s milk. The success in increasing the production of goat milk is strongly influenced by human resource capability in organizing their productive assets. The success of accessing information from various parties will be able to bring new thoughts and ideas to dairy goats farming. Ability to explore new ideas in the activities of goats farming can drive their business more efficient and competitive.

Business competition and the dynamic of socio-economic in society have rise problems for dairy goat farmers. Those problems could include technical problems of farm management, human
related to marketing. The existence of problems can encourage dairy goat farmers seeking solutions and new ideas to eliminate the impact of problems so that sustainability of dairy goat farming can be sustained efficiently. To survive in the dairy goat industry, farmers are required to respond creatively to the changes and problems that arise dynamically. Creativity will be able to encourage farmers more competitive, productive and dairy farm grows well.

Related to this, a study related to creativity dairy goat farmers in Banyumas has the purpose of identifying the creativity level of farmers and the important factors associated with the development of creativity of goat farmers in Gumelar Subdistrict, Banyumas.

MATERIALS AND METHODS

The study of farmers creativity in dairy goat farming has involved 50 respondents which were selected using random sampling method. Respondents were dairy goat farmers in 5 villages of Gumelar Subdistricts. Gumelar sub district as a center of dairy goat development was purposively chosen as area sample, while 5 villages were selected randomly.

The primary data was collected directly from respondents through observation and interview using questionnaire. Observed variables were independent variables, includes: age, level of education, farming experience, and dependent variables, namely: the degree of farmers’ creativity. Descriptive statistics were used to describe the degree of creativity of dairy goat farmers. Spearman rank correlation test was used to identify and analyze the factors associated with the enhancing of the creativity of farmers.

RESULTS AND DISCUSSIONS

Profile of Respondents

Gumelar Subdistrict has been identified as the center of PE (etawah cross) development area in Banyumas since year 2007. The region is suitable for the development of dairy goats farming as mentioned by Hendri and Wahizi (2009) that the area with average of rainfall reaches 1,408 mm / year, daily air temperature range between 18-24°C and humidity of 80% was potential for the development of dairy goats farming. There are 1,597 people involved in a dairy goats farming with population of dairy goats was 4,203 heads.

Majority of respondents (dairy goat farmers) in the Gumelar Sub District were categorized in productive age (18-55 years old). It can be also stated that the average age of dairy goat farmers was 49.4 years. Mc Evoy et al. (1989) mentioned that productive age has a positive role in improving the performance of the work. Increased the age of human at group of productive age can improve job performance, which in turn can provide more output. Hasnain (2014) stated that the productive age has the ability to absorb more knowledge than younger and older age.

Educational attainment of dairy goat farmers was categorized low and indicated by average length of study was just 6.6 years. This illustrates that the average dairy goats’ farmers have only passed from basic education (primary school). The relatively low education may inhibit the absorption of knowledge. Caloghirou et al. (2004) stated that individual skills refer to the level of education and training of the workforce, and the experience acquired in a given field of knowledge over time. However, dairy goat farmers in Gumelar subdistrict, Banyumas has sufficient experience to keep the dairy goat farming at the average of 12.7 years. Experience can provide adequate supplies for farmers to improve their farming culture. Smith (2001) stated that more training and farming experience can translate knowledge into a production of output more effectively. Development of dairy goat farmers was supported by the existence of the farmers group. The farmer has been involved in the group for average of 6.3 years with a range of 4-8
years. Involvement in group of farmers can encourage farmers to interact socially and gained a lot of knowledge and experience. Hotho et al. (2012) illustrated that social interaction is a prerequisite for the subsidiary absorptive capacity as it enables employees to participate in the transformation of new knowledge to the local context and the development of local applications.

**Role of Different Variables to Enhance Creativity**

Entrepreneurship is crucial values in the development and sustainability of dairy goat farming in Gumelar subdistrict, Banyumas. Sustainability of farming must be supported by having entrepreneurial spirit and creativity value of each farmer. Bilton (2007) stated that creativity provides the basis for innovation and business growth which can result in a competitive advantage for the organization. Creativity is the ability of farmers to find a new idea or combine new ideas with existing ideas to solve problems. Performance of farmers in creating new ideas, looking for new experiences and frequently to put questions to other farmers when problems occur would help them to develop their farming and increase the production of dairy goats. West (2002) mentioned that creativity is more on idea generation.

There are 3 major components to evaluate creativity of dairy goat farmers, namely (1) originality in thinking (2) happy to ask questions (3) always want to look for new experiences. Based on these components that are translated in the questionnaire, it appears that the dairy goat farmers in the Gumelar Sub district have moderate level of creativity with a score of 71.7. The context of score shows that dairy goat farmers tend to active enough in asking for something in particular efforts to resolve the problem on its dairy farming, seeking new experiences, especially thinking in formulating the feed to increase milk production. High value of investment in the dairy goat farming requires farmers to be careful and always think creatively for their business development. Farmers have always thought to sustain their high investment is embedded in the business dairy goats. Eddy (2009) stated that people who are creative and innovative are able to develop and maintain their business.

Increasing levels of farmers’ creativity would bring more new ideas in solving problems related to the issue of good dairy goat management such as the issue of feed, reproduction and processing. Personal characteristics of farmers and environmental conditions can contribute to strengthening the level of creativity of dairy goat farmers. Enhancing the individual creative performance is a step when organizations are necessary to achieve competitive advantage (Oldham and Cummings, 1996). Zhou and George (2001) stated that individual characteristics can affect a person’s creativity. Based on the Spearman rank correlation analysis demonstrated that the creativity of farmers was significantly related to age of farmers (P <0.01), educational attainment (P <0.01) and their experience in farmers’ organizations (P <0.05). The higher the education that is owned by farmers can significantly increase the level of creativity of farmers. Soekartawi (2008) states that a low education level is generally less enjoys new things so that the mental attitude to increase knowledge less.

Farming experience possessed by dairy goat farmers is an important factor in strengthening the creativity of farmers. The ability of farmers in understanding farm flow and character of their farm would be an important value in finding ways and means to solve problems. Longer experience possessed by farmers would be able to raise the competence and confidence of farmers to develop new ideas in the face of business barriers. King and Gurland (2007) stated that the experience in conducting activities may make someone more competent and can then perform with more ideas to solve problems. Instead of age have a negative relationship with creativity. It means getting old of dairy goat farmers would tend to be stagnant for business challenges, will not be effective and flexible in exploring new ideas to face the challenges of the dairy goat industry. Carmen *et
al (2008) stated that that age have a significant negative relationship with creativity in conditions which creative support was low.

CONCLUSIONS

Based on the above it can be concluded that the dairy goat farmers in the Gumelar sub district have sufficient creativity level as an important factor in maintaining their business. Age, education and experience in groups of farmers are important factors to increase the level of creativity. Creativity of dairy goat farmers can be increased through increased knowledge of farmers and strengthening the intensity groups’ interaction. Improving education of farmers and their experience in farmers group would enhance creativity of dairy goat farmers.

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Utilization of Communication Media in the Process of Extension to Develop Farm Business at Minahasa District North Sulawesi Province

Anneke K. Rintjap, Jolanda K.J. Kalangi, Maasye T. Massie

ABSTRACT: Government’s target to provide animal protein needs of Indonesian society consumptin is a driving force in improving farm business. One factor that must be considered to improve the farm business is the availability of adequate information. Lack of communication and dissemination of adequate information would impede the achievement of sustainable business. In the field of animal husbandry, the dissemination of information is done through extension by using the media as a communication tool, are very helpful for breeders in acquiring innovations and solutions to improve system maintenance thus increasing the welfare of farmers. Communication extention is an activities of extension in which the counseling process requires expertise and communication skills of an instructor in conveying information. At Minahasa, each instructor handle 3-4 villages with very minimal competence. These limitations can be overcome by using communication media that help spread information wider to reach farmers. The purpose of this research is to describes the communication media used by instructor in providing information to farmers. The aim of this study describes the use of media of communication by extension agents in providing information to breeders. The media of communication used are electronic media (radio and TV) and printed media (Newspapers and brochures), these medias are the variables analyzed descriptively with presentation model. The study’s result indicated that electronic media (TV and radio) was the most effective media used as source of information.

Keyword: Media, Communication, Counseling, Farm Business

INTRODUCTION

The government of the Republic of Indonesian is building the agricultural sector and one of its programs is to achieve food sovereignty including animal food (meat) in order to fulfill the needs of animal protein for Indonesian communities. This becomes a driving factor in increasing competitiveness in the field of cattle breeding. In order to increase the above-mentioned competitiveness, the quality Human Resources (HR) and the technology of cattle breeding is a dominant factor to be paid attention to. The Information Technology (IT) about cattle breeding will be useful if applied well by all stakeholders.

The venture of cattle breeding in Minahasa Regency is generally dominated by local people’s small-scale cattle breeding and is run traditionally. The kinds of livestock dominantly raised by them are cows, pigs and poultry. The livestock’s population in Minahasa Regency can be seen on Table 1.
Table 1. Kinds of Livestock in Minahasa Regency

<table>
<thead>
<tr>
<th>No.</th>
<th>Kinds of Livestock</th>
<th>Population (head)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cows</td>
<td>20,559</td>
</tr>
<tr>
<td>2</td>
<td>Pigs</td>
<td>113,757</td>
</tr>
<tr>
<td>3</td>
<td>Chicken</td>
<td>6,999,990</td>
</tr>
<tr>
<td>4</td>
<td>Laying Pullet</td>
<td>260,020</td>
</tr>
<tr>
<td>5</td>
<td>Broiler</td>
<td>318,800</td>
</tr>
<tr>
<td>6</td>
<td>Quails</td>
<td>80,975</td>
</tr>
<tr>
<td>7</td>
<td>Goats</td>
<td>2,682</td>
</tr>
<tr>
<td>8</td>
<td>Rabbits</td>
<td>1,450</td>
</tr>
</tbody>
</table>

Sources: Agriculture, Livestock and Plantation Service (2014)

The development of the venture of cattle breeding in Minahasa Regency needs close cooperation between the government and other parties, for instance, private corporations. One of the factors that has to be paid attention is to increase the venture of cattle breeding is the availability of adequate information. The participation of breeders in various activities of developing the business of cattle breeding is influenced by many factors, among others, the availability of adequate information (Sucihati Ningsih, 2010). The lack of communication and the information which is not adequately spread will hamper the reaching of sustainable cattle breeding. The extention’s communication is participation and exchange of experiences.

An extention agent is the one who explains who? Says what? In what channel to whom? With what effect? (Lasswell, 1964). In the field of cattle breeding, the spread of information which is done through extention programs by using media as the means of communication is very helpful to breeders in obtaining information about innovation and solution to improve their breeding system so as to increase breeders’ prosperity (well-being). The communication of extention is an activity where in the process of giving extention, an agent (penyuluh) needs expertise and communication skills in delivering information (Subedi, 1996 and Sulaiman, 2006). In this connection, the government through relevant services or agencies are carrying out the program of developing the venture of cattle breeding through intensive and continuous guidance in the form of accompanying by an extention agent.

In Minahasa Regency, an extention agent who only has a minimum competence is expected to handle 3 – 4 villages. This limitation can be bridged by using media of communication to help spread information in order to be able to reach broader groups of breeders. The aim of this study is to describe various media of communication used by extention agents in giving information to breeders through electronic media (TV and radio) and printed media (newspapers and brochures). The variables are analyzed descriptively by using presentation model.

**MATERIAL AND METHODS**

This study was conducted in Minahasa Regency, North Sulawesi Province, by using survey method (Singarimbun and Effendi, 1995). The location of the study was taken by purposive sampling method with the consideration that there were certain groups of breeders who had got the government’s aid and accompanying from the Food Resilience Agency (Badan Ketahanan Pangan) of Minahasa Regency.

The respondents in this study were the breeders who joined (members) in the Food Resilience Agency of Minahasa Regency and were taken by total sampling method and numbering 63.
respondents which were distributed in three groups. They are the groups who refer themselves as kelompok afinitas Tondegesan numbering 23 respondents, kelompok afinitas Suluan numbering 16 respondents and kelompok afinitas Pinasungkulan numbering 19 respondents. The respective group was accompanied by an agent. The data were analyzed descriptively with the percentage of each variable. The variables analyzed covering electronic media (TV and radio) and printed media (newspapers and brochures).

RESULTS AND DISCUSSION

A professional extention agent whether he/she is from governmental agency or from private corporation should apply effective approach communication and is capable of comprehending fully the materials of communication and also able to apply the means of communication used.

Rintjap et al (2013) says that feedback is the response to message delivered by the giver through media used. The results of Abdullah’s research (2012) about the role of extention and breeders’ groups to inhance the adoption of technology of beef cattle breeding indicates that extention is an important role in developing cattle breeding, especially in strengthening farmers’ groups and the inhancement of the process of technology adoption by the breeders.

The results of study by Yosi Arie Shandi (2010) and Rintjap (2015) that the receiving of information is largely affected the groups members’ needs. The results of study by Oto Jacob and Shimayohol Dandu (2011) towards farmers in Nigeria stated that interpersonal channel of communication used to deliver messages had an effect to the rise of farmers’ income in villages.

The variables analyzed descriptively with presentation model was printed media (newspapers and brochures) and electronic media (TV and radio).

The average answers of respondents are categorized by making interval scores calculated from the highest score which is subtracted from the lowest score divided by five, obtained interval for category as much as 0.08, thus the respondents’ categorized answers are determined based on scores as on Table 2.

Table 2. Determination of Category of Score Based on Respondents’ Categorized Answers.

<table>
<thead>
<tr>
<th>No.</th>
<th>Scale of Categorized Answers</th>
<th>Category of Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.00 – 1.80</td>
<td>Very Poor</td>
</tr>
<tr>
<td>2</td>
<td>1.81 – 2.60</td>
<td>Poor</td>
</tr>
<tr>
<td>3</td>
<td>2.61 – 3.40</td>
<td>Fair</td>
</tr>
<tr>
<td>4</td>
<td>3.41 – 4.20</td>
<td>Good</td>
</tr>
<tr>
<td>5</td>
<td>4.21 – 5.00</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

Source : Sugiyono, 2008

Description of variables examined are presented in the form of frequency and percentage of respondents’ answers is presented on Table 3.
Table 3. Variables of Electronic Media and Printed Media.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Percentage of Respondents’ Answers</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>%</td>
</tr>
<tr>
<td>Electronic Media</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Printed Media</td>
<td>0</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Source: Processed Data

Table 3 indicates 34 respondents (57.968%) agree to use electronic means in receiving messages delivered. The average score shows that grade 3.50 is located on good criterion (based on Sugiyono’s criteria, 2008) which is presented on Table 2. It means electronic media used by extention agents in providing or delivering messages was considered good by breeders. For printed media, as many as 33 persons (50.789%) respondents answered that they agreed to use printed media in receiving messages delivered. The average score shows that grade 3.39 lies on medium criterion (based on Sugiyono’s Criteria, 2008) which is presented on Table 2. It means the electronic media used by extention agents is considered good by the breeders. From printed media as many as 33 persons (50.769%) respondents answered that they agreed using printed media in receiving messages delivered. The average score shows that grade 3.39 lies on medium criterion (based on Sugiyono’s criteria, 2008) which is presented on Table 2. It means printed media used by extention agents is considered good by breeders.

Electronic media and printed media used by extention agents showed that electronic media has higher value than printed media. And this is a fact that makes agents prefer using electronic media, such as TV and radio than printed media, such as newspapers and brochures. The study’s results by Pete Verget III et al (2005) showed that beef cattle breeders in Florida, USA, received messages sent by extention agents through channel of leaflets and radios. Kakansing (2009) stated that farmers basically are doing activities to fulfill their needs, and messages which are considered unsuitable with their needs will not be responded by farmers. Message contents in the form of information which is presented in the form of image, sound and text are easily understood by communicators (Rintjap, 2014). The study’s results indicated that the most effective media used as sources of information is electronic media, such as TV and radio. Extention agents directly deliver messages containing information regarding methods of breeding suited to breeders’ needs and to the species of livestock raised.

REFERENCE


The Influence of Dairy Farming Motivation on Dairy Cows Productivity in Different Disaster Prone Areas of Merapi Volcano

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ABSTRACT: This study aimed to analyze: 1) Dairy farmers motivation in disaster-prone areas (DPA) II and DPA III of Merapi volcano, and 2) The influence of dairy farmers motivation on dairy cows productivity. The research was conducted using household survey with interviews involving respondents were selected. The location determined by purposive sampling study, which was located in DPA II and DPA III of Merapi volcano. Samples or materials research was determined by Purposive Sampling method. Dairy farmers in disaster-prone areas chosen with the following criteria: 1) maintain dairy cows at least one year, and 2) as the member of farmer group’s cage. The respondent took by using the Census for farmers who have the criteria. Assessment of dairy farming motivation was based on criteria according to the Likert scale. In order to determine the influence of dairy farming motivation on the productivity of dairy cows made by Regression. The average value of dairy farming motivation was high for both areas of research in DPA III of 110.19 while in DPA II amounted to 106.05. Farmer motivation in the DPA III was higher if compared with the farmer in DPA II. There were very little influence of dairy farming motivation on the productivity of dairy cows, even in terms of milk production (0.07), services per conception (0.05) and calving interval (0.002).

Keywords: Motivation, Dairy farming, Productivity of dairy cows, Merapi disaster-prone areas

INTRODUCTION

Dairy farm is one of the main businesses in the livestock sub-sector which has a prospective opportunities. The development of the dairy farm providing a positive impact on job creation in rural and promising cash income, so it can motivate farmers to take an active role in agribusiness activities in order to improve the income and quality of family nutrition. Dairy farm in Yogyakarta is mostly done on the slopes of Merapi. Merapi slope according to BNPB (2010) is divided into three disaster-prone areas (DPA), namely DPA I, DPA II and DPA III. DPA III is the area that closest from the peak of Merapi volcano. Most of the dairy farm on the slopes of Merapi, which is located in the Sleman regency cultivated by small farmers.

Dairy farmer income generated from the sales of milk production and calves. To get a high milk production and calf every year, it’s necessary to have a high quality of dairy cows and good management. Good management in livestock is one of the key of the productivity to be optimal. Farmers in maintaining dairy cows in their daily life may possible because of the motivation from themselves. The importance of the farmers motivation in raising dairy farm needs to be studied more in depth, and analyzed the effect of farmers motivation to the productivity of dairy cattle that reflected not only milk production but also on reproductive performance in the form of services per conception (S/C) and calving interval (CI). Dairy cow productivity greatly impact to the economic income of the farmer. This study was inspired by Nasrudin research (2011) which states that there is a relationship between farmers motivation with income of farmers.
MATERIALS AND METHODS

The research was conducted using household survey with interviews involving respondents were selected. The location determined by purposive sampling study, which was located in DPA II and DPA III of Merapi volcano. Samples or materials research was determined by Purposive Sampling method. Dairy farmers in disaster-prone areas chosen with the following criteria: 1) maintain dairy cows at least one year, and 2) as the member of farmer group’s cage. The respondent took by using the Census to farmers who have the criteria. Overall the number of respondents are 60 farmers, consisting of 40 farmers from DPA III and 20 farmers from DPA II. Assessment of dairy farming motivation was based on criteria according to the Likert scale. In order to determine the influence of dairy farming motivation on the productivity of dairy cows made by Regression.

RESULTS AND DISCUSSION

The average value of a dairy farmers motivation in DPA III amounted to 110.19 while in DPA II amounted to 106.05. Motivation of dairy farmers in DPA III is higher than the motivation of farmers in DPA II. This is because of farmers in the DPA III more experienced (8.73 years) if compared with farmers in the DPA II (2.95 years). Farmer’s active participation in the group can increase their knowledge and motivation in this business. This is due, farmers can exchange information with others and receive information from extension workers, and they also get support/ease of access to services in infrastructure and in product sales.

Dairy cows productivity can be observed in three important aspects, including milk production, service per conception (S/C) and calving interval (CI) (Table 1). Milk production and the value of the S/C in DPA III is better than DPA II, however, the value of CI in DPA III longer if compared with CI in DPA II.

Table 1. The productivity of dairy cows

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Region</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The average milk production per dairy cows (liters / day)</td>
<td>DPA III</td>
<td>10.25</td>
<td>11.43</td>
</tr>
<tr>
<td>Services per conception (frequency)</td>
<td>DPA II</td>
<td>1.89</td>
<td>1.92</td>
</tr>
<tr>
<td>Calving interval (months)</td>
<td></td>
<td>12.48</td>
<td>11.47</td>
</tr>
</tbody>
</table>

Source: Primary data analyzed (2014)

The average value of milk production at both sites is higher than the average productivity of milk in Sleman regency before the Merapi eruption of 2010 according to Assessment Institute of Agricultural Technology (2012); 10 liters/head/day and after the eruption of 9.15 liters/head/day. The value of the milk production according to Ilham & Priyanti (2011) in the members of the cooperative on the slopes of Merapi, which is between 9-15 liters/head/day. The value of services per conception at both sites of study, included in the normal category. According Toelihere (1993) in the Indonesia Directorate General of Livestock and Animal Health, Directorate of Livestock Breeding (2012), the ranges value of the S/C normally between 1.6- 2.0. Thus, according Vandeplassche (1982), the low value of the S/C is very important in the economic sense, both in natural insemination or artificial insemination (IB). The value of S/C exceeding 2.0 is considered unfavorable because it demonstrates reproduction inefficient and would be detrimental economically. Value of calving interval is better than the research Pramono et al., (2008) in 62.
groups of farmers who are members of three dairy cooperatives that are UPP Kaliurang, Sarono Makmur and Warga Mulya in Yogyakarta that shows the value of CI average $434.77 \pm 59.20$ days. Calving Interval value of dairy cows in DPA II approached the optimum for CI cows according Vandeplassche (1982), i.e 12 months.

The amount of influence of the dairy farmers motivation to the milk production can be observed in Table 2. The correlation coefficient (R) of 0.264 and R Square of 0.07. The value of the effect of motivation on milk production is very small, which is only 0.07.

**Table 2. Model Summary**

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.264a</td>
<td>0.70</td>
<td>0.053</td>
<td>3.44991</td>
</tr>
<tr>
<td>a. Predictors: (Constant), motivation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The amount of influence of dairy farmers’ motivation to services per conception can be observed in Table 3. The value of correlation coefficient (R) of 0.223 and R Square of 0.05. The value of the effect of motivation on the S/C is very small, which is only 0.05.

**Table 3. Model Summary**

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.223a</td>
<td>0.050</td>
<td>0.033</td>
<td>1.16840</td>
</tr>
<tr>
<td>a. Predictors: (Constant), motivation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The amount of influence of dairy farmers motivation to calving interval can be observed in Table 4. The correlation coefficient (R) of 0.041 and R Square of 0.002. The value of the effect of motivation on calving interval is very small, which is only 0.002.

**Table 4. Model Summary**

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.041a</td>
<td>0.002</td>
<td>-0.016</td>
<td>5.23548</td>
</tr>
<tr>
<td>a. Predictors: (Constant), motivation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Results of the three regression analysis proved that the influence of dairy farmers motivation to dairy cow productivity is very small, include in terms of aspects of milk production, services per conception and calving interval. The productivity of dairy cow is influenced by factors of the livestock management, especially the availability of feed and balanced according to the needs of livestock, the quality of the parent, the quality of semen and artificial insemination experts.

Management of the dairy farm is the actualization of farmer’s attitudes toward business. Attitude according to conception “Tripartite model” of Rosenberg and Hovland (1960 in Ajzen, 1988), expressed as a construct cognitive responses (response of perceptual and statement that they believed), the response affection (response of neural sympathetic and statement of affection) and response behavior (response of regarding actions and statements regarding the behavior). Dairy farm business by the farmers does not involve cognitive and affective, including motivation. Behavioral aspects (maintenance) which is a habit, livestock and equipment of livestock production
greater influence on the productivity of dairy cow.

**IMPLICATIONS**

The average value of dairy farming motivation was high for both areas of research in DPA III of 110.19 while in DPA II amounted to 106.05. Farmer’s motivation in the DPA III was higher than in DPA II. There were very little influence of dairy farming motivation on the productivity of dairy cows, even in terms of aspects of milk production (0.07), services per conception (0.05) and calving interval (0.002).

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Potential and Opportunities of Livestock Development in 24 Locations PSDSK Assistance of BPTP Support For Food Security

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ABSTRACT: Assistance is one important aspect in the success of the strategic program of the Ministry of Agriculture. BPTP active role as a source of appropriate technology is indispensable in assisting efforts to increase cattle business development and success of government programs to improve livestock productivity. PSDSK assistance, an activity organized by the Ministry of Agriculture for FY 2014 is implemented by 24 BPTP scope Center for Agricultural Technology Assessment and Development. The location for PSDSK mentoring set after coordinating with related agencies. Performance of accompaniment by the Ministry of Agriculture has generally been able to increase daily weight gain (Average Daily Gain/ADG), an average of 0.341 kg/head/day at group level before assistance becomes 0.669 kg/head/day after the assistance. An increase in the average weight cut after mentoring reaches 20% of the average before the assistance (of 252 kg/head into 341 kg/head). BPTP which produces innovations tend to reach higher achievement than that innovation BPTP has been adopted, except for reproductive innovations, the percentage is almost the same among the innovations produced and adopted (60%). PSDSK Assistance by the Ministry of Agriculture in 2010 through 2014 has developed very dynamically. Location determination requires coordination of technical assistance at the local level along with related agencies, and should chance to be a show window for the development of the region.

Keywords: Potential opportunity, PSDSK, Food security

INTRODUCTION

The goal of PSDSK-2014 is to increase the population and reduce the number of imported cattle ready for slaughter, Assessments Institute for Agricultural Technology (Balai Pengkajian Teknologi Pertanian (BPTP)) carry PSDSK assistance since 2010. PSDSK-2014 assistance is carried out by 24 BPTP. Institute for Agricultural Technology (BPTP) is a technical implementation unit (UPT) Government Center c / q. Ministry of Agriculture in the area must have a functional obligation to be actively involved in the success of PSDK 2014 in Indonesia. This paper aims to reveal PSDSK development assistance activities, especially the technical aspects and production.

MATERIALS AND METHODS

This research was conducted by utilizing the primary data and secondary data. Primary data came from interviews with the help of a questionnaire on various stakeholders, namely farmers and person in charge of PSDSK assistance in BPTP. Secondary data were obtained from the various documents on the relevant institutions at central and local level assessments location. Data were collected from 2010 to 2014 analyzed descriptively, and to some variables do simple statistical processing. The data used in this study include the growing amount of location assistance, as well as technical parameters and other related parameters, such as Average Daily Gain (ADG), slaughter weight, and so on.
RESULTS AND DISCUSSION

Aspects of Mentoring

Mentoring is holistic, synergistic, coordinated, focused and measurable is expected by all parties to accelerate the achievement of the targets. BPTP active role as a source of appropriate technology is indispensable in assisting efforts to increase cattle business development and success of government programs to improve livestock productivity.

PSDK assistance activities by the Ministry of Agriculture implemented by 24 BPTP scope Center for Technology Assessment and Development of Agriculture. The Ministry of Agriculture is conducting PSDK assistance as is follows (Table 1).

Table 1. PSDK 2014 Assistance

<table>
<thead>
<tr>
<th>No</th>
<th>UNIT</th>
<th>No</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>WEST JAVA</td>
<td>13</td>
<td>CENTRAL KALIMANTAN</td>
</tr>
<tr>
<td>2</td>
<td>CENTRAL JAVA</td>
<td>14</td>
<td>SOUTH KALIMANTAN</td>
</tr>
<tr>
<td>3</td>
<td>YOGYAKARTA</td>
<td>15</td>
<td>EAST KALIMANTAN</td>
</tr>
<tr>
<td>4</td>
<td>EAST JAVA</td>
<td>16</td>
<td>NORTH SULAWESI</td>
</tr>
<tr>
<td>5</td>
<td>ACEH</td>
<td>17</td>
<td>CENTRAL SULAWESI</td>
</tr>
<tr>
<td>6</td>
<td>NORTH SUMATRA</td>
<td>18</td>
<td>SOUTH SULAWESI</td>
</tr>
<tr>
<td>7</td>
<td>WEST SUMATRA</td>
<td>19</td>
<td>BALI</td>
</tr>
<tr>
<td>8</td>
<td>RIAU</td>
<td>20</td>
<td>WEST NUSA TENGGARA</td>
</tr>
<tr>
<td>9</td>
<td>JAMBI</td>
<td>21</td>
<td>EAST NUSA TENGGARA</td>
</tr>
<tr>
<td>10</td>
<td>SOUTH SUMATRA</td>
<td>22</td>
<td>BENGKUL</td>
</tr>
<tr>
<td>11</td>
<td>LAMPUNG</td>
<td>23</td>
<td>BANTEN</td>
</tr>
<tr>
<td>12</td>
<td>WEST KALIMANTAN</td>
<td>24</td>
<td>GORONTALO</td>
</tr>
</tbody>
</table>

BPTP technology assistance by supporting self-sufficiency in beef is done through a regional approach in the biophysical, socio-economic, cultural and institutional. Therefore, before starting assistance activities need to be identified first a few things about the rough terrain that includes elevation, rainfall, temperature, humidity, and so on. This was done to provide an overview of potential problems and potential areas of assistance that will be planned location. Identification of socio-economic conducted to determine the performance of socio-economic community that can be used as the basis for mentoring methods. While the socio-cultural and institutional identification includes procedures for social institutions, institutional breeders, and institutional supporters.

PSDK assistance strategy includes: 1) Identify all programs support PSDK across the province; 2) Mapping program: provincial - district - the District - Village; 3) Determination of the location of assistance; 4) Implementation of assistance include the application of appropriate technology and institutional engineering.

Aspects of Technology and Production Achievement

Performance of accompaniment by the Ministry of Agriculture has generally been able to increase daily weight gain (Average Daily Gain/ADG) shown in Figure 3, which is an average of 0.341 kg/head/day at group level before assistance becomes 0.669 kg/head/day after the assistance. However, this achievement is not maximized to equal potential ideally (0.868 kg/head/day). It also
depends on the maintenance of old cattle as mentioned by Siregar (2003) that the lower ADG directly result in increased long maintenance of cattle to reach the ideal weight cut.

![Figure 3. Average achievement ADG before and after assistance (kg/head/day)](image)

An increase in the average weight cut after mentoring reach 20% of the average before the assistance (of 252 kg/head into 341 kg/head). Efforts are still needed in the repair of non-genetic factors, namely aquaculture feed technology and management to achieve the ideal slaughter weight, as stated by Diwyanto and Rusastra (2013).

![Figure 4. Average weight cut before and after assistance (kg/head)](image)

PSDSK mentoring by an average BPTP able to achieve an increase in slaughter weight range 25-150 kg/head. Target launched by the Director General of Animal Husbandry and Animal Health (2009) to achieve self-sufficiency in meat in 2014 for fattening the target body weight daily (PBBH) for cattle Peranakan Ongole (PO) of more than 0.7 kg/day and beef cattle crossbreeding with larger subtropical 0.9 kg/day with the weight cut to local and cross cows with sub tropical each more than 400 kg and 500 kg. With the assistance PSDSK able to increase ADG 0.669kg/day and nearly meet the targets of the Directorate General of Livestock and Animal Health, but to slaughter weight has not been able to meet the target.
If the comparison between the resulting innovation and innovation is adopted, Figure 5 shows that the Ministry of Agriculture which produces innovations tend to be much more than that innovation BPTP has been adopted, except for reproductive innovations that percentage is almost the same among the innovations produced and adopted (60%). This means that they need to attempt to emphasize the introduction of innovations that address the problems of farmers or innovation in accordance with the expectations of farmers. This innovation should especially easy in application, low cost and able to provide better results than the practice that has been done breeder.

Innovation reproduction have equal percentage caused by natural mating or AI technology that is already generally known and practiced breeders, so the introduction of these innovations do not face their own obstacles. Rate of adoption of institutional innovation looks bigger than marketing innovation, it is supported by the presence of organized trainings BPTP (as much as 96% BPTP), as well the role of the Ministry of Agriculture in the mentoring group intensive livestock during the program.

Figure 5 also shows the adoption of a fairly high percentage of feed innovation and innovation composting. Both of these innovations carry the spirit of the utilization of local resources as cheap feed ingredients that are always available. Local resources are much cheaper than imported technology. According Mariyono and Krishna (2009) the technology developed by BPTP is better suited for applications at the field level as compared with the general nature of technology, because of technology BPTP specific location or appropriate technology.

**CONCLUSIONS**

Assistance PSDSK by the Ministry of Agriculture in 2010 through 2014 is able to increase the productivity of cattle that ADG and cow slaughter weight compared to prior guidance PSDSK. Performance of accompaniment by the Ministry of Agriculture has generally been able to increase daily weight gain (Average Daily Gain/ADG), ie an average of 0.341 kg/head/day at group level before assistance becomes 0.669 kg/head/day after the assistance. An increase in the average weight cut after mentoring reach 20% of the average before the assistance (of 252 kg/head into 341 kg/head). BPTP which produces innovations tend to be much more than that innovation BPTP has been adopted, except for reproductive innovations that percentage is almost the same among the innovations produced and adopted (60%). Although it has not yet been possible to meet the target of the Directorate General of livestock and animal health.
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Livestock Farmers’ Characteristics of Bali Cattle Fattening in West Timor (Case Study on Farmers Group Nekmese, Usapinonot, North Central Timor, East Nusa Tenggara)

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ABSTRACT: The research aims was to study the farmers’ characteristics of Bali cattle fattening at the farm people to obtain a variety of information that can become a reference in order to increase the capacity of farmers to manage beef cattle fattening. Research was carried out from December 2014 to March 2015 which is a wet month and July until August 2015 representing a dry month, in Farmers Group Nekmese in Usapinonot Village, West Insana District, North Central Timor Regency, East Nusa Tenggara Province. The method used was survey and direct observations in the field. Animal groups target were selected using purposive sampling method with the criteria having and raising livestock fattening males at least one bull. To obtain more in-depth information and interviews, discussions was conducted with the chairman and members of farmer groups using questionnaires. Measurement variables included age, gender, level of education and experience of farming. Data were analyzed descriptively. Results of research showed the age of the farmers at the level of productive age with an average 30-64 years, with a male farmers’ distribution by 47.17%, while 52.83% of women farmers. The average of level education of farmers was not school 9.431%, primary school 84.91%, junior high school 1.89% and senior high school 3.77%. Judging from the experience of farming, most farmers (30.19%) had experience in raising cattle more than 14 years, the remaining 10 -13 years experience farmers of 26.42%; 6 - 9 years 18.88%; 2 - 5 years 13.21% and less than 2 years at 9.43%. Livestock rearing was still done traditionally with low quality and quantity feed control, minimum health controls, while fattening cattle age varies and the fattening period average 7 - 9 months. It was concluded that characteristics of farmer needs to be improved, especially in the aspect of formal and non-formal education so the farmers’ capacity/ability in technology adoption and management of cattle fattening was more optimal.

Keywords: Farmers, Characteristics, Fattening, Bali Cattle, West Timor

INTRODUCTION

Farmers are key and the main component in the management of the beef cattle fattening because it has a central role in determining the success or failure of the farm. A good management ability of farmers can increase the productivity of livestock; on the contrary it will give minimum results when management carried out by the farmers is not standardized. Theoretically, to obtain optimal results in fattening beef cattle, the influence of internal and external factors must be considered. Judging from the internal factors, some factors are believed to fairly determine the effectiveness of the role of farmers in managing beef cattle fattening are their characteristics including age, education level, raising experience and gender. In addition, some of the main things that need to get the farmers’ attention in managing beef cattle fattening is the ability of farmers to select calves, fattening system used, feed materials selection and manner of administration, the provision of the enclosure, as well as disease control and prevention. While external factors are influential in determining the farmers’ management was the availability of labor, availability of calves, feed and animal health.

Beef cattle fattening, especially Bali cows has become an integral part of the lives of the
farmers/breeders and had been conducted for generations in West Timor. Nevertheless, the study of the farmers’ characteristics in West Timor in Bali cattle fattening has not been done. Therefore, this study is expected to provide important information relating to the characteristics of the farmers/breeders in the farms. Thus it can be used as valuable information in order to increase the farmers’ capacity to manage beef cattle fattening, which in turn can have a positive impact in increasing livestock productivity.

**MATERIALS AND METHODS**

The research was conducted from December 2014 until March 2015 in which it was the wet month (rainy season) and July and August 2015 that represent the dry season (dry season) at Nekmese Farmers Group in Usapinonot Village, West Insana District, North Central Timor Regency, East Nusa Tenggara Province.

The materials used in this study included the target farmer groups as respondents as many as 53 people and questionnaires (questionnaires). The method used was in the form of surveys and direct observations in the field. Selection of farmer group used purposive sampling method with consideration that the selected group was the group that met the criteria in conducting cattle fattening. The group that was selected in the farmers’ data was the respondent. Farmer respondents’ criteria was at least had one male tail of Bali cattle that was being fattened. Data collection was conducted through interviews with the chairman and members of farmer groups using questionnaires. Farmers’ characteristics that become variables measured and observed in this study were age, gender, level of education, rearing experience and livestock rearing pattern. The data collected were tabulated and analyzed descriptively.

**RESULTS AND DISCUSSION**

**Age.** The average age of 53 Bali cattle farmers in Farmers Group Nekmese were 30-34 years old (13.21%), 35-39 years old (9.43%), 40-44 years old (9.43%), 45-49 years old (18.87%), 50-54 years old (15.09%), 55-59 years old (16.09%), 60-64 years old (15.09%) and 65-69 years old (1.89%). The results showed that beef cattle farmers in Farmers Group Nekmese, Usapinonot village was dominated by the productive age group (30-64) years old, while the non-productive age group (above 64 years) was only one farmer (2%). It shows the readiness of physical and psychological maturity in maintaining cattle ranchers. Physical maturity was important because by having a strong physical farmers can prepare needs of livestock every day, especially in the form of forage legumes and grasses that were taken from the garden or pasture which were relatively far away.

In addition, the condition of that age such farmers are able to think and do a good job as well as be able to accept new innovations to make it useful for the progress of his efforts. According to Tarmidi (1992) on the condition of 15-65 years of age, a person was included in the productive age category with the ability to work that still relatively good and thinking ability that was good enough. In the demographic analysis, age structure population can be divided into three groups, namely (a) the younger age group, under 15 years old; (b) the productive age group, aged 15-64 years old; and (c) older age groups, aged 65 years old and over (Tjiptoherijanto, 2000).

**Gender (Sex).** The results showed that the ownership and maintenance of cattle fattening was not only conducted by male gender, but also by women. Men who own and raise livestock fattening was 47.17%, while the women was 52.83% (Table 1). This illustrates that the participation of women in beef cattle fattening was quite high. The higher participation of women farmers than the men was caused by some of the women had to have lived alone (widowed) with the children and because the husband as the head of the family generally looked for another job outside the main job as a farmers/breeder so they did not have enough time to raise cattle.

According to Suradisastra and Lopez (2000), in most societies, roles of men as workers was
generally dominance in the family farming activities including farm businesses, demonstrated by the high level of physical participation conducted. While the female gender participation was relatively low despite a huge influence. Female farmers typically had a responsibility and a double role in the household, in addition to participating in the livestock business where women had a responsibility to take care of the household and children. It can be positive or negative impact on livestock productivity was maintained. Time raising livestock is mainly concerned with feeding time and the amount of feed given relatively less when compared to male farmers.

Therefore, although the gender participation of women was quite high in beef cattle fattening farmer group in West Timor, according to Suradisastra and Lopez (2000), gender status of women in the cattle business was limited by social status, especially with regard to the level of education, health, and positions in decision making, barriers to work due to low mobility aspect and was expected to be with their children at home, employment status where women often earned a lower position than men. Likewise, there were often different remuneration for the same job and position. In terms of technology, certain gender often had more negative effects than positive one.

Table 1. Usapinonot Village, West Insana District, North Central Timor Regency, East Nusa Tenggara Province

<table>
<thead>
<tr>
<th>Description</th>
<th>Number of Respondents</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender (Sex)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Male</td>
<td>25</td>
<td>47.17</td>
</tr>
<tr>
<td>□ Female</td>
<td>28</td>
<td>52.83</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>53</strong></td>
<td><strong>100</strong></td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Formal Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Uneducated</td>
<td>5</td>
<td>9.43</td>
</tr>
<tr>
<td>□ Elementary</td>
<td>45</td>
<td>84.91</td>
</tr>
<tr>
<td>□ Junior high</td>
<td>1</td>
<td>1.89</td>
</tr>
<tr>
<td>□ Senior high</td>
<td>2</td>
<td>3.77</td>
</tr>
<tr>
<td>□ College</td>
<td>-</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>53</strong></td>
<td><strong>100</strong></td>
</tr>
<tr>
<td><strong>Raising Experience</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ &lt; 2 Years</td>
<td>5</td>
<td>9.43</td>
</tr>
<tr>
<td>□ 2 - 5 Years</td>
<td>7</td>
<td>13.21</td>
</tr>
<tr>
<td>□ 6 – 9 Years</td>
<td>10</td>
<td>18.88</td>
</tr>
<tr>
<td>□ 10 – 13 years</td>
<td>14</td>
<td>26.42</td>
</tr>
<tr>
<td>□ &gt; 14 years</td>
<td>16</td>
<td>30.19</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>53</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

**Level of education.** The average education levels of farmers who fattened the meat cattle were dominated by elementary and no school education respectively 74.36% and 13.51%. Farmers who had senior high school and junior high education were 5.41% amounting to 2.70% (Table 1). The impact of educational level was still quite low causing the management aspect in fattening business owned by farmers was low and suboptimal. Farmers with low levels of education will lead to the ability to adopt a technology will be hampered. The result of observation of fattening business showed that low level of education caused low ability of feedlot farmers’ governance in managing feed, housing, health and understanding of the calves used in fattening. Feed given did
not guarantee the needs of livestock because it was quite volatile in terms of quality and quantity. Housing system used did not ensure the comfort and health of livestock. Similarly, the fattened calves had not been standardized, so that the impact on growth and the duration in fattening cattle were getting longer.

According to Hernanto (1995), limited farmers’ level of education was relatively resulted in a slow response to adapt to new technologies, weak supervision and weak production in processing their field practiced. Meanwhile, according to Widyaningrum et al. (2013), general education level of farmers in East Nusa Tenggara was low, so it affected the farming pattern. Moreover, the productivity of livestock kept on dry land farmers was relatively low. Therefore, it needs a continuous assistance to provide education or training so that their knowledge can be improved in developing fattening business.

Raising experience. The results showed that the majority of farmers (30.19%) had experience in raising cattle more than 14 years, the rests who had 10-13 years experienced was 26.42%; 6-9 years was 18.88%; 2-5 years was 13.21% and less than 2 years was 9.43% (Table 1). Although most farmers had experienced in raising cattle more than 14 years, field observations showed that the management of the improvement is not significant, especially in terms of feed management, especially housing hygiene that directly related to animal health as well as the calves treatment. It has correlation with the orientation of cattle fattening which was still a sideline business. In addition, in the aspects of housing, lack of capital becomes an obstacle to build a standardized enclosure equipped with food and drink container as well as adequate drains and water supply for cleaning the enclosure and cattle. Judging from the calves fattening, although some farmers raised cattle for long enough, they still needs assistance and understanding to choose the right calves to be used in an the fattening business.

Results of this research illustrated that the experience had not been entirely influencing or positively correlated with improvement of beef cattle fattening management. Improvements management was related more to capital and fattening business orientation, in addition to the farmers’ level of education. According to Murwanto (2008), raising experience is a good teacher. With enough experience to raise cattle, the farmers will be more careful in their business and correct deficiencies in the past. Nevertheless, the availability of supporting resources was needed in improving the maintenance management of the cattle in the fattening process.

Cattle Raising Patterns. Generally, raising beef cattle carried by livestock farmers in Indonesia is still largely traditional with the quality and quantity of feed that is not scalable and secure, less efficient reproductive, minimum health control, and the cow is always in a cage (not grazing) (Karnadi, 2006). Field observations indicated that beef cattle raising was conducted by means of an enclosure placed in an individual swath in a communal housing belonged to farmer groups that were built together with minimum drainage.

Feeding pattern with a “cut and carry” system with an average feeding 3 times per day, morning, afternoon and evening or night, with the type of feed and the amount of the provision which varied for both forage legumes and non-legumes. The type of feed given to cattle generally include leucaena (Leucaena leucocephala), natural grass, King Grass, White Teak (Gmelina arborea), kubesak (Acacia leucophloea), Gliricidia (Gliricidia sepium), stems and leaves of banana (Musa x paradisiaca), Turi (Sesbania grandiflora), Aangsana (Pterocarpus indicus), Imperata (Imperata cylindrica), kapok leaves (Ceiba pentandra), cassava leaves (Manihot utilissima), jackfruit leaves (Artocarpus heterophyllus) as well as flowers fence. Feeding amount was not fixed, subject to availability and the ability of farmers to obtain it. The dominant factors that affected the availability of feed given to the cattle were climatic factors, particularly rainfall. Distribution of drinking water on average was one to three times a day, morning, afternoon and evening. Nonetheless, there were farmers who did not provide drinking water, but replace it by giving banana stem. Distribution of banana stem was also conducted when cattle did not want to drink water.
Table 2. Patterns maintenance Bali cattle by cattle ranchers in Bali in Nekmese Farmers Group, Usapinonot, Timor Tengah Utara

<table>
<thead>
<tr>
<th>Description</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing pattern</td>
<td></td>
</tr>
<tr>
<td>Feed distribution</td>
<td>Communal</td>
</tr>
<tr>
<td>□ Feed distribution system</td>
<td>Cut and carry</td>
</tr>
<tr>
<td>□ Feed distribution schedule</td>
<td>3 times (morning, afternoon, evening)</td>
</tr>
<tr>
<td>□ Kind of feed</td>
<td>Varied</td>
</tr>
<tr>
<td>Water distribution</td>
<td></td>
</tr>
<tr>
<td>□ Distribution Schedule</td>
<td>1 – 3 times</td>
</tr>
<tr>
<td>Fattened calves age</td>
<td>Varied (&lt; 1 – 4 years)</td>
</tr>
<tr>
<td>Raising period</td>
<td>7 - 9 months</td>
</tr>
</tbody>
</table>

CONCLUSION

From the description above, it can be concluded that the characteristics of the farmers needs to be improved, especially in the aspects of education both formal and non-formal so that their capacity/ability in adopting technology and management of beef cattle fattening could be more optimal. Characteristics of farmers in this research are:

1. Farmers’ age was dominated by productive age with an average of 30-64 years old with male distribution of 47.17% and 52.83% of women.
2. The average education level was uneducated as much as 9.43%, elementary education as much as 84.91%, junior high school education as much as 1.89% and junior high school education as much as 3.77%.
3. The majority of farmers (30.19%) had experience in raising beef cattle more than 14 years, the remaining was 10-13 years as much as 26.42%; 6-9 years as much as 18.88%; 2-5 years as much as 13.21% and less than 2 years as much as 9.43%.
4. The pattern of cattle raising was still conducted traditionally with a low feed management, minimum health controls with a vary of calves ages and the raising period was of 7-9 months.

REFERENCE

Output Estimation of Ongole Crossbred Cattle Breeding in Klirong, Kebumen, Central Java

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corresponding email: profsumadi@yahoo.co.id

ABSTRACT: This research aims to identify the location of the source of beef cattle, calculate the Natural Increase (NI) and determine the output of Ongole cross breed cattle in Klirong, Kebumen, Central Java. The village used in the study Jeruk Agung, Pandan Lor and Kedung Sari. The material used in this study is a questionnaire for local government and farmer. Respondents used in the study of 230 people is composed of Jeruk Agung village as many as 50 people, the village of Kedung Sari 77 people and the villages of Pandan Lor 103 people. Natural Increase (NI) PO cattle in Klirong district of Kebumen 2015 was 51.95%, respectively with males and females of 27.93% and 24.02%. The result of output estimation for PO cattle in district of Klirong for male culled cattle was 20.41% and female culled cattle was 23.79% of the population while the magnitude of the output estimation of male replacement cattle was 66.86% and female replacement cattle was 48.4% of the population.

Keywords: Output, Natural Increase, Peranakan Ongole (PO), Kebumen

INTRODUCTION

One of national assets animal husbandry from Klirong Subdistrict Kebumen Region that has big potential can be develop is Ongole crossbred cattle. Ongole crossbred cattle breeding is crucial matter to support cattle beef industry, however until now animal breeding necessary not only quantity but also quality is not yet enough were provided by local production. Availability of information about reproduction performance is needed to know the potential area for breeding cattle resource. Potential or output Ongole crossbred cattle is the amount of cattle that can be taken out to other area or slaughtered in certain area without disturbing cattle population balance.

MATERIALS AND METHODS

This research was conducted on January 2015 in Klirong Subdistrict, Kebumen Region, Central Java. The Villages was used in this research as follows Jeruk Agung, Pandan Lor, and Kedung Sari.

MATERIALS

Materials that was used in this research as follows questionaries for government and farmers. Respondent which used in this research was 230 persons consist of Jeruk Agung Village 50 persons, Kedung Sari Village 77 persons, and Pandan Lor Village 103 persons.
METHODS

Implementation of Subdistrict animal breeding potential was did by using census method with used appropriate methods on the field, and used appropriate sampel which related to the research methode. It was choose 3 representative villages by sampling quota on Klirong Subdistrict, Kebumen Region. Furthermore each farmer in the choosen village acted as respondence then censused by questionaries and variable observed include farmer identity, the aim of rearing, the motivation of rearing, cattle ownership, production organize, mutation, rearing system. Secondary data was collected from related instance on the research place, included animal statistic. According to breeding theory approach, that was analized cattle output from an area furthermore determined availability of cattle breed and cattle to be fattened.

RESEARCH DESIGN

Collected data was tabulated corresponding with needs and then analiyzed
1. farmer identity was analyzed with counting average percenteg deviation standard and then shows in table.
2. Cattle identity was analyzed by calculate average percentage and deviation standard then made it in table and resulted technical coefficient which used to calculate NI, NRR, and potential (output) in an area.
3. Natural Increase (NI) is calfing rate to population in one year minus death percentage of cattle to population in one year.
4. Net Replacement Rate (NRR) is female calf total which is born and be expected to live in certain age, devided with necessity total of dam replacement annaly, multiplied 100%; or is male calf total which is born and be expected to live in certain age, devided with necessity total of sire replacement annaly, multiplied 100%.
5. Potential (output) of beef cattle from an area is the amount of beef cattle which can be drop out for send to other area without disturbing population balance of cattle. Output consist of young male and female animal which the amount is same with NI residual that have been minus total replacement necessity.
6. Population development of beef cattle in five years ago was needed for estimated population-average increase every year.
7. Source breeding area is an area that fostered as breeding provider for other area namely by criteria as follow.
   a. Beef cattle population pretty much.
   b. Number of cattle slaughtered is increase, or at least not decrease.
   c. NRR more than 100
   d. Body size of cattle in certain age fulfill certain body size standard (for male cattle is about 10% from cattle availability and for female cattle is about 90% from availability).

RESULT AND DISCUSSION

Natural Increase (NI)

Average of Natural Increase (NI) of Ongole crossbred cattle in Klirong Subdistrict on 2015 according to Table 6 can bee seen 51.95% with Male and female NI respectively 27.93% and 24.02%. the value of NI in this research was higher than previous research by Tonbesi et al.
(2009) and Sumadi et al. (2007) respectively 21.72% and 46.68±9.16. The height of NI value was caused by the height of birth rate compared with death rate. Many factors were affected such as birth percentage to population, comparison between mature male and female cattle and death rate (Sumadi et al., 2004).

Net Replacement Rate (NRR)

NRR value of male Ongole crossbred cattle was 637.77% and female 355.85%, its mean the stock of replacement male cattle as many as 6.37 times of necessity, replacement female cattle as many as 3.55 times of necessity, in other words the stock of male and female cattle in Klirong Subdistrict was sufficient. This research indicated that surveyed area can provide the candidate male and female replacement cattle without importing cattle replacement from other area. The animal population was declared surplus if NRR value more than 100% and population drained if NRR value less than 100% (Hardjosubroto, 1994).

Output

Table 1. Potential or Output of Ongole Crossbred cattle in Klirong Subdistrict Kebumen Region on 2015

<table>
<thead>
<tr>
<th>No.</th>
<th>Variable</th>
<th>Pandan Lor (%)</th>
<th>Jeruk Agung (%)</th>
<th>Kedung Sari (%)</th>
<th>Kecamatan (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(heads)</td>
<td>(heads)</td>
<td>(heads)</td>
<td>(heads)</td>
</tr>
<tr>
<td>1.</td>
<td>Culled cattle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Sire</td>
<td>23.53</td>
<td>16.00</td>
<td>12.82</td>
<td>5.00</td>
</tr>
<tr>
<td></td>
<td>Dam</td>
<td>11.76</td>
<td>8.00</td>
<td>20.51</td>
<td>8.00</td>
</tr>
<tr>
<td></td>
<td>Total Residual</td>
<td>35.29</td>
<td>24.00</td>
<td>33.33</td>
<td>13.00</td>
</tr>
<tr>
<td>2.</td>
<td>Replacement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Sire</td>
<td>32.35</td>
<td>22.00</td>
<td>46.15</td>
<td>18.00</td>
</tr>
<tr>
<td></td>
<td>Dam</td>
<td>32.35</td>
<td>22.00</td>
<td>20.51</td>
<td>8.00</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>64.71</td>
<td>44.00</td>
<td>66.67</td>
<td>26.00</td>
</tr>
</tbody>
</table>

According to the table 8 total output of Ongole crossbred cattle for culled male 12.72% and female 23.79% totally 26.01% of population. Male replacement cattle was 41.04% and female 32.95% of population. The highest output of male culled Ongole crossbred cattle was in Pandan Lor Village as many as 23.53% whereas the lowest output was happened in Kedung Sari Village 1.52%. The highest output of female culled Ongole crossbred cattle was in Jeruk Agung Village 20.51% and the lowest output was happened in Kedung Sari Village as many as 10.61%. The highest output of replacement male Ongole crossbred cattle was in Pandan Lor Village as many as 46.97% and the lowest output was happened in Pandan Lor Village as many as 20.51%. Total percentage of the highest whole output was in Pandan Lor Village as many as 64.71% and the lowest output was happened in Jeruk Agung Village as many as 39.00%. Generally the number of estimation replacement cattle output percentage was higher than percentage of culled cattle. This case related to the huge number of necessity and replacement cattle stock. Total stock of replacement cattle was higher than necessity of replacement cattle so that why remainder of replacement cattle can be exported (Sumadi, 1999).
Population Dinamics

Based on equation of line regression \( Y = 213.5(X) + 5434 \) resulted of time series analysis data from 2010 until 2014, it can be estimated that cattle population on 2015 until 2019 as follows on table 2, with technical coefficient estimation is constant.

**Table 2. Population Development Estimation of Ongole crossbred cattle in Klirong Subdistrict Kebumen Region on 2015 until 2019**

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
<th>Increase (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>6075</td>
<td>19.61</td>
</tr>
<tr>
<td>2016</td>
<td>6288</td>
<td>3.50</td>
</tr>
<tr>
<td>2017</td>
<td>6502</td>
<td>3.40</td>
</tr>
<tr>
<td>2018</td>
<td>6715</td>
<td>3.28</td>
</tr>
<tr>
<td>2019</td>
<td>6929</td>
<td>3.19</td>
</tr>
</tbody>
</table>

It will happen if technical coefficient is constant. Based on data which was shown in Table 2 and 3 can be estimated the output of Ongole crossbred cattle from 2014 until 2019 as follows.

**Table 3. Potential estimation or Output of Ongole crossbred cattle in Klirong Subdistrict Kebumen Region on 2014 until 2019**

<table>
<thead>
<tr>
<th>No.</th>
<th>Variable</th>
<th>2014 (%)</th>
<th>2015 (heads)</th>
<th>2016 (heads)</th>
<th>2017 (heads)</th>
<th>2018 (heads)</th>
<th>2019 (heads)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Culled cattle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Sire</td>
<td>20.41</td>
<td>68</td>
<td>1240</td>
<td>1283</td>
<td>1327</td>
<td>1371</td>
</tr>
<tr>
<td>b.</td>
<td>Dam</td>
<td>23.79</td>
<td>79</td>
<td>1445</td>
<td>1496</td>
<td>1547</td>
<td>1597</td>
</tr>
<tr>
<td>2.</td>
<td>Replacement Residual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Sire</td>
<td>66.86</td>
<td>223</td>
<td>4062</td>
<td>4204</td>
<td>4347</td>
<td>4490</td>
</tr>
<tr>
<td>b.</td>
<td>Dam</td>
<td>48.40</td>
<td>161</td>
<td>2940</td>
<td>3043</td>
<td>3147</td>
<td>3250</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>115.26</td>
<td>384</td>
<td>7002</td>
<td>7248</td>
<td>7494</td>
<td>7740</td>
</tr>
</tbody>
</table>

The result calculation of output estimation Ongole crossbred cattle in Kebumen Region (Table 3) indicated output estimation of culled sire Ongole crossbred cattle on 2015 until 2019 respectively 1240, 1283, 1327, 1371 and 1414 cattle. Output estimation of culled dam Ongole crossbred cattle respectively 1445, 1496, 1547, 1597 and 1648. The result of output estimation from residual replacement was higher from young male cattle respectively 4062, 4204, 4347, 4490 and 4633 cattle. The output estimation dam replacement respectively 2940, 3043, 3147, 3250 and 3354 cattle. The amount of estimation value output from residual replacement compared with culled cattle related to the amount of total necessity and replacement stock. The availability replacement stock was higher than replacement stock necessity so that residual of replacement stock can be release in huge number. The residual of replacement stock can be released to other area for replacement stock in that area (Sumadi, 1999).
CONCLUSION AND SUGGESTION

Conclusion
The result of output estimation of Ongole crossbred cattle on Klirong Subdistrict for culled male cattle was 20.41% and culled female cattle was 23.79% from population whereas output estimation of sire replacement was 66.86% and dam replacement was 48.4% to population. The factors that affected the amount of output such as necessity and availability replacement stock. Klirong Subdistrict Kebumen Region was resource area of Ongole crossbred cattle (Kebumen) breed.

Suggestion
It is needed to do further research about potential estimation of Ongole crossbred cattle in Kebumen Region with larger area and covers all area in Kebumen Region.

REFERENCES
Effects of *Hibiscus sabdariffa* and *Schleichera oleosa* Liquid Smoke on Lipid Content, Lipid Oxidation and Residual Nitrite in *Se’i* (Rotenese Smoked Beef)

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**ABSTRACT.** *Hibiscus sabdariffa* calyces and liquid smoke are kinds of ingredients which are always used in some processed meat products. The objectives of this study were to determine the effect of Roselle calyces extract (*Hibiscus sabdariffa*) (RCE), *Schleichera oleosa* liquid smoke (SOLS) and a combination of the extract and the liquid smoke (RCSO) on lipid content, lipid oxidation and residual nitrite of *se’i* (Rotenese smoked beef). The experiment was assigned in a completely randomized design (CRD) with 6 treatments namely: control (C) = *se’i* traditional (without extract or liquid smoke), RCE₁ = roselle extract 4% (w/v), RCE₂ = roselle extract 8% (w/v), SOLS= *Schleichera oleosa* liquid smoke (5%) (v/w), RCSO₁ = roselle extract 4% + liquid smoke 5%, RCSO₂ = roselle extract 8% + liquid smoke 5%. There were three replicates each treatment. Data were analyzed using Analysis of variance (ANOVA) and continued by Duncan multiple range tests to detect differences between means. Result showed that lipid content was significantly lower (P<0.05) in *se’i* giving RCE or SOLS compared to their combination (RCSO). Based on TBA numbers, RCSO₁ was the most effective treatment compared to other treatments in inhibiting lipid oxidation in *se’i*. Residual nitrite was significantly increase (P<0.05) in *se’i* adding RCE or SOLS. The experiment showed that combination of roselle (*Hibiscus sabdariffa*) extract and *Schleichera oleosa* liquid smoke (RCSO₁ or RCSO₂) was more effective in inhibiting lipid oxidation while roselle (*Hibiscus sabdariffa*) extract (RCE) or *Schleichera oleosa* liquid smoke (SOLS) alone was more effective in reducing lipid content. Addition of roselle (*Hibiscus sabdariffa*) extract (RCE) or *Schleichera oleosa* liquid smoke (SOLS) caused nitrite residual of *se’i* increasing.

**Key words:** Roselle, liquid smoke, *se’i*, lipid oxidation, lipid content, residual nitrite

**INTRODUCTION**

*Se’i* (Rotenese smoked meat) is usually made from beef, slicing into rope-shape, spicing with salt and saltpeter (KNO₃), then cured and smoked. The traditional (vaporous) smoking of *se’i* is usually done by *Schleichera oleosa* wood smoke and above the meat surface is covered with *Schleichera oleosa* raw leaves.

Nowadays *se’i* has been produced in home and industry scale too. As a smoked meat product, the safety of *se’i* depends on level of carcinogenic compounds and residual nitrite which always contained in cured and smoked meat products. The carcinogenic compounds such as polycyclic aromatic hydrocarbons (PAHs) are formed and released during pyrolysis of wood. In traditional smoking, *se’i* is placed directly over the smoking wood thus all components of smoke, include PAH, and adhere directly to meat surface. On the other hand, when *se’i* is processed with liquid smoke, level of the carcinogenic compounds is very low since before applied in food, the liquid smoke was distillated and filtrated.

Using of saltpeter (KNO₃) in *semi* plays an important role on enhancing red bright color as
well as preservative. However, a safety concern relating to the use of nitrate/nitrite is leading to a
formation of carcinogenic compounds such as nitrosamines and nitrosamines. Thus, residual nitrite
concentration in food product should be low to avoid formation of the carcinogenic compounds.

Organic acids are good sources of bioactive compounds that could help to reduce the level of
residual nitrite in meat products (Viuda-Martos et al., 2009). Organic acids also contain in roselle
calyces such as: oxalic dan succinic acids, malic dan tartaric acids and ascorbate acid. In liquid
smoke also contains organic acids. It has not been reported effect of roselle and liquid smoke on
reducing residual nitrite in meat products included in se’i.

Mainly in meat products included se’i contain high levels of lipids. Lipid content in se’i is
an important point to be considered since it relates to cardiovascular diseases. Thus using of
antioxidant in meat products may help to reduce the incidence of the diseases. In roselle calyxs
and in liquid smoke contain phenols. Phenolic compounds are known for exhibiting antioxidant
properties that could decrease the rate of lipid oxidation. Addition of roselle extract in sucuk dan
kavurma could reduced TBA numbers (Bozkurt and Belibag, 2009). Giving liquid smoke in beef
patties could reduced TBA numbers (Estrada-Munoz et al., 1998). It has not been reported effect
of roselle and liquid smoke on lipid oxidation of se’i. Therefore, this study aimed to investigate
the effect using roselle extract, liquid smoke and the mixture of roselle and liquid smoke on lipid
content, lipid oxidation and residual nitrite of se’i. (Rotenese smoke beef).

MATERIALS AND METHODS

A total of 10 kg of beef was taken from butt and rump of Bali cattle, was purchased in the
meat shop in Kupang. The beef was trimmed of fat and connective tissue, cut into rope-shaped
with three cm in thickness. Addition 20 g of refined and ground table salt and 300 mg of saltpeter
of kg−1 meat then mixed well. The beef divided into six groups namely: Control (C) = without
adding roselle or liquid smoke, RCE1 = roselle 4% (w/v), RCE2 = roselle 8% (w/v), SOLS=
Schleichera oleosa liquid smoke (5%) (v/w), RCSO1 = roselle 4% + liquid smoke 5%, RCSO2 =
roselle 8% + liquid smoke 5%.

Calyces of roselle was obtained from Oefafi village-Kupang-East Nusa Tenggara Province.
The calyces were separated from seed and dried in oven at temperature of 60° C for 3 days, then
blended with Philips blender to obtain the mass. To obtain 4% and 8% (w/v) of roselle extract,
each of 4 and 8 g of roselle mass poured into volumetric glass and added distilled water up to 100
ml, stirred at 600° C for 5 min and filtered with Whatman (No.41) (Karabacak and Bozkurt, 2008)
with modification. The filtrate then poured in the batches RCE1 and RCE2 respectively, mixed well
and marinated for 12 h.

Schleichera oleosa liquid smoke was obtained from Department of Agricultural Technology,
Gadjah Mada University. It was produced in 4000° C pyrolysis temperature, destilated and filtrated.
To obtain SOLS, five ml of Schleichera oleosa liquid smoke poured in the batches and mixed well
in batches (SOLS). To obtain RCSO1 = roselle extract 4% + liquid smoke 5% and RCSO2 =
roselle extract 8% + liquid smoke 5%, roselle extract added first, followed by liquid smoke and
then mixed well. All treatment then cured for ± 12 h and then smoked used Schleichera oleosa
wood except for SOLS, RCSO1 and RCSO2 were smoked in oven at 100° C until well done. When
the beef surface was dry, firmness and the color turned to bright red, the smoking was stopped.
Triplicate pieces of meat, 100 g of each piece, were carried out for each group of se’i used as
samples.

Lipid content was determined by Soxhlet extraction (AOAC, 1995). Residual nitrite level
was determined as mg NaNO2 / kg se’i by a spectrophotometer method at 540 nm (AOAC,
Lipid oxidation was determined as 2-thiobarbituric acid-reactive substances (TBARS) in mg malondialdehyde (MDA)/kg se’i by a spectrophotometer method as described by Mohd-Esa et al. (2010).

All data obtained from the experiment were analyzed by analyses of variance (ANOVA). Duncan Multiple Range Test (DMRT) was used to determine differences among mean values SPSS 18.

**RESULTS AND DISCUSSION**

Addition of roselle, liquid smoke or mixture of roselle and liquid smoke affect lipid content, thiobarbituric acid reactive substances values (TBARS) and residual nitrite of se’i (P<0.05). Se’i treated with roselle extract (RCE$_1$ or RCE$_2$) or *Schleichera oleosa* liquid smoke (SOLS) had lower lipid content than se’i treated with combination of roselle and liquid smoke (RCSO$_1$ and RCSO$_2$). The lowest lipid content was found at se’i treated with *Schleichera oleosa* liquid smoke (SOLS) (P<0.05) (Table 1).

**Table 1.** Average of lipid content, lipid oxidation (TBARS), residual nitrite level (ppm) of se’i treated with roselle extract, *Schleichera oleosa* liquid smoke and their combination

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Control (C)</th>
<th>Roselle extract 4% (RCE$_1$)</th>
<th>Roselle extract 8% (RCE$_2$)</th>
<th>Schleichera oleosa liquid smoke 5% (SOLS)</th>
<th>Roselle extract 4% + liquid smoke 5% (RCSO$_1$)</th>
<th>Roselle extract 8% + liquid smoke 5% (RCSO$_2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipid (%)</td>
<td>6.39 ± 0.02c</td>
<td>5.60 ± 0.01b</td>
<td>5.67 ± 0.01b</td>
<td>5.13 ± 0.02a</td>
<td>6.02 ± 0.01c</td>
<td>6.56 ± 0.03c</td>
</tr>
<tr>
<td>DM ± Std</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TBARS (Mg. Malonaldehyde/Kg ± Std)</td>
<td>0.85 ± 0.01c</td>
<td>0.64 ± 0.01b</td>
<td>0.68 ± 0.01c</td>
<td>0.68 ± 0.01c</td>
<td>0.40 ± 0.01a</td>
<td>0.71 ± 0.01d</td>
</tr>
<tr>
<td>Nitrite Residual (ppm ± Std)</td>
<td>29.01 ± 2.23c</td>
<td>51.32±2.33b</td>
<td>50.86±2.21b</td>
<td>64.21±2.21c</td>
<td>28.62±2.20a</td>
<td>28.83±2.21b</td>
</tr>
</tbody>
</table>

a,b: significantly difference at P<0.05. ± std (standard deviation). DM= dry matter. ppm = part per million. TBARS= Thiobarbituric Acid Reactive Substance

Addition of roselle (RCE$_1$ or RCE$_2$), liquid smoke (SOLS) and combination of roselle and liquid smoke (RCSO$_1$ or RCSO$_2$) resulted in a significant reduction in the TBA values of se’i (P<0.05). The highest TBA values of se’i was in control (C) and the lowest was in roselle 4% + liquid smoke 5% (RCSO1).

Lipid oxidation occurred because of membranes of muscle destroyed by heating while smoking. As a result lipoprotein complexes were broken and lipids tissue was easily attacked by oxygen and catalysts, in consequence the smoked meat more sensitive to oxidation (Onibi, 2000). In roselle calyces contain antioxidant compounds such as vitamin C, anthocyanins, b-carotene and lycopene (Wong, Yusof, Ghazali, & Che Man, 2002). Whereas in liquid smoke contains aldehyde, carboxylic acids and phenols as antioxidant compounds (Rorvik, 2000). It could be suggested that in this experiment the roselle extract, the liquid smoke and their combination could slow the rate of lipoprotein rupture so the rate of oxygen attack the lipid tissue was slow, thereby the rate of lipid oxidation was low. However, the combination of roselle 4% and liquid smoke 5% are more powerful to inhibit the rate of lipid oxidation compared to other treatments.
The means residual nitrite permitted in processing meat is 30 mg/Kg (Indonesian Food and Drugs Board, 2013). It is interested that addition of roselle or liquid smoke caused the residual nitrite level significantly increased (P<0.05), and the level was higher than the level permitted by Indonesian Food and Drugs Board (2013). Meanwhile addition of roselle and liquid smoke together (RCSO$_1$ and RCSO$_2$) caused the level of nitrite residual was same with control and the nitrite level was lower than the level permitted by Indonesian Food and Drugs Board (2013).

Commonly in se’i processing, nitrate/saltpeter is added to form specific color of se’i and also as a preservative. When nitrate was added, it is converted to nitrite by nitrate – reducing bacteria and then it is reduced to nitric oxide (NO) that reacts with myoglobin to form nitric-oxymyoglobin, red in color but unstable. When the meat is smoked, nitric-oxymyoglobin is converted to Nitrosylhemochromagen that is responsible for stable cured-pink color (Sebranek and Bacus, 2007). That is the favorable color of se’i.

Nitrite, also can react with secondary and tertiary amines which then result in formation of carcinogenic n-nitrosamines in cured meat (Choi et al., 2007). Nitrosamine formation in meat increases with higher cooking temperatures (Sen et al., 1973). It was reported that in raw-cured sausages level of nitrite turn down as storage time increased and at 20 days the nitrite reduced quickly, after that became moderately stable (Moawad et al., 2012). Thus in this experiment, residual nitrite level could decline further if the se’i was stored. However it should be proved by other experiment.

CONCLUSIONS

Based on the result above it could be concluded that combination of roselle (Hibiscus sabdariffa) extract and Schleichera oleosa liquid smoke (RCSO$_1$ or RCSO$_2$) was more effective in inhibiting lipid oxidation while roselle (Hibiscus sabdariffa) extract (RCE) or Schleichera oleosa liquid smoke (SOLS) alone was more effective in reducing lipid content. Addition of roselle (Hibiscus sabdariffa) extract (RCE) or Schleichera oleosa liquid smoke (SOLS) increased nitrite residual of se’i.

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Moawad, R.K., W. M. Abozeid, and A.S. Nadir. 2012. Effect of nitrite level and tea catechins on
Chemical Composition and Antioxidative Potential of Chicken Sausage with Substitution of Tempe

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ABSTRACT: The experiment was conducted to investigate the chemical composition and antioxidative potential of chicken sausage with substitution of tempe. The experiment used five levels of tempe substitution, namely 0, 5, 10, 15 and 20%, with three replications. The data observed were chemical composition, including moisture, protein and fat contents, and antioxidative potential of the chicken sausage expressing by 2,2-diphenyl-1-picrylhydrazyl (DPPH). The data were analyzed by analysis of variance of one way classification, and mean differences were tested by Duncan `s New Multiple Ranges Test. The results of the study showed that substitution of tempe did not affect on moisture and protein contents, but it affected on fat content (P<0.05). The fat content increased as increasing of substitution of tempe. The substitution of tempe also did not affect on DPPH of chicken sausage. Chicken sausage with the substitution of tempe up to 20% had an antioxidative potential with the DPPH range values of 20.60 to 26.81%.

Keywords: Chicken Sausages, Tempe, Chemical Composition, Antioxidative Potential.

INTRODUCTION

The sausage is one processed meat products are growing rapidly and popular in Indonesian society. The processed meat products have a high nutritional value. The term of sausage comes from the Latin, salsus which means salt. This refers to the terms of pieces or crushed meats preserved by salting. Along with the development of the food industry, are now starting to develop research on the making of sausages with meat combine with other foodstuffs to improve the nutritional quality of the sausages as diversification of food. Soy protein products are generally used as ingredients in the sausage product because of its functional properties that can improve the quality of sausages (Hin et al., 2000).

Tempe is a fermented soybean with Rhizopus oligosporus. Protease enzyme produced by molds during the fermentation process of soybeans into tempe will degrade proteins (polypeptides) into peptides that are shorter and free amino acids. Tempe as traditional foods likely as potential antioxidants fights free radicals, which can slow aging and prevent degenerative diseases (atherosclerosis, coronary heart disease, diabetes mellitus, and cancer). In addition, tempe also has been known to contain antibacterial substances that cause diarrhea, lowering blood cholesterol, preventing heart disease, hypertension, and others.

Binding peptides between myofibrilar meat protein and soy protein with the aid of heating can improve the functional properties of foodstuffs (Feng and Xiong, 2002), including the antioxidant potential. Based on this phenomenon, research on sausage products with a combination of broiler meat and soybean is expected to be a new breakthrough for food products in Indonesia and is able to give a plus for health benefits. This study aims to determine the effect of substitution of soybean in broiler chicken meat sausage on chemical characteristics and antioxidant potential of broiler chicken meat sausage.
MATERIALS AND METHODS

Materials used in the manufacture of sausages are chicken, 36-hours fermentation tempe, skim milk powder, garlic, pepper, coriander, salt, water ice, sugar, starch, and the plastic casing. Materials used in the chemical composition test is distilled water, chloroform, methanol, 1M NaCl, Tris-HCl 2M, and a solution of biuret.

Tempe manufacture

Soy beans are soaked in a just boil water, then cooled until the water is warm and the skin discarded until clean. Soy beans boiled until the water frothing or soft, then discarded cooking water, then drained soybeans. After drying, soybeans transferred into the concave container or bowl. Tempe yeast and Sago flour were added and mixed until well blended. Mix was put into plastic and sealed. Plastic wrap pierced with the tip of a knife in both sides to get some air. Tempe was put into a warm place for about 36 hours.

Sausage manufacture

Manufacture of sausage was done based on the percentage of soybean are used for substitution of chicken meat. Broiler chicken meat is ground. Basic ingredients, such as meat broiler chicken sausage and tempe were tested on water and fat content. Analysis of water content and fat sausage formulation designed to determine the method by Morrison et al. (1971).

Manufacture of sausages made by substitution level of tempe into sausage meat chicken. 0% substitution level tempe into the meat used as a control. Substitution of tempe in this study were 5, 10, 15, and 20%. Broiler chicken meat and 36-hours fermentation tempe were milled, mixed with all the other ingredients, salt, garlic, pepper, skim milk powder, coriander, sugar, water ice, and tapioca flour, then chopped (crushing) during 30 minutes. Furthermore, dough was put into a plastic casing and boiled in water bath with a temperature of 80°C for 30 minutes.

Chemical composition tests

Water content was determined by the method according to graphymetrically method by AOAC (AOAC, 1970). Determination of fat content was carried by soxhlet method, by extracting the samples with chloroform:methanol solution of 2:1 (Atkinson et al., 1972). The protein content was determined spectrophotometrically by Biuret method with a wavelength of 540 nm. Absorbance of samples will be compared to the absorbance of standard bovine serum albumin (Owusu-Apenten, 2002).

Antioxidant activity test

The antioxidant activity was tested on the 1,1-diphenil-2-picrylhydrazyl (DPPH) value. The DPPH value was tested spectrophotometrically with a wavelength of 517 nm (Soler-Rivas, et al., 2000, cit. Rodriguez-Ambriz, 2007).

Data analysis

Chemical composition data were analyzed by variance analysis of completely randomized design (CRD). The mean treatment differences were tested by Duncan’s New Multiple Ranges Test (DMRT).
RESULTS AND DISCUSSION

Chemical composition

The mean chemical composition of broiler chicken meat sausage with tempe substitution can be seen in Table 1.

Table 1. Mean values of chemical composition of broiler chicken sausage substituted by tempe

<table>
<thead>
<tr>
<th>Variables</th>
<th>Substitution level of tempe (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Moisture (%)</td>
<td>71.2</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>9.23</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>3.12&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>ns</sup>Not significant
<sup>abc</sup>Different superscripts in the same row showed significant difference (P<0.05).

Moisture. The water content of broiler chicken meat sausage with tempe substitution was showed in Table 1. The results of statistical analyzes showed that the water content of broiler chicken meat sausage was not significantly different with different levels of substitution tempe. Water content in the control chicken sausage or sausage meat broiler without substitution tempe was 71.2% and the water content of broiler chicken meat sausage with substitution tempe 5, 10, 15, and 20% was 70.94, 72.33, 70.24, and 63.17%, respectively. Judge et al. (1989) stated that the water content of chicken broiler is approximately 73.7% and according to the SNI (1992) tempe had a maximum water content of 65%. In theory, increasing the level of tempe will reduce the water content of chicken meat sausage. However, the increasing the level of tempe did not decrease the water content of the sausage. This is because the meat as the main ingredient in manufacturing of sausages has a relatively high water content so that the substitution of soybean up to 10% has no contribution to lowering the water content of the sausage meat broiler meat substituted tempe.

Protein content. The mean protein content of broiler chicken meat sausage by tempe substitution was showed in Table 1. The results of the statistical analysis showed that the protein content of broiler chicken meat sausage was not significantly different with different levels of tempe substitution. This is because the protein content of meat and tempe is relatively the same. Broiler chicken meat protein was 22% (Judge et al., 1989), while tempe contained a minimum of 20% protein (SNI, 1992). Therefore, the increase of the level of tempe on the sausage will have no effect on the protein content of sausage meat.

According to SNI (1995) sausage has a minimum protein content of 13%, while the research that has been conducted shows that the data on the protein content of the broiler chicken meat sausage substitute tempe level 0 and 5% were under the SNI, which amounted to 9.23 and 12.38%. This is because the protein content according to SNI is total protein, whereas in this study the protein content meanted is soluble protein.

Fat content. The result of the fat content of broiler chicken meat sausage with tempe substitution was showed in Table 1. The results of the statistical analysis showed that the fat level of broiler chicken meat sausage was significantly different with different level of tempe substitution. This is due to the fat content of meat and fat content of tempe. Increase of the tempe level in broiler chicken meat sausage caused increase of fat level. Data from this study showed differences in the levels of fat in each level tempe substitution in chicken meat sausage. Fat content in the control...
sauce or sausage meat broiler without tempe substitution or tempe substitution levels 0% and 5% level of substitution tempe is highly significant with sausage meat broiler chicken with tempe 15% substitution level. The highest fat content found in broiler chicken meat sausage with tempe substitution level of 15% with a content of 5.82%.

**Antioxidant activity**

The antioxidant activity of broiler chicken meat sausage with tempe substitution was showed in Table 2. Broiler chicken meat sausage with tempe substitution levels of 0 to 20% had a number of 1,1-diphenil-2-picrylhydrazyl (DPPH) of 20 to 37%. The results showed no difference in the numbers radical scavenging activity at each level of tempe substitution in broiler chicken meat sausage.

**Table 2.** 1,1-Diphenil-2-picrylhydrazyl (DPPH) values of broiler chicken sausage substituted by tempe

<table>
<thead>
<tr>
<th>Substitution level of tempe (%)</th>
<th>DPPH value (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>21.42</td>
</tr>
<tr>
<td>5</td>
<td>20.60</td>
</tr>
<tr>
<td>10</td>
<td>24.19</td>
</tr>
<tr>
<td>15</td>
<td>36.02</td>
</tr>
<tr>
<td>20</td>
<td>26.81</td>
</tr>
</tbody>
</table>

At tempe are antioxidant factor II (6,7,4 trihydroxy isoflavone). These antioxidants are synthesized during the fermentation process of soybeans into tempe by bacteria *Micrococcus luteus* and *Coreyne bacterium*. Increased levels of substitution of soybean on broiler chicken meat sausages will increase the antioxidant activity. However, in this study increased levels of substitution of soybean on broiler chicken meat sausage did not increase antioxidant activity. This is due to increased levels of substitution of soybean on broiler chicken meat sausage did not increase antioxidants, because antioxidants in broiler chicken meat sausage substituted tempe not only from tempe, but also from the results of the digestion of meat protein peptide or protein tempe.

Some research suggests that protein digestion in meat and soybean will produce amino acids and peptides simple functional capabilities, ie to inhibit hypertension and as an antioxidant. Antioxidant derived from soybean tempe active peptides which are broken down by protease enzymes during fermentation 24 hours. During the fermentation process the protein to be broken down by protease enzymes to produce active peptides that can capture free radicals DPPH in total antioxidant activity test (Rahayu, 2009).

**CONCLUSIONS**

Based on the study it can be concluded that the substitution of tempe into sausage meat broiler slightly affects the water content and protein, but many affect the fat content. Broiler chicken meat sausage with substitution tempe has potential as an antioxidant, but increased levels of tempe not always increase antioxidant activity.
REFERENCES


In Vitro Antioxidant Activity of Beef Lung Protein Hydrolysates

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ABSTRACT: The objective of this research was to prepare beef lung protein hydrolysates with pepsin and to measure their antioxidant activity. Materials used in this research were beef lung protein concentrate and pepsin. Beef lung protein hydrolysates were produced by enzymatic hydrolysis using pepsin. Antioxidant activity assay of beef lung protein hydrolysates was conducted using DPPH and TBA tests. The result obtained was beef lung used has 19.07% protein. Protein in the protein concentrate was 85.13%. Beef lung protein concentrate has a water binding activity as 2.05 ml/g, oil absorption 5.86 ml/g, foam capacity 49.4% with foam stability 55 min. Antioxidant activity of beef lung protein hydrolysates with TBA method ranged from 24.18-64.23 umol/kg. Radical scavenging activity with DPPH ranged from 9.52-39.48%. It could be concluded that hydrolysis with pepsin can produce beef lung protein hydrolysates with the antioxidant activity.

Keywords: Protein hydrolysates, Beef lung, Antioxidant, Radical scavenging activity.
Carcass Production and Chevon Quality of Kacang Buck Reared Traditionally in Grobogan, Central Java, Indonesia

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ABSTRACT: Kacang goat is one of indigenous goats in Central Java, Indonesia. Kacang goats are mostly reared traditionally that lead to low in productivity. This research was done to study the productivity and meat quality of Kacang buck reared traditionally in Grobogan, Central Java where the buck are concentrated. Ten heads of Kacang buck reared by farmers having the slaughtered weight of 14.60±2.84 kg were used in this study. They were reared in a combination of grazed during the day and kept in animal housing at night. Data were analyzed descriptively, except for meat quality in the Longissimus dorsi and Bicep femoris muscles were analyzed using T-test. The average carcass weight was about 5.66±1.16 kg (38.79±2.41%). Those Kacang buck produced 3.57±1.05 kg of chevon (62.69±6.50% of carcass without kidney) and had meat bone ratio of 2.21±0.64. The pH value, water-holding capacity, cooking loss, and tenderness (Warner-Bratzler shear force) in the Longissimus dorsi and Bicep femoris muscles were similar. The value of pH, water-holding capacity, cooking loss, and tenderness (Warner-Bratzler shear force) in the Longissimus dorsi muscles were 6.27±0.02, 34.84± 2.34%, 25.28 ±2.97%, and 6.18±0.36 kg/cm² respectively, while the value of those in the Bicep femoris muscles were 6.21±0.09, 32.35±1.83%, 25.91±3.03%, and 6.85±0.45 kg/cm² respectively. The content of moisture, protein, and fat in the Longissimus dorsi muscles were similar. Moisture, protein, and fat content in the Longissimus dorsi muscles were 74.87±1.96%, 19.65±1.77%, and 3.10±0.95%, while those in the Bicep femoris muscles were 74.42±1.60%, 19.58±1.29%, and 3.30±0.55%. It can be concluded that the carcass production and meat quality of Kacang buck reared traditionally might be increased by improving better management practice.

Keywords: Carcass production, Kacang goat, Meat quality.

INTRODUCTION

There was a tendency of increasing chevon demand in Central Java, Indonesia. In 2011, goats in Central Java were slaughtered more than sheep (938,180 heads of goats vs. 500,300 heads of sheep) (BPS Jateng, 2012). People prefer chevon than mutton, because chevon has leaner meat, and nutritious (containing 19.6%-20.7% of meat protein (Musnandar et al., 2011)), therefore it is preferred by health conscious consumers (Webb et al., 2005). These conditions have stimulated people to increase local breed goat production. Kacang goat is one of indigenous goats in Central Java, Indonesia that well adapted to harsh condition. However, Kacang goats are mostly reared traditionally that lead to low in productivity. Although having small in size, Kacang goat had 46.67% of dressing percentage (Hutama, 2014) and prolific (Sodiq and Sumaryadi, 2002; Rahayu, 2011; Panjono et al., 2012).

Most of Kacang goats in Grobogan, Central Java are reared traditionally, grazed during the day in native pasture and kept in animal housing at night. Although the goats have low in
productivity, the quality of meat is more important to study because health conscious consumers need the information. This research was done to study the productivity and meat quality of Kacang buck reared traditionally in Grobogan, Central Java where the buck are concentrated.

MATERIALS AND METHODS

Ten heads of Kacang buck reared by farmers in Grobogan, Central Java, Indonesia, having the slaughtered weight of 14.60±2.84 kg were used in this study. They were reared in a combination of grazed during the day and kept in animal housing at night. Parameters observed were dressing percentage, the percentage of carcass composition (meat, fat, and bone), chevon quality in the Longissimus dorsi and Bicep femoris muscles. Chevon quality observed were physical quality included pH, water-holding capacity/WHC, cooking loss, and tenderness using Warner-Bratzler shear force values (Shirima et al., 2013) and chemical quality included water, fat, protein content, and collagen in meat using near infrared spectroscopy (NIRS) (Prevolnik et al., 2004). Data were analyzed descriptively, except for meat quality in the Longissimus dorsi and Bicep femoris muscles were analyzed using T-test.

RESULTS AND DISCUSSION

Carcass Production of Kacang Buck. The average carcass weight of Kacang buck was about 5.66±1.16 kg (38.79±2.41% of the slaughter weight). The slaughtered weights of Kacang bucks in this research were around 10.18 kg to 19.11 kg (14.60±2.84 kg). The slaughtered weights were lower than other researchers that reported 15 kg (Sumardianto et al., 2013), 18.60 kg (Devendra, 1993), and 21.10-21.92 kg (Gafar et al., 2013). Kacang bucks reared by farmers in Grobogan were infested worms in their gastrointestinal tracts because they were grazed early in the morning, were not dewormed, and never fed concentrate. Therefore, the body weight gain decrease gradually. The carcass weight produced was similar to Sumardianto et al. (2013) that reported 5.63 kg (37.50%). However, the dressing percentage were relatively lower than those reported by Devendra (1993), Naser (2006), Gafar et al. (2013), and Hutama (2014). Kacang buck fed concentrate produced 53.3-56.75% (Gafar et al., 2013), 51.64% (Naser, 2006), and 46.67% of dressing percentage (Hutama, 2014). Devendra (1993) stated that dressing percentage of Kacang goat reared by farmers in Malaysia was 44.20%, while those reared in the research station with better management produced 51.30%.

Those Kacang bucks produced 3.57±1.05 kg of chevon (62.69±6.50%), 0.40±0.12 kg of fat (7.26±2.13%), and 1.62±0.15 kg of bone (30.05±6.31% of carcass without kidney). They had meat bone ratio of 2.21±0.64. These results were similar to Sumardianto et al. (2013) research that Kacang goat produced 62.28% of chevon, 9.70% of fat, and 28.02% of bone, and 2.6 of meat bone ratio. Those results indicated that Kacang goats that were grazed and fed roughage without concentrate produced lower chevon. Sebsibe et al. (2007) reported that Ethiopian goats fed concentrate had higher meat bone ratio (4.03 - 5.01) than those pre-experimental slaughter group (3.75 - 4.30).

Chevon Quality of Kacang Buck. The pH value, water-holding capacity, and cooking loss in the Longissimus dorsi muscles were 6.27±0.02, 34.84±2.34%, and 25.28±2.97% respectively, while the value of those in the Bicep femoris muscles were 6.21±0.09, 32.35±1.83%, and 25.91±3.03% respectively (Table 1). Those value were not significantly different (P>0.05) in both Longissimus dorsi muscles and Bicep femoris muscles.
Table 1. Physical Quality of Chevon from Kacang Buck

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Longissimus dorsi</th>
<th>Biceps femoris</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.28 ± 0.02</td>
<td>6.21 ± 0.09</td>
</tr>
<tr>
<td>Water-holding capacity (%)</td>
<td>34.84 ± 2.34</td>
<td>32.35 ± 1.83</td>
</tr>
<tr>
<td>Cooking loss (%)</td>
<td>25.29 ± 2.97</td>
<td>25.91 ± 3.03</td>
</tr>
<tr>
<td>Tenderness (kg/cm²)</td>
<td>6.18 ± 0.36</td>
<td>6.85 ± 0.45</td>
</tr>
</tbody>
</table>

The high pH of Kacang bucks was maybe caused by low muscle glycogen content. Low muscle glycogen content could be due to lack of nutrition caused by traditionally management system. Soeparno (2009) stated that there is a relationship among pH value, glycolysis process, and post-mortem muscle glycogen reserve. Sebsibe et al. (2007) reported that a relatively high pH (5.78 to 5.94) in the local Ethiopian goat (Afar, Central Highland, Long-eared Somali) was caused by inadequate nutrition from the extensive management system. Judge et al. (1989) stated that animal could have high post mortem muscle pH (around 6.5-6.8). The high pH will increase water-holding capacity (relatively the same as living muscle) and decrease cooking loss (Judge et al., 1989). Judge et al. (1989) also stated that the ultimate pH variation was influenced by energy metabolism during muscle to meat conversion process. In this study, the pH value (6.21-6.28) and water-holding capacity/WHC (32.35-34.84%) were higher and the cooking loss (25.29-25.91%) was lower than those of Das and Rajkumar (2010) research. Das and Rajkumar (2010) reported that meat pH of Barbari, Marwari, and Jamunapari goats were between 5.67 and 5.79, while WHC were 22.00-24.00% and cooking loss were 36.00-38.00%. Limea et al. (2009) also reported that Creole goats having lower pH (5.52-5.84) had higher cooking loss (24.40-33.00%). Judge et al. (1989) stated the higher pH (5.2 to 6.8), the more protein bound water, and therefore the WHC increased.

Meat tenderness (Warner-Bratzler shear force) in the Longissimus dorsi (LD) and Bicep femoris (BF) muscles were similar (P>0.05) that were between 5.77 and 7.81 kg/cm² (6.18±0.36 kg/cm² in the LD and 6.85±0.45 kg/cm² in the BF muscles). The similarities of tenderness in LD and BF muscles was influenced by the collagen content of meat that was similar (1.89±0.31% in the Longissimus dorsi muscles, while 2.13±0.11% in the Biceps femoris muscles. Lawrence and Fowler (2002) stated that the higher collagen content, the meat will be less tender.

The content of water, fat, and protein in the Longissimus dorsi and Bicep femoris muscles were similar (P>0.05). Water, fat, and protein content in the Longissimus dorsi muscles were 74.87±1.96%, 3.10±0.95%, and 19.65±1.77%, while those in the Bicep femoris muscles were 74.42±1.60%, 3.30±0.55%, and 19.58±1.29% (Table 2).

Table 2. Chemical Quality of Chevon from Kacang Buck

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Longissimus dorsi</th>
<th>Bicep femoris</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water content</td>
<td>74.87 ± 1.96</td>
<td>74.42 ± 1.60</td>
</tr>
<tr>
<td>Fat content</td>
<td>3.10 ± 0.95</td>
<td>3.30 ± 0.55</td>
</tr>
<tr>
<td>Protein content</td>
<td>19.66 ± 1.77</td>
<td>19.58 ± 1.29</td>
</tr>
<tr>
<td>Collagen</td>
<td>1.89 ± 0.31</td>
<td>2.13 ± 0.11</td>
</tr>
</tbody>
</table>

The water content of meat in Kacang buck reared traditionally (fed roughage) was...
relatively high (72.29%-78.83%). In this study, the water content of meat was higher than in Baiti et al. (2013) research. Baiti et al. (2013) reported that the prediction of water content in goat fed roughage and concentrate (CP=12%) was 58.09% to 58.25%. However, Wismer-Pedersen (1987) stated that water content in lean meat might reach 76%. The variation of water content was influenced by fat content of meat. The higher fat content, the water content will decrease up to 10% (Wismer-Pedersen, 1987). In this research, the high water content was caused by the relatively low fat content of meat (1.19%-4.33%). Low fat content of meat could be caused by under nutrition from traditionally management system that goats were only fed roughages without concentrate (energy source). The fat content of meat was similar to those of Barbari, Marwari, and Jamunapari goats (Indian local breed goats) from semi intensive management system: 1.98-2.64% (Das and Rajkumar, 2010). However, Baiti et al. (2013) predicted that the fat content in goats fed concentrate were around 21.10% to 21.33%. Soeparno (2009) stated that grazed animals tended to produce low fat content and high water content of meat. The protein contents of meat in this study (16.48%-21.89%) were similar to Das and Rajkumar (2010) research that reported 19.21% to 20.01%. Judge et al. (1989) stated that lean meat contained 19-23% of protein, while Musnandar et al. (2011) reported 19.6%-20.7% of meat protein content.

**CONCLUSIONS**

It can be concluded that the carcass production and meat quality of Kacang buck reared traditionally might be increased by improving better management practice. Farmers should improve the quality of feed, and prevent the goat from worm infection to produce higher carcass production and better chevon quality.

**REFERENCES**


Fraud Identification in Meatballs Product Using Porcine Detection KIT and Multiplex Polymerase Chain Reaction Methods

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ABSTRACT: Transparency in meat label is very important. Accurate labeling is essential for protection of consumer health and religious credence, as well as to ensure the authentication of product before consumers decided to purchase. Pork adulteration and its derivates in food product, without any clearly labeling is consider to be fraudulent in trade. The presence of pork in food products are serious concern for moslem as pork is prohibited by The Holy Qur’an. The aim of this research was to determine the presence of pork and to identify meat origins in ten meatballs, taken from northern Yogyakarta-Indonesia. Two methods based on protein and DNA were used for identification. They were Porcine Detection KIT and Multiplex Polymerase Chain Reaction. Porcine Detection KIT is based on principle of immunochromatographic rapid test. The target antigens are bound by highly specific antibodies attached to test line and colored microparticles. While, Multiplex Polymerase Chain Reaction is capable of amplifying few DNA target into milion copies of DNA, using multiple primers. The DNA was isolated from sample using Genomic mini KIT. Optimizing of PCR was conducted in advance to obtain the most optimum annealing temperatures for DNA amplification. Three sets of primer used in this study for multiplex amplification: pig (Sus scrofa), cow (Bos taurus) and chicken (Gallus gallus). PCR products were analyzed by electrophoresis on 1.5% agarose gel run in TBE1x buffer at 100V. The results showed that Porcine Detection KIT and Multiplex Polymerase Chain Reaction can detect the presence of pork in samples. Porcine Detection KIT can detect one sample which contaminated with pork. Multiplex PCR not only can detect the presence of pork, but also beef and chicken. There were two samples contaminated with pork according to multiplex PCR detection

Keywords: Meatball, Porcine Detection KIT, Multiplex Polymerase Chain Reaction

INTRODUCTION

Transparency in meat label is very important. Accurate labeling is essential for protection of consumer health and religious credence, as well as to ensure the authentication of product before consumers decided to purchase. Pork adulteration and its derivates in food product, without any clearly labeling is consider to be fraud in trade. According to Indonesia law, UU No.18/2012, fraud in food products might be subjected to punishment. Besides it, most of Indonesian people are Muslim. Meatball is one of many popular food in Indonesia. In the recent year, there were some issues related to meatball fraudulent. In December 2012, the Department of Livestock and Fisheries of South Jakarta district found a stall selling meatball that contain pork in the Kebayoran Baru (Syailendra, 2012). At the same time, Assessment Body of Food, Drug and Cosmetic Majelis Ulama Indonesia, East Kalimantan, find meatball products in Samarinda and Kutai regency indicated mixed with pork (Amirullah, 2012). Pork protein, due to its being cheap and readily available, might be fraudulently used to substitute other animal proteins. Moslems are required to
eat halal food by ignoring food from pork origine. Halal is an Arabic term which means permitted, allowed, authorised, approved, sanctioned, lawful, legal, legitimate or licit. Guidelines for halal are given by Allah in the Holy Qur’an. Halal meat must be obtained from halal animals and processing only. Over last decades, meat industry has enforced strong measures towards establishment of effective traceability systems to preserve food safety and quality from fram to fork (Shackel, 2008).

The meat chain conforming to all halal requirements is very complex and the risk of cross-contamination is substantial (Bonne et.al, 2008). During processing, food products might be subjected to thermal treatments (e.g. cooking, pasteurisation and sterilisation), high pressure, pH modification, irradiation and drying. Pork protein detection might be impossible, particularly if proteins are degraded or severely or altered during processing. In such case, DNA based methods like PCR can be employed to detect pork detection adulteration in meat products. Identification methods using highly degraded(substrate should be based on the analysis of very short DNA fragments, preferably 100-200 base pair. The objectives of this research was to detect commercial meat balls from fraudulent sources by using Porcine Detection KIT and Multiplex PCR. Porcine Detection KIT is based on immunochromatography, antigen in the sample is bound by a very specific antibodies on the test strip form the antigen-antibody complex. Test strips also contain dyes for marking the antigen microparticles that are bound by the antibody samples. Amplification of PCR is based on the hybridisation of specific oligonucleotides to a target DNA and synthesis. The amplification of DNA fragments, followed by agarose gel electrophoresis for fragment size verification.

MATERIALS AND METHODS

Fresh beef, pork and chicken samples which were used for positive samples were bought from supermarket in Yogyakarta, as well as ten different meat ball samples). Samples were stored -18°C until used. These samples were grounded and then diluted in PBS solution into the concentration of 10% (0.2 g/2 ml), centrifugated on 2,000 rpm for 20 minutes and immunochromatographic strip test were applied to the supernatan of the samples for regarding the solution migration using a porcine detection test-KIT XEMA.

DNA extraction was prepared using Genomic DNA Mini KIT Geneaid Germany with minor modification PCR amplification was performed in final volume of 25 µL containing 12.5 µL Master Mix PCR, 3 µL Primer, 4.5 µL H₂O-PCR, 1 µL MgCl₂ and 4 µL for each template DNA of the samples. PCR was carried out in a INFINIGEN PCR Machine Thermocycler. The cycling conditions: after the initial heat denaturation for 5 min at 94°C followed by 35 cycles at 94°C for 30 sec, 35 cycles at 59°C (for pork primers) and 57°C (for beef and chicken primers) for 1 min, 35 cycles at 72°C for 1 min and a final extension at 72°C for 5 min. Multiplex PCR was developed using each of the primer sets previously designed for simplex PCR. As for simplex PCR, amplification was performed in a final volume of 25 µL containing 12.5 µL Master Mix PCR, 3 µL Primer, 4.5 µL H₂O-PCR, 1 µL MgCl₂ and 4 µL for each template DNA of the samples. The choice of template concentration depend on the nature of sample. PCR products were analyze by electrophoresis on 1.5% agarose gel (Bioron) run in TBE 1X buffer for 55 min at 100 V.
RESULTS AND DISCUSSION

Porcine Detection KIT

Quick qualitative results have found using Porcine Detection-KIT. Based on the Figure 1. has showed the red line on the test strip. The picture was taken 15 minutes after the test strip is dipped in the supernatant samples meatballs. Positive results of samples containing pork indicated by the appearance of two red lines, while one red line showed the negative results. Samples with ambiguous results were retested.

The principle of testing with porcine-KIT detection is based on immunochromatografi. Antigen in the sample is bound by a very specific antibodies on the test strip form the antigen-antibody complex. Test strips also contain dyes for marking the antigen microparticles that are bound by the antibody samples.

The Immunochromatographic test has several advantages over traditional immunoassays, such as simplicity of procedure, rapid operation and immediate results, low cost, no requirements for skilled technicians or expensive equipment. This test also suitable for the on-site detection of antibodies (Shangjin Cui, 2008)

Polymerase Chain Reaction

In Figure 2. can be seen the emergence of DNA in the positive control and the samples were isolated. Based on Figure 2. can be seen that the DNA positive control in the pork, beef and chicken can be seen clearly, showing a lot of isolated DNA. In the sample No. 1, DNA samples were clearly visible, followed by samples number 5, 6 and 8. While the sample number 2, 3, 4 and 7 were not so obvious, but still visible, whereas in sample numbers 9 and 10 is hardly noticeable. DNA samples isolated in lines number 2, 3, 4 and 7 are not so obvious. This is possibility that DNA was degraded during the cooking process of meatballs or meatballs are heated repeatedly. Bottero et al. (2003), DALMASSO et al. (2003) states that the DNA is degraded into the smallest fragment can still be done by PCR amplification. In the sample number 4 and 7, visualization under UV light visible generate smear. This can occur because on meatball dough contain contaminant.
compounds such as oligopeptides, polysaccharides, proteins or other organic materials (Nuraini, 2004).

Multiplex PCR

Multiplex PCR was performed using three primer types: pork, beef and chicken in a single reaction. Positive control used were fresh meat pork, beef and chicken in a single reaction. Figure 3. shows the results of multiplex PCR products electrophoresis with 1.5% agarose gel at a voltage of 100 volts for 60 minutes. It showed that the amplification of DNA in all samples with DNA fragments that appeared 290 bp for the pork (*Sus scrofa*), 104 bp for the species of beef (*Bos taurus*) and 183 bp for the species chicken (*Gallus gallus*).

Samples containing pork has indicated by the appearance of DNA at 290bp on the sample number 7 and number 9. The DNA appears on the sample number 9 is much thinner than the number 7 which is thick and clearly visible. Samples containing beef has shown by the appearance of DNA with 104 bp length. It were visible clearly on the sample numbers 1 to 10. Samples containing chicken has indicated at 183bp that can be seen in the sample numbers 2-10, but only the sample numbers 2,5,7 and 9 were visible, the rest has formed very thin. PCR is capable of amplifying very few copies of DNA and its detection limit is much lower than what is observed with protein based assays. PCR amplification is based on hybridization of specific oligonucleotides to a target DNA and synthesis of million copies flanked by these primers. The simplest PCR strategy applied to evaluate presence of any species in a meat product is the amplification of DNA fragment, followed by agarose gel electrophoresis for fragment size verification.

The main difficulty in the development of a multiplex PCR is the difference in length of amplified fragments, they should differ in length by 40-50 bp to permit adequate resolution of fragments by agarose gel electrophoresis. Other difficulties can arise when samples are subjected to severe heat treatments. In These cases, DNA fragmentation reduces the number of species that can be identified at the same time to four or five (Bottero, M. T. And Dalmasso,A, 2011)
CONCLUSION

Fraudulent meat balls in commercial market could be detected by Porcine Detection KIT and Multiplex Polymerase Chain Reaction.

ACKNOWLEDGEMENTS

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REFERENCES


Identification of Dog Meat Species by Polymerase Chain Reaction (PCR)

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Corresponding author: * Email: dyahaw@ugm.ac.id

ABSTRACT: Recently, consumption of animal protein, especially meat consumption in Indonesian society continues to have a trend a significant increase from year to year. As a country with Muslim majority, the provision of food of animal origin that are safe, healthy, whole and halal is a challenge that must be met in order to meet the demand for animal protein. The existence of a food safety issue, namely the phenomenon of adulteration of meat consumption is a priority to be anticipated. Meat adulterations have been reported mainly in processed meat products such as beef meatballs mixed with pork or chicken meat. Nevertheless, meat adulteration by adding dog meat into the beef products, is feared will happen too. This is because dog meat is also widely consumed by the public. The purpose of this study was to detect the DNA of dog meat and dog meat content in the beef meatballs with simplex polymerase chain reaction technique (PCR). The study was conducted using sample of fresh and cooked dog meat to determine DNA of dog species and determined dog meat content in beef meat balls using variation level of mixture at 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100%, respectively. Furthermore, determination of species of dog meat is done by PCR. The results indicated that dog meat species were accurately determined in PCR. It is concluded that PCR can be useful for fast, easy, and reliable control of adulterated consumer meat products. These findings may contribute to a better awareness about food safety and concern of halal food.

Keywords: dog meat, adulteration, meat ball, PCR

INTRODUCTION

The level of consumption of dog meat in Indonesia tends to increase today. The consumption of dog meat is present in several regions in Indonesia, including Yogyakarta, Solo, Jakarta, Bandung, Bali, Medan, Manado and others (Prabowo, 2014). Dog meat consumption tends to increase is not in accordance with the rules of food of animal origin that are safe, healthy, whole, and halal (ASUH). Food safety of animal origin is food that does not contain ingredients that may interfere with or endanger human health. Food of animal origin is a healthy food derived from healthy animals and cut, or dealt with in ways determined. Food of animal origin is a whole food that does not deviate or reduced by a substance. Food of animal origin is a halal food derived from animals were handled in accordance with Islamic law. Dog meat, including meat that is forbidden in Islamic law is therefore is necessary to get control. Increased consumption of dog meat is high enough feared will lead to adulteration of the consumption of halal meat to dog meat. Adulteration of food of animal origin with the dog meat is quite profitable since stray dogs in some countries performed at a cheap price (Rahman et al., 2014). Facts on society shows that lately people have noticed the authenticity of meat and processed meat products must halal for consumption (Nakyinsige, 2012). In Indonesia, the government has set rules regarding halal food contained in the Decree of the Ministry of Religion of the Republic of Indonesia Number 578 of 2001, “ Halal food is food that does not contain elements or illicit material that is forbidden to be

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consumed by Muslims and processing does not conflict with Islamic law”. It is also listed in the Act no. 18 in 2009, in the Part of the Veterinary Public Health, Article 56. jo. Act no. 41 in 2014, “Veterinary Public Health is an organization of animal health in the form: b). Guarantee the safety, health, wholeness, and halal animal products”.

One way of monitoring that can be done is by conducting laboratory tests on meat and food products of animal origin were falsified. Test against counterfeiting of food products of animal origin using Enzyme Linked Immunosorbent Assay (ELISA) and Polymerase Chain Reaction (PCR) has been widely reported. The PCR technique were considered in this study to reveal a method of rapid detection, high sensitivity, inexpensive, and accurate of dog meat adulteration in Indonesia.

MATERIAL AND METHODS

**Meat samples.** Meat samples were in the form of fresh dog meat and processed dog meat sold in stalls and meatballs. Meat ball samples were made from mixture between beef and dog meat with some differences in concentration of 5 to 10%. The mixtures of meat were prepared in a total weight of 100 g. Meat samples were stored at −20 ± 1 °C until analyzed.

**Genomic DNA extraction.** Genomic DNA was extracted from each meat samples by using Genomic DNA mini kit (Geneaid, USA) and used for PCR analysis. The amount of 30 mg of flesh were cut into pieces and put in a 1.5 ml microcentrifuge tube. Meat samples were crushed using a micro pastel and 200 µl GT buffer were added for homogenized. The amount of 20 µl proteinase K (10 mg/ml) was added for cell lysis. Then DNA genomic extracted according to kit instructions. The purified DNA was eluted in elution buffer provided with kit and stored at −20 °C, and the extracted DNA was checked by Nanodrop Spectrophotometer.

**Purity and concentration of DNA.** DNA concentration was calculated at a wavelength of 260 nm, protein absorbance at a wavelength of 280 nm and purity of DNA was calculated by comparing the OD 260 and OD 280. The concentration of DNA (ug/ml) = A 260 x 50 x dilution factor (Sambrook and Russel, 2001).

**Primers.** Primers PCR primers for the amplification of dog meat were designed as described by Martin et al. (2007), forward primers were AATTGAATCGGGCCATGAA and reverse primers were CTCCTCTTGTGTTTTAGTTAATCTG.

**Polymerase Chain Reaction (PCR).** The 25-µl reaction mixture was prepared in an Eppendorf tube containing 2 µl sample DNA, 1.25 µl forward primer, 1.25 µl reverse primer, 8 µl ddH2O and 12.5 µl Kappa. The thermocycler was programmed for 40-cycle PCR. The PCR program could be seen in the Table 1.

<table>
<thead>
<tr>
<th>Step</th>
<th>Temperature (°C)</th>
<th>Time</th>
<th>Cycle (X)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predenaturation</td>
<td>93</td>
<td>2 minutes</td>
<td>1</td>
</tr>
<tr>
<td>Denaturation</td>
<td>93</td>
<td>30 second</td>
<td>40</td>
</tr>
<tr>
<td>Annealing</td>
<td>50</td>
<td>30 second</td>
<td>40</td>
</tr>
<tr>
<td>Extension</td>
<td>72</td>
<td>15 second</td>
<td>40</td>
</tr>
<tr>
<td>Last extension</td>
<td>72</td>
<td>3 minutes</td>
<td>1</td>
</tr>
</tbody>
</table>

Electrophoresis was run on agarose gel (2%) at 50 V, 1 hour. The resulting gel was stained with FluoroSafe DNA Stain and DNA loading dye (Geneaid), visualized using a UV transilluminator, and photographed with digital camera.

RESULTS AND DISCUSSION

Results of calculation the purity and concentration of DNA meat samples shown in Table 3.
Table 3. Calculation of DNA purity and concentration

<table>
<thead>
<tr>
<th>No.</th>
<th>Samples</th>
<th>OD 260</th>
<th>OD 280</th>
<th>Purity of DNA (µg/ml)</th>
<th>Concentration of DNA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Fresh beef</td>
<td>0.1508</td>
<td>0.1915</td>
<td>2.262</td>
<td>0.787</td>
</tr>
<tr>
<td>2.</td>
<td>Bovine meat balls</td>
<td>0.2340</td>
<td>0.2642</td>
<td>3.510</td>
<td>0.886</td>
</tr>
<tr>
<td>3.</td>
<td>Fresh dog meat</td>
<td>0.1790</td>
<td>0.2155</td>
<td>2.685</td>
<td>0.830</td>
</tr>
<tr>
<td>4.</td>
<td>Processed dog meat</td>
<td>0.1733</td>
<td>0.2095</td>
<td>2.599</td>
<td>0.827</td>
</tr>
<tr>
<td>5.</td>
<td>Dog meat ball 5%</td>
<td>0.1519</td>
<td>0.1918</td>
<td>2.278</td>
<td>0.792</td>
</tr>
<tr>
<td>6.</td>
<td>Dog meat ball 10%</td>
<td>0.1559</td>
<td>0.1960</td>
<td>2.338</td>
<td>0.795</td>
</tr>
<tr>
<td>7.</td>
<td>Dog meat ball 20%</td>
<td>0.1461</td>
<td>0.1864</td>
<td>2.191</td>
<td>0.784</td>
</tr>
<tr>
<td>8.</td>
<td>Dog meat ball 30%</td>
<td>0.1504</td>
<td>0.1904</td>
<td>2.256</td>
<td>0.790</td>
</tr>
<tr>
<td>9.</td>
<td>Dog meat ball 40%</td>
<td>0.1478</td>
<td>0.1886</td>
<td>2.217</td>
<td>0.784</td>
</tr>
<tr>
<td>10.</td>
<td>Dog meat ball 50%</td>
<td>0.1403</td>
<td>0.1816</td>
<td>2.104</td>
<td>0.773</td>
</tr>
<tr>
<td>11.</td>
<td>Dog meat ball 60%</td>
<td>0.1471</td>
<td>0.1871</td>
<td>2.206</td>
<td>0.786</td>
</tr>
<tr>
<td>12.</td>
<td>Dog meat ball 70%</td>
<td>0.1561</td>
<td>0.1968</td>
<td>2.341</td>
<td>0.793</td>
</tr>
<tr>
<td>13.</td>
<td>Dog meat ball 80%</td>
<td>0.1434</td>
<td>0.1838</td>
<td>2.151</td>
<td>0.780</td>
</tr>
<tr>
<td>14.</td>
<td>Dog meat ball 90%</td>
<td>0.1425</td>
<td>0.1829</td>
<td>2.137</td>
<td>0.779</td>
</tr>
<tr>
<td>15.</td>
<td>Dog meat ball 100%</td>
<td>0.1447</td>
<td>0.1852</td>
<td>2.170</td>
<td>0.781</td>
</tr>
</tbody>
</table>

There were differences variation in the concentration of DNA that could be caused by physical treatment given as well as the ability to break down the cell extraction buffer (Mulyani et al., 2011). The purity of DNA obtained does not indicate the value range of 1.8 to 2. The purity of DNA that are less than 1.8 indicate contamination of protein and or phenol while DNA purity values greater than 2 indicates contamination of Ribo Nucleic Acid (RNA) (Clark and Christopher, 2000). Thenawijaya (1995) stated that the purity of DNA is affected by the presence of fat, proteins, polysaccharides and organic materials.

Furthermore, the results showed the DNA isolation band intensities varying obtained on the results of electrophoresis using a 2% agarose gel (Figure 1). Concentration and purity of DNA does not necessarily indicate a band with a thickness of high intensity.
Figure 1. Agarose gel analysis from (1) fresh beef, (2) bovine meat balls, (3) fresh meat, (4) processed dog meat, (5) dog meat ball 5%, (6) dog meat ball 10%, (7) dog meat ball 20%, (8) dog meat ball 30%, (9) dog meat ball 40%, (10) dog meat ball 50%, (11) dog meat ball 60%, (12) dog meat ball 70%, (13) dog meat ball 80%, (14) dog meat ball 90%, (15) dog meat ball 100%

The quality of the isolated DNA can be influenced by the heating process and physical treatments on dogs and processed meat meatball dog. It is also influenced by the addition of spices or other ingredients such as flour (Andree, et al., 2004, Fibriana, 2001).

Figure 2 showed the result of PCR product electrophoresis of dog meats. In this study, primer used for PCR was 12S ribosomal RNA gene. The result of PCR product electrophoresis dog meats were specific using 12S ribosomal RNA gene residing on the size of 101 bp. (Martin, 2006). In this figure, fresh dog meat (no 3), processed dog meat (no. 4) and dog meatballs with various concentrations (no. 5-15) showed a fluorescent band and parallel to the size of 100 bp. Fresh beef (no 1) and bovine meat ball (no 2) were used as negative controls and showed no fluorescent band.

Ali et al. (2014) detected until 0.1% dog meat in beef sausage using PCR technique. Besides, Ilhak and Arslan, 2007 by using PCR technique also could detect the mixture of dog meat 0.1% in beef, goat and lamb. Matsunaga et al. (1999) also reported the PCR products of the various processed meat, such as beef, goat, lamb, chicken, horse and pork with temperature 100 oC or 120 oC, 120 min. Their results revealed that PCR was the method of choice for identifying meat species in muscle foods.

Figure 2. Agarose gel analysis of PCR products. (M) marker DNA ladder 100 bp, (1) fresh beef, (2) bovine meat balls, (3) fresh meat, (4) processed dog meat, (5) dog meat ball 5%, (6) dog meat ball 10%, (7) dog meat ball 20%, (8) dog meat ball 30%, (9) dog meat ball 40%, (10) dog meat ball 50%, (11) dog meat ball 60%, (12) dog meat ball 70%, (13) dog meat ball 80%, (14) dog meat ball 90%, (15) dog meat ball 100%

CONCLUSION

The PCR techniques can be used to determine the DNA of fresh dog meat and processed so that halal food security can be realized. The PCR technique can be useful for fast, easy, and reliable control of adulterated consumer meat products. These findings may contribute to a better awareness about food safety and concern of halal food.
REFERENCES


Study on the Physico-Chemical Characteristics of Meat from Goat Given Ration Papaya Leaves (*Carica papaya* L.)

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ABSTRACT: This research was conducted to study the effect of papaya leaves feeding on the physico-chemical characteristics of goat meat. Twelve (12) Bligon goats with bodyweight of about 16 kg were divided into three groups, each group consisted of 4 Bligon goat. Group A was fed (as the control) 0% Papaya leaves+60% Elephant grass+40% concentrate, group B was fed 15% Papaya leaves+45% Elephant grass+40% concentrate, and group C was fed 30% Papaya leaves+30% Elephant grass+40% concentrate. The goat growth period was conducted for two months and the goats were slaughtered to take samples from *Longissimus dorsi* (LD) and *Biceps femoris* (BF) muscles. The data from Completely Randomized design were analyzed by analysis of variance of factorial pattern 3x2 (three levels of Papaya leaves feeding and two kinds of meat samples) with three replications for each treatment. The mean differences were further tested by Duncan’s New Multiple Range Test. The result showed that there were not significant differences (P>0.05) on the chemical composition (moisture, protein, fat, and collagen) as affected by levels of Papaya leaves. The levels of Papaya leaves resulted in significant differences (P<0.05) on color and water-holding capacity, and there were no further differences for pH, cooking loss, and tenderness.

Keywords: Physical characteristic, Chemical composition, Goat meat, Papaya leaves

INTRODUCTION

Meat is one of food source which plays a great role to fulfill daily nutrition of human life. Meat and meat products are essential in the diet and required to maintain the health of a human body (Nestle, 1999). The nutritive value of meat is very high due to the presence of high quality protein, vitamins, minerals and fat (Mallika *et al*., 2009). The goat meat is widely consumed and is important source of animal protein, preferred and comparable with other meats in respects to its moisture, protein and ash contents, contains more arginine, isoleucine and adequate amount of essential amino acids (Rahman *et al*., 2012). But recently, negative campaign about muscle food, and their possible health hazard effects, shows that consumers are increasingly interested about health oriented functional meat products (Biswa *et al*., 2011). To clarify the minor opinion, some researches of animal feeding modification are undergone, expected to result animal source food especially meat that not only fulfilling nutritional need but to raising consumer’s health status as well.

Feeding Papaya leaves as ration for goat is one effort to utilize herbs and medicinal plants, considering food feeding has positive influent to livestock that will increase meat quality and give
benefits to health status. The plant might provide a useful source of new medicines, pharmaceutical entities and bioactive compounds for enhancing animal production and health; and food safety and quality, while conserving environment (Makkar et al., 2007). Ayoola & Adeyeye (2010) analyzed for the phytochemical composition, phytochemical screening and revealed the presence of bioactive compound such as saponins, cardiac glycoside, alkaloids and absence of tannins in the green, yellow and brown Papaya leaf. The qualitative phytochemical analysis of *Carica papaya* leaves showed the presence of alkaloid, flavanoid, Saponin, Tannin and Glycosides (Adachukwu, 2013). It is obvious from plant secondary metabolites (PSM) biochemistry that PSM have a wide range of biological activities and enomous potential for uses in animal production (Mirzaei, 2012). Therefore, the objective of this study was to evaluate the effects of papaya leaves feeding on the physico-chemical characteristics of goat meat.

**MATERIALS AND METHODS**

Before this biologic experiment was begun, animal care and handling were accomplished based on experimental method with through 2 phases; palatability phase and adaptive phase.

**Animals and Diets.** Twelve Bligon goats (mean body weight 16 ± 0.5 kg) were used in this study and divided into 3 groups. Each group consisted of 4 Bligon goat and fed 3 dietary treatments. These 3 diets were: 1) Group A (R0): 0% Papaya leaves + 60% Elephant grass + 40% concentrate, 2) Group B (R1): 15% Papaya leaves + 45% Elephant grass + 40% concentrate, and 3) Group C (R2): 30% Papaya leaves + 30% Elephant grass + 40% concentrate. Goats were housed in 1.5 x 0.75 m individual pens and allowed ad libitum access to water during 8 weeks.

**Goat Slaughter and Sample Collection.** After feed treatment, all of goats were slaughtered by Halal method (Sivakumar, 2013; Budiharta, 2009; Soeparno, 2009). Muscle sampling (*Longissimus dorsi*/*LD and Biceps femoris*/BF) were taken from the half of each carcass. The samples was trimmed free of all subcutaneous fat and epimysial connective tissue, approximately 100 g, was frozen and stored at -20°C until chemical analysis (Sanudo et al., 2000).

**Meat Quality Measurement.** The pH level postmortem of *L.dorsi* and *B.femoris* muscles were measured using a pH meter equipped with a penetrating electrode. The color was measured on the muscle surface at 60 min after cutting, using a color chart provided by Meat Colour Scores AUSMEAT. Cooking loss was evaluated in refrigerated meat samples of similar geometry, individually placed inside polyethylene bags in a water bath at 80°C during 30 min and cooled for 15 min under running tap water. They were taken from the bags, dried with filter paper and weighed. The Warner-Bratzler shear force was evaluated in subsampels, prepared manually, of 1.5 cm$^2$ cross section and 3 to 4 cm in length. The water-holding capacity (WHC) was determined by using the method recommended by Hertog-Meischke et al. (1997) cited Cetin et al. (2012), 300 mg meat samples placed on Whatman filter paper. The samples were kept between glass slip and under a fixed weight of 1 kg for 20 minutes. At the end of the waiting period, the filter paper was taken. The impressions released by the water were measured using milimetric paper and calculated. The proximate composition such as moisture, protein, fat and collagen were determined on fresh *L.dorsi* and *B.femoris* muscle samples by using foodscan the method of NIRS (Near infrared spectroscopy) according to AOAC (2007).

**Statistical Analysis.** A completely randomized design of factorial 3 x 2 analysis with feeding treatment factor and meat sample factor was used to evaluate chemical composition and physical quality. When analysis of variance revealed a significant (P<0.05) effect, means were separated using Duncan’s Multiple Range Test (DMRT) (Steel & Torrie, 1993).
RESULTS AND DISCUSSION

Chemical Composition. The chemical composition of *L.dorsi* and *B.femoris* muscles are presented in the Table 1.

Table 1. The effect of fed papaya leaves on chemical composition of goat meat

<table>
<thead>
<tr>
<th>Parameter (%)</th>
<th>Muscle</th>
<th>Papaya leaves levels (%)</th>
<th>Average&lt;sup&gt;ns&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture content</td>
<td>LD</td>
<td>70.96±2.15</td>
<td>72.67±1.48</td>
</tr>
<tr>
<td></td>
<td>BF</td>
<td>73.76±0.79</td>
<td>72.76±0.51</td>
</tr>
<tr>
<td></td>
<td>Average&lt;sup&gt;ns&lt;/sup&gt;</td>
<td>72.36±2.12</td>
<td>72.72±1.03</td>
</tr>
<tr>
<td>Crude Protein</td>
<td>LD</td>
<td>19.85±1.21</td>
<td>19.74±0.43</td>
</tr>
<tr>
<td></td>
<td>BF</td>
<td>20.52±0.34</td>
<td>20.42±0.16</td>
</tr>
<tr>
<td></td>
<td>Average&lt;sup&gt;ns&lt;/sup&gt;</td>
<td>20.18±0.90</td>
<td>20.08±0.47</td>
</tr>
<tr>
<td>Crude Fat</td>
<td>LD</td>
<td>7.37±2.98</td>
<td>5.27±1.83</td>
</tr>
<tr>
<td></td>
<td>BF</td>
<td>3.28±0.96</td>
<td>4.55±0.60</td>
</tr>
<tr>
<td></td>
<td>Average&lt;sup&gt;ns&lt;/sup&gt;</td>
<td>5.32±2.99</td>
<td>4.91±1.32</td>
</tr>
<tr>
<td>Collagen</td>
<td>LD</td>
<td>1.76±0.25</td>
<td>1.59±0.18</td>
</tr>
<tr>
<td></td>
<td>BF</td>
<td>1.57±0.10</td>
<td>1.58±0.13</td>
</tr>
<tr>
<td></td>
<td>Average&lt;sup&gt;ns&lt;/sup&gt;</td>
<td>1.67±0.20</td>
<td>1.63±0.12</td>
</tr>
</tbody>
</table>

<sup>ns</sup> = not significant
Pl = Papaya leaves

The analysis of variance on chemical composition revealed that there were no significant (P>0.05) difference between the three Papaya leaves levels. The result showed that Papaya leaves feeding (R1 & R2) did not significantly effect on the chemical composition including moisture content, crude protein, crude fat and collagen.

Physical Quality. The Physical Quality of *L.dorsi* and *B.femoris* muscles are presented in the Table-2. The evaluation of physicochemical quality (instrumental color, pH, water-holding capacity = WHC, cooking loss and shear force value) was found to the considerably variables. Papaya leaves feeding did not affect on pH value, cooking loss and shear force value, but on color and WHC were significantly different (P<0.05). According to the result, suggest that myoglobin pigment concentration in group R1 (Papaya leaves level 15%) is clearly deposited in red fiber in muscle, this result is in agreement with Biswas et al. (2011) who stated that color attributes (hue, chroma and value) were affected by the addition of fiber, color is one of the most important quality attribute that affects consumer’s acceptability of the meat. Lawrie & Ledward (2006) stated that myoglobin pigment concentration is the determinant for meat color. Water holding capacity of LD and BF muscles showed difference among treatments R0, R1 and R2, this described that Papaya leaves feeding could increase the water holding capacity in LD and BF muscles. Water holding capacity is very important to determine meat taste and texture so it is substantial for food formulation. Soeparno (2009) stated that food water holding capacity is associated with protein involvement therefore the main factors affecting water holding are pH, salt and temperature.
Table 2. The effect of fed papaya leaves on physical quality of goat meat

<table>
<thead>
<tr>
<th>Parameter (%)</th>
<th>Muscle</th>
<th>Papaya leaves levels (%)</th>
<th>Average&lt;sup&gt;ns&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R0 (0% Pl)</td>
<td>R1(15% Pl)</td>
<td>R2(30% Pl)</td>
</tr>
<tr>
<td>Color</td>
<td>LD</td>
<td>3.33±0.72</td>
<td>4.33±0.48</td>
</tr>
<tr>
<td></td>
<td>BF</td>
<td>3.80±0.86</td>
<td>4.33±0.62</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>3.57±0.82&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.33±0.55&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>pH</td>
<td>LD</td>
<td>6.17±0.99</td>
<td>6.20±0.19</td>
</tr>
<tr>
<td></td>
<td>BF</td>
<td>6.17±0.09</td>
<td>6.13±0.03</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>6.17±0.09</td>
<td>6.17±0.04</td>
</tr>
<tr>
<td>WHC (%)</td>
<td>LD</td>
<td>17.14±7.44</td>
<td>27.60±5.17</td>
</tr>
<tr>
<td></td>
<td>BF</td>
<td>15.86±6.63</td>
<td>20.34±8.03</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>16.51±6.56&lt;sup&gt;a&lt;/sup&gt;</td>
<td>23.97±7.36&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Cooking Loss</td>
<td>LD</td>
<td>35.52±4.10</td>
<td>36.75±5.07</td>
</tr>
<tr>
<td></td>
<td>BF</td>
<td>42.45±1.43</td>
<td>39.67±2.49</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>38.99±4.67</td>
<td>38.21±4.01</td>
</tr>
<tr>
<td>Shear force value (kg/cm&lt;sup&gt;2&lt;/sup&gt;)</td>
<td>LD</td>
<td>7.94±3.25</td>
<td>7.11±3.54</td>
</tr>
<tr>
<td></td>
<td>BF</td>
<td>10.55±4.45</td>
<td>6.48±3.09</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>9.25±3.87</td>
<td>6.80±3.10</td>
</tr>
</tbody>
</table>

<sup>ab</sup>: Average in the same row with different superscript are significantly different -(P<0.05)

<sup>ns</sup> = not significant

Pl = Papaya leaves

CONCLUSIONS

The most important of this study was the chemical composition which did not change by Papaya leaves feeding for goat. The most of the physical quality of goat meat did not change significantly, but the color scores and water-holding capacity increased. It was shown that Papaya leaves in the diet did not influence on physicochemical quality of goat meat.

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The Effect of Acetic Acid Concentration and Curing Time on the Characteristics of Native Chicken Legs Skin Gelatin

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ABSTRACT: Gelatin is a denaturalized protein that is derived from collagen by acidic or alkaline hydrolysis and is an important functional biopolymer that has a very broad application in many industrial fields. This research was aimed to determine the effect of acetic acid concentration and curing time on the characteristics of native chicken legs skin gelatin. The experiment used Completely Randomized Design (CRD) with two factors and three replicates of treatment. The first factor was concentration of acetic acid solution, consisted of (3, 5 and 7%). The second factor was immersion time in acetic acid (12, 24 and 36 hours). The result showed that concentration acetic acid solution had significant effect (P<0.05) on the yields, gel strength, viscosity and protein content of native chicken legs skin gelatin but had no significant effect (P>0.01) on water content and pH value. The curing time had no significant effect (P>0.05) on the pH value, yields, gel strength and viscosity of gelatin. It was concluded that the native chicken legs skin gelatin with concentration of acetic acid 3, 5 and 7% had similar characteristics to the commercial gelatin but the best characteristics gelatin was produced from 3% acetic acid concentration and 24 hours curing time (yields 12.31%, gel strength 64.16 g/Bloom, viscosity 5.50 cP, protein content 89.90%, water content 7.31% and pH value 5.33).

Keywords: Acetic acid, Gelatin, Native chicken legs skin and Curing

INTRODUCTION

Gelatin is a protein of animal origin, that can be obtained from collagen by acidic or alkaline hydrolysis. Gelatin is a denaturalized protein that is derived from collagen and is an important functional biopolymer that has a very broad application in many industrial fields. Its functional properties depend on processing conditions as well as the raw material (Sobral and Habitante, 2001). Gelatin production required a curing step to improve quality of gelatin. Curing materials from the group of acids have been widely applied in gelatin production. Effect of Acetic Acid concentration and curing time to produce gelatin from native chicken legs skin was limited information. Thus, this research was conducted to study the effect of combination between different concentration acetic acid solution and curing time on characteristics of native chicken leg skin gelatin.
MATERIALS AND METHODS

Materials. Five thousand g native chicken legs skin were used as a raw material, acetic acid solution (CH₃COOH 0.5M), and distilled water.

Preparation of gelatins. Gelatine was prepared by the acid extraction method (Ockerman and Hansen, 2000). Acetic acid (CH₃COOH 0.5M) concentrations of 3%, 5% and 7% (v/v) were used as a treatments. The raw material were soaked at different curing time of acetic acid solution 12 hours, 24 hours and 36 hours. After soaked, samples were neutralized to pH 6, weighed and extracted. The extraction process were performed on three steps (each step for 3 hours), the first step at 50°C, second step at 55°C and then at 60°C. Solubilized gelatin was separated from residual skin fragments by filtration through a nylon filter. The extracted gelatin was concentrated at 70°C for 5 hours and it was stored in the refrigerator 5-10°C for 30 minutes, then dried at 60°C for 24-36 hours until the gelatin sheet solid. Gelatin sheets were milled and packaged in vacuum plastic and stored in a desiccator for subsequent process.

Experimental design and data analysis. The experiment were determined by analysis of Completely Randomized Design (Steel and Torrie, 1991) with two factors and three replicates of treatments. The first factor was concentration of acetic acid solution consisting of 3 levels (3, 5 and 7 percents). The second factor was different curing time consisting of 3 levels (12, 24 and 36 hours). The significant differences of the average were determined using Duncan’s new multiple range test.

Parameters. The characteristics parameters of this research were yield, gel strength, viscosity, protein content, water content and pH value gelatin. The yield obtained from dry weight ratio of raw material and the weight of the extracted pigskin multiplied by 100% (AOAC, 1995). Gel strength was determined with a Universal Testing Machine (Zwick/Z.0,5). Gelatin solution 6.67% w/v (6.67 grams to 100 ml distilled water) was heated at 60°C to dissolve the particles. Solution in the container Ø5 cm and height 6 cm was stored at 5°C for 16-18 hours. Gelatin was placed at the bottom of the plunger (Ø=13mm). Measurement was conducted at the temperature of 10°C and the speed 10 mm/min as deep as 4 mm was used as plunger. The value of gel strength (g Bloom) use the formula = 20 + 2.86 x 10-3D, where D = F/G x 980; F = height chart before fracture; G = constant (0.07) (Said et al., 2011). Viscocity was measured by gelatin powder dissolved in distilled water at a temperature of 40°C with a solution concentration of 6.67%.

RESULTS AND DISCUSSION

Yield. The yield is amount of dry gelatin produced from a number of raw materials with extraction process (Said, 2011). Statistical analysis showed that the interaction between the concentration of acetic acid and curing time had no significant (P> 0.05) while the concentration of acetic had significant effect (P< 0.05) on the yield of native chicken legs skin gelatin. Duncan test resulted that the yield of gelatin tended to rise with increasing the level of acetic acid concentration. Chamidah and Elita (2002 ) reported that acetic acid solution used to hydrolyze collagen making it easier solubility in hot water when the extraction of gelatin. The collagen structure is open due to several bond in protein molecules apart. Several author have reported different gelatin yield, from the 16 % (Binsi et al., 2009), the skin of goat was 6.32% (Said et al., 2011). Yield of these results were 13.01 to 14.42 % and it was included in the range of Indonesian National Standard of gelatin (Taufik, 2011).
Table 1. The characteristics of native chicken leg skin gelatin

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Curing (hours)</th>
<th>Acetic acid concentration (%) + Sd</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Yields (%)</td>
<td>12</td>
<td>13.20±0.05</td>
<td>13.52±0.02</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>14.12±0.03</td>
<td>14.42±0.21</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>13.01±0.07</td>
<td>13.11±0.10</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>13.44±0.02b</td>
<td>13.68±0.05c</td>
</tr>
<tr>
<td>Gel Strength (g/Bloom)</td>
<td>12</td>
<td>64.84±0.62</td>
<td>65.81±0.56</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>64.16±0.40</td>
<td>66.02±0.02</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>64.12±0.17</td>
<td>66.09±0.91</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>64.37±0.17c</td>
<td>65.96±0.02d</td>
</tr>
<tr>
<td>Viscosity (cP)</td>
<td>12</td>
<td>5.70±0.37</td>
<td>4.43±1.04</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>5.50±0.12</td>
<td>4.40±0.11</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>4.50±0.16</td>
<td>4.41±1.14</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>5.23±5.15a</td>
<td>4.41±0.79d</td>
</tr>
<tr>
<td>Protein Content (%)</td>
<td>12</td>
<td>88.63±0.08</td>
<td>88.21±0.17</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>89.60±0.10</td>
<td>89.33±0.12</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>89.92±0.17</td>
<td>89.43±0.01</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>89.38±0.62c</td>
<td>88.99±0.62c</td>
</tr>
<tr>
<td>Water Content (%)</td>
<td>12</td>
<td>7.36±0.01</td>
<td>7.19±0.16</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>7.31±0.03</td>
<td>7.19±0.21</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>7.22±0.19</td>
<td>7.44±0.27</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>7.31±0.62c</td>
<td>7.27±0.22c</td>
</tr>
<tr>
<td>pH Value</td>
<td>12</td>
<td>5.26±0.08</td>
<td>5.28±0.17</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>5.33±0.10</td>
<td>5.26±0.12</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>5.23±0.34</td>
<td>5.25±0.56</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>5.27±0.62b</td>
<td>5.26±0.06b</td>
</tr>
</tbody>
</table>

Different letters in the same row and column indicated the significant differences (P<0.05)

**Gel strength.** Gel strength is very important on physical properties of gelatin. The average gel strength of native chicken legs skin gelatin was displayed in Table 1. Statistical analysis indicated that the level of acetic acid concentration gave significant effect (P<0.05) while the level curing time and their interaction had no significant effect (P>0.05) on gelatin. The value of gel strength was increase with increasing acetic acid level. Arnesen and Gildberg (2002) reported that a high content of hydroxyproline caused the gel strength increased. The presence of hydroxyproline caused the stability of the hydrogen bonds between water molecules and free hydroxyl groups of amino acids in gelatin, it is very important for gel strength. Furthermore Sims et al. (1997) reported that the gel formation of a stable condition that ability of a free chain to form a lot of crosslinking. Gel strength values of gelatin was ranged 64.12 - 67.09 g Bloom, that in line with the criteria of ISO 75-300 g Bloom (Said, 2011)

**Viscosity.** The average viscosity of native chicken legs skin gelatin is displayed in Table 1. Statistical analysis indicated that interaction between acetid acid concentration and curing time
had no significant effect \((P>0.05)\) on gelatin. The value of viscosity tended to decreased at the acetic acid and curing time increased. In order words, the higher concentration, the viscosity was tended to decreased. This is because the curing material has been breaking the peptide bonds of amino acids into short-chain molecule so that its viscosity decrease. This is because the viscosity of gelatin is directly proportional to the gel strength that was not significantly different between treatments \((\text{Astawan et al., 2002})\). Furthermore, \(\text{Ulfah et al. (2011)}\) explained that viscosity is affected by molecular weight and amino acid chain length. Increased concentrations of \(\text{CH}_3\text{COOH}\) in the gelatin production process can reduce the viscosity. This is because the curing material has been breaking the peptide bonds of amino acids into short-chain molecule so that its viscosity decrease. Viscosity values from these research was ranged 4.27 to 5.70 cP. It values is included in the ISO range 2.0 to 7.5 cP \((\text{Sompie et al., 2012})\).

**Protein Content.** Gelatin is the collagen protein, a group derived from the structural proteins and extracellular matrix and produced in large quantities \((\text{Said et al., 2011})\). The average protein content of native chicken legs skin gelatin was presented in Table 1. Statistical analysis indicated that the differences in level of acetic acid concentration had high significant effect \((P<0.05)\) on protein content of gelatin, whereas the curing time and the interaction between these two different factors had no significant effect \((P>0.05)\) on levels of protein gelatin. Duncan test results showed that protein content of gelatin from chicken skin had a tended to increase with increasing level of acetic acid solution. According to \(\text{Swatland (1984)}\), age slaughter affect the content of collagen in the skin, increasing age increased collagen protein. Protein content from native chicken skin gelatin ranged 88.10 to 89.92 \%, that it was not different with commercial gelatin \((\text{Said et al., 2011})\).

**Water content.** The water content average of native chicken legs skin gelatin was presented in Table 1. Statistical analysis indicated that the differences in level of acetic acid concentration no significant effect \((P>0.05)\) on water content of gelatin. Tabel 1 showed that water content of gelatin from chicken legs skin had a tended to decreased with increasing level of acetic acid solution and curing time. Water content of gelatin decreased due to the denaturation resulting in molecular changes and the amount of water that is bound to decline collagen structure and produce gelatin with a weak structure, so that the water holding capacity will lead to volatile water during the drying gelatin and water content becomes lower dry gelatin \((\text{Astawan and Aviana, 2002})\). Water content from native chicken legs skin gelatin ranged 7.12 to 7.44 \%, that it was not different with commercial gelatin \((\text{Taufik, 2011})\).

**pH Value.** The pH value of gelatin is very important on chemical properties because its can affect the properties of gelatin others to determined the subsequent application of gelatin. The average pH value of native chicken legs skin gelatin was ranged between 5.03 to 5.41. Statistical analysis indicated that interaction between level of acetic acid concentration had no significant effect \((P>0.05)\) on pH value of native chicken skin gelatin. This is because the raw materials that have been in curing skin with acetic acid before undergoing a process of neutralization and washing before further processing so that the acid molecules that are bound to skin protein amount is very small. Conditions in the range of neutral pH values indicate that the process of neutralizing and washing the raw material before the extraction process is running perfectly so that contamination can be minimized. Therefore, the neutralization process plays an important. The pH values average of gelatin was ranged 5.03 to 5.41 that in line with the commercial gelatin \((\text{Taufik, 2011})\).

**CONCLUSIONS**

Native chicken legs skin gelatin with concentration of acetic acid 3, 5 and 7 \% had similar characteristics to the commercial gelatin but the best characteristics gelatin was produced from
3% acetic acid concentration and 24 hours curing time (yields 12.31%, gel strength 64.16 g/
Bloom, viscosity 5.50 cP, protein content 89.90%, water content 7.31% and pH value 5.33).

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Sam Ratulangi University 2015.

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ABSTRACT: Fermented milk is capable of suppressing the growth of pathogenic bacteria that can be harmful to human health. The objective of this research was to evaluate antibacterial activity of fermented milk added sweet corn and cultured with lactic acid bacteria (LAB) and yeast Kluyveromyces lactis. The LAB used in this research were Lactobacillus bulgaricus and Streptococcus thermophilus. The treatments were arranged in a factorial 2x2 and allocated in completely randomized design with four replications. The treatments were consist of two factors, A as level of sweet corn (A1= 25% and A2= 75%) and factor B as level of yeast (B1= 0.5% and B2= 1%) and LAB 5% for all treatment with four replications. There were two bacterial test (Escherichia coli and Staphilococcus aureus) used in the assay test. Antibacterial activity assay of product towards pathogenic bacteria was confirmed using disc paper diffusion method. The result showed that E. coli sensitivity was highly significant different (P<0.01) towards sweet corn fermented milk using yeast 1% and 75% addition of sweet puree with the average of wide of zone of inhibition was 5 mm. Furthermore, in the antibiotic sensitivity test for two antibiotics (tetracycline and chloramphenicol 30µg) showed that E. coli was highly sensitive to both antibiotics. On the other hand, S.aureus was resistance to fermented product but sensitive to both antibiotics that indicated by wide of zone of inhibition formed. As a conclusion, fermented milk cultured with yeast-LAB able to inhibit the growth of E coli in the invitro test.

Keywords: antibacterial, LAB, yeast, pathogenic, zone of inhibition

INTRODUCTION

Lately, the need for food of animal origin that is capable of reducing the pathogenic bacteria increasingly becoming a concern. Direct source of contamination, animal enteric pathogens, was cause of food-borne disease occurred. Along with the increasing community awareness and understanding towards healthy food and beverage or so-called functional food, then the demand for such products increased rapidly both in quality and quantity. One of is a fermented milk which is known as yogurt that in the fermentation process using lactic acid bacteria (LAB) as starter culture or also as source of probiotic. The benefits of probiotics have been recognizing and exploring for over a century. Among a number of functional compounds recognized, bioactive components from fermented food and probiotics certainly take the center stage due to their long tradition of save and beneficial effects (Ahmed and Wang 2009).

Another milk cultured product known is kefir. Kefir is self-carbonated refreshing fermented milk with slight acidic taste made from kefir grains, a complex and specific mixture of lactic acid bacteria (LAB) and yeast held together by a polysaccharide matrix. The micro-organisms contained within the kefir grain typically produce lactic acid, antibiotics and several kinds of bactericide, such products inhibiting the proliferation of both degrading and pathogenic microrganisms in kefir milk (Angulo 1993).

Unlike kefir, sample used in this study is fermented milk similar to kefir using only two types
of LAB (*Lactobacillus bulgaricus* and *Streptococcus thermophilus*) and yeasts *Kluyveromyces lactis*. While the addition of sweet corn aims to increase the variety of flavors and also as sources of carbohydrate or sugar for LAB and yeast culture that involved in the fermentation process. It is expected that the product able to suppressed the growth of pathogens in the invitro, and also beneficial to the health of the digestive tract. Therefore, the aim of current research was to study the antibacterial activity of fermented milk added sweet corn puree and cultured with LAB and *yeast Kluyveromyces lactis* on pathogenic bacteria growth as one of fermented milk benefits.

**MATERIALS AND METHODS**

**Sample sources**

Milk used in this study was obtained from Lives Stock farm located at the ring road around the University of Syiah Kuala. Lactic acid bacteria as culture derived from Food Science Microbiology Laboratories, Agriculture Institute Bogor, while *yeast Kluyveromyces lactis* used was previously isolated from naturally fermented buffalo milk (Yurliasni, 2010)

**Sample preparation**

Fresh milk that obtained from small dairy farm in Aceh province was pasteurized at 90 to 95°C for 10 min, then cooled at 30°C. Sweet corn were obtained from public market and made into puree using a blender, then filtered to produce a smooth texture and pasteurized at 90 to 95°C for 5 min. 5% of LAB was added to all pasturized milk, mix in sweet corn puree, and inoculated with yeast culture that previously growth in milk as well, in accordance with treatment designed, incubated at 30°C for 24 h. This experiment using a completely randomized factorial design consisted of treatment were sweet corn puree percentage (25% and 75%) and yeast percentage (0.5% and 1%) and each treatment replied four times.

**pH and lactic acid level measurement**

Measurement of pH and lactic acid levels is done after an incubation period. pH was measured using a pH meter (AZ 86 502), while lactic acid levels were analyzed using Mann’s Acid Test method (Hadiwiyoto, 1994)

**Total number of microorganisms**

Nutrient agar media (Oxoid) was autoclave for 15 min at 15psi pressure 121°C and cool to 45°C. Pour-plate technique or serial dilution used for plating sample (Cappucino and Natalie 2005). Serial dilutions of sterile pepton water made up to 10⁶. 1 mL sample was transferred in any dilution in sequence until dilution 10⁻⁵ and 10⁻⁶. 1 mL of each dilution placed into sterile petri dish in duplicate. Molten agar 45°C was poured into petridishes containing diluted sample. Incubated at 30°C for 24 h. Total number of cfu/mL counted on Quebec colony counter.

**Antimicrobial activity assay**

The selected bacterial test (*Escherichia coli dan Staphylococcus aureus*) were grown in physiological NaCl at 37°C for 24 h until the stationary phase, then by pour-plate technique and serial dilution bacterial test were plated on A (Violet Red Bile(VRB) Agar media (Oxoid) and Vogel Johnson (VJ) Agar media (oxoid) respectively about 10³ cfu/mL. Antibacterial activities against *E.coli* and *S. aureus* were observed by using diffusion methods as described by Bonev et al.(2008). Using paper disk 100 µL of sample was spotted in duplicates onto the surface of VRBA and VJA agar plate containing lawn of *E.coli* and *S. aureus*. The agar plates then incubated at 37°C for 24 h and examined for clear zones of inhibition around the spots where sample were applied by using calipers.
Data analysis

The quantitative data were analyzed by using Two-way analysis of variance (ANOVA) and the differences among treatments means were examined by Duncac Multiple range Test P<0.05 (Steel and Torrie, 1995) The total of microrganism cell (cfu/mL) from sample test was converted to logarithmic value before statistical analysis.

RESULTS AND DISCUSSION

Based on Table 1, shows that the addition of yeast *Kluyveromyces lactis* and sweet corn puree with different percentages in fermented milk does not affect the pH value. This is indicated by the absence of differences in pH values between treatments, but this value is lower than normal yogurt 4.5 to 4.6. Fleet (1990) reported that bacteria, predominantly LAB, commonly excrete organic acids which lead to a lowering in the pH, therefore, interrelationship between LAB and yeast as applied in many fermented foods and beverages, plays an essential role in fermented product.

The treatment given significantly increase( P < 0.05 ) lactic acid levels of fermented milk shown by the lower percentage adition of sweet corn puree (25%). Viljoen (2006) state that when starch-rich material such sweet corn puree mix in the milk fermentation cultured with yeast-LAB, the interaction between yeast and lactic acid bacteria create environmental condition that protect the product from spoilage by fungi and pathogens owing to the low pH and high composition of acetic and lactic acids.

<table>
<thead>
<tr>
<th>Fermented milk samples</th>
<th>pH</th>
<th>Lactic acid level (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A₁ B₁</td>
<td>4.010±0.00</td>
<td>1.53±0.06³</td>
</tr>
<tr>
<td>A₁ B₂</td>
<td>4.010±0.00</td>
<td>1.54±0.04³</td>
</tr>
<tr>
<td>A₂ B₁</td>
<td>4.010±0.00</td>
<td>1.29±0.08⁸</td>
</tr>
<tr>
<td>A₂ B₂</td>
<td>4.010±0.00</td>
<td>1.30±0.03³</td>
</tr>
</tbody>
</table>

Note: means with different superscript at the same column differ significantly (P<0.05)

Data in Table 2 indicates that the treatment significantly inhibit ( P < 0.05 ) the growth of *E. coli* which was can be seen by zone of inhibition formed but not inhibit *S. aureus*. In contrast to other studies have shown that kefir inhibited the growth of *S. aureus* (Yusekdag et al 2004a). The reason is kefir in this study contains some lactic acid bacteria such as *L. cremoris*, *Lc. Lactis*, *Str. thermophilus* dan *Str. Durans*. Antibacterial activity in fermented milk sample was produced by extracellular metabolites during milk fermentation. Previous research states that antimicrobial effects present in fermented food and beverages are attributed to organic acids, antibiotic factor, volatil acids, hydrogen peroxide and and a number of substrates excrete in the product (Bull and Slater 1982). Silva et al. (2008) studied the effect of antimicrobial activity of broth (added with different sugars) with kefir grain and he found that kefir grains promoted the hydrolisis of non reducing sugar, which were converted into organic acid and substances capable of producing inhibition halos in experiments with pathogenic microorganisms included *E.coli* and *S. aureus*. The results showed that inhibition of sampel on *E. coli* was higher than on *S. aureus* and it means that *S. aureus* resistant to the fermented milk samples. Fermented milk treated with the addition of 25 % sweet corn puree and of 0.5 and 1 % yeast culture produces the largest zone of inhibition, but there is no difference between the two treatments. Table 2 also shows that the susceptibities of two bacteria test to two different antibiotics. The result of antibiotic sensitivity assay showed that
both of bacteria test had different resistance level on each tested antibiotic. Furthermore, E. coli and S.aureus was highly sensitive to chloramphenicol but less sensitive to tetracycline based on the size of zone of inhibition.

Table 2. Antibacterial activity assay of sample

<table>
<thead>
<tr>
<th>Fermented milk samples</th>
<th>E.coli</th>
<th>S. aureus</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 B1</td>
<td>0.50±0.00a</td>
<td>0.00</td>
</tr>
<tr>
<td>A1 B2</td>
<td>0.47±0.03a</td>
<td>0.00</td>
</tr>
<tr>
<td>A2 B1</td>
<td>0.42±0.03b</td>
<td>0.00</td>
</tr>
<tr>
<td>A2 B2</td>
<td>0.41±0.04b</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Antibiotics

<table>
<thead>
<tr>
<th></th>
<th>Chloramphenicol</th>
<th>Tetracycline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.50±0.03</td>
<td>1.50±0.00</td>
</tr>
<tr>
<td></td>
<td>0.40±0.04</td>
<td>0.45±0.01</td>
</tr>
</tbody>
</table>

Note: means with different superscript at the same column differ significantly (P<0.05)

Basically the total amount of bacteria in fermented milk such as yogurt immediately after 24 h incubation is $10^8$ cfu / mL, but very different from fermented milk that used mixed cultures.

Table 3 shows that the addition of yeast culture and sweet corn puree does not effect the total amount of microorganism. Previous study by Witthuhn et al. (2004) state that the content of bacteria in kefir varied from $6.4 \times 10^4$ to $8.5 \times 10^8$ cfu/g, and yeast from $1.5 \times 10^5$ to $3.7 \times 10^7$ cfu/g. Iregoyen et al. (2005) also reported that besides a viable population of $10^8$ cfu/mL of lactobacilli, lactococci and $10^5$ cfu/mL of yeast, kefir also had $10^6$ cfu/mL of acetic acid bacteria after 24 h fermentation.

Table 3. Total number of microorganism

<table>
<thead>
<tr>
<th>Fermented milk samples</th>
<th>CFU/mL</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 B1</td>
<td>5.593 ± 0.35</td>
</tr>
<tr>
<td>A1 B2</td>
<td>5.693 ± 0.45</td>
</tr>
<tr>
<td>A2 B1</td>
<td>5.060 ± 0.31</td>
</tr>
<tr>
<td>A2 B2</td>
<td>5.973 ± 0.16</td>
</tr>
</tbody>
</table>

When related to pH value and lactic acid levels obtained after the fermentation, as states by Nout (1991) that excessive acid production by lactic acid bacteria will result in decline in the number of surviving yeast, which consequently leads to deficiency of growth factors. As a result of such deficiency the lactic acid bacteria would produce less acid and in turn allow an increase in yeast numbers.

CONCLUSION

Fermented milk with high lactic acid levels of all treatment given as well as the addition of sweet corn and yeast LAB able to suppress the growth of pathogenic bacteria better with a wider zone of inhibition formed.
ACKNOWLEDGEMENT

We appreciate great thankfully to Microbiology Laboratory, Faculty of Veterinary Medicine, Syiah Kuala University, Darussalam Banda Aceh and Food Science Microbiology Laboratories, Agriculture Institute Bogor for providing pathogenics bacterial cultures and Lactic acid bacteria as culture starter respectively. We also thankfully to Mutti Zulfikar, S.Pt for supporting this research.

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Effect of Storage Period Eggs on Egg Quality Characteristics
Naked Neck Chicken

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ABSTRACT: Eggs are one of the farm products that have a high market share, prices are relatively cheap and protein with a complete amino acid. Therefore egg storage must be considered because it will affect to egg quality. The aim of the study was to examine the effect of storage periods egg on egg quality external and internal characteristics. The research using egg Naked Neck chicken 60 grains (20 grains per treatment). For treatment 3 and 7 days eggs stored at room temperature. To examine the external and internal egg quality used by egg multi tester EMT-5200. The results showed that almost all the external and internal quality variables egg Naked Neck chicken was not affected by storage period, except for the egg weight, yolk weight and Haugh unit (HU) score. Eggs at stored 7 days different significantly with treatment 0 and 3 days (P <0.05) at 41.25±9.07 vs. 35.59±6.14 vs. 35.59±6.14 (egg weight) and 14.81±3.72 vs. 11.55±2.35 vs. 12.16±2.12 (yolk weight). As for the best HU score is at 0 day storage period eggs (fresh) (P <0.05) compared with 3 and 7 days. The percentages of yolk color almost evenly for all treatments ranging from a score of 3-10. It can be concluded that the characteristics of the external and internal egg quality of Naked Neck chicken foremost influenced by egg storage time period is the score of HU.

Keywords: Naked Neck Chicken, Storage Periods, Egg Quality

INTRODUCTION

The quality of chicken eggs is determined by external and internal egg quality. Both are very important for the egg industry (Roberts, 2004). Currently concern about the quality of the egg continues to grow (Kemps et al., 2006). During the egg storage will change the content, so the quality will decline. Storage time seems to be a factor that affects the quality of the albumen or Haugh unit (HU). Haugh unit (HU) is a standard for measuring the internal quality of the egg (albumen quality and freshness of eggs) (Keener et al., 2006). The higher the HU score, the higher the quality of the egg whites. Eggs were stored longer will reduce the viscosity so that the egg whites HU score will decrease (Raji et al., 2009; Tona et al., 2013).

As a model, in studies using eggs Naked Neck chicken. Naked Neck chicken is the type of chicken that naturally do not have feathers on the neck and is one of the local Indonesian chicken germplasm. Naked Neck chicken originated from Transylvania, Romania and spreads all over the world were brought by the Dutch East India Company in order to trade around the 17th century (Ramsey et al., 2000). According to Islam and Nishibori (2009), Naked Neck chicken have good adaptation to tropical environments and low nutrient nutrition, and disease resistance, and superior to the normal feathered chickens in terms of growth, egg production, quality of eggs and meat. Based on the above, the study was conducted to determine and obtain information on the effect of storage period on the external and internal quality characteristics of eggs Naked Neck chicken.
MATERIALS AND METHODS

Samples of eggs

Eggs are used in the study were collected from the chicken complex Indonesian Research Institute for Animal Production (IRIAP) approximately 60 grains. Each treatment consisted of 20 items. For the treatment period of 3 and 7 days of storage, eggs stored at room temperature.

Measurement characteristics of external and internal egg quality

All variable characteristics of the external and internal egg quality in research are measured automatically using egg multi tester EMT-5200 (Robotmation, Co., Ltd., Tokyo).

Grade eggs

To grade eggs, using standard research from the United States Department of Agriculture (USDA) (2000) is the standard eggs generally has three grades, namely Grade AA, grade A and grade B. HU score 72 or more, egg white of not colorless and still static including AA quality. HU score of 60 to 71 with egg white looks limpid and somewhat static include quality A, while the quality of the eggs with a HU score of 31 to 59 with egg white looks limpid but already somewhat liquid and not static then include quality B.

Statistical analysis

Data were analyzed using One Way ANOVA with SPSS 17.0 by a factor of egg storage period. If the results analysis of treatment are different, then followed by Duncan’s comparison Multiple Range Test (Steel and Torrie, 1995). As for the color of egg yolks analyzed description (percentage).

RESULTS AND DISCUSSION

External quality characteristics of eggs

Statistical analysis showed that the external quality eggs Naked Neck chicken for variable weight and thickness of eggshell showed no difference (P>0.05), whereas for egg weight 7 day storage period shows the influence of different (P<0.05) with storage periods 0 and 3 day (Table 1). This is due at the beginning of egg retrieval for each randomized treatment, egg weight only known after weighing for each treatment. However, the weight of the eggs used in the research is still in the normal range, with the range of 30 to 50 g.

<table>
<thead>
<tr>
<th>Storage Period (day)</th>
<th>Egg Weight (g)</th>
<th>Eggshell Weight (g)</th>
<th>Thick Shell (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (fresh)</td>
<td>35.59±6.14</td>
<td>2.52±0.66</td>
<td>0.45±0.03</td>
</tr>
<tr>
<td>3</td>
<td>36.24±5.59</td>
<td>2.41±0.98</td>
<td>0.44±0.05</td>
</tr>
<tr>
<td>7</td>
<td>41.25±9.07</td>
<td>2.79±1.20</td>
<td>0.42±0.04</td>
</tr>
</tbody>
</table>

Description: The letters are not the same as the direction of the columns indicate significant differences (P<0.05).

Judging from its weight, the weight of egg Naked Neck chicken in research to three treatments egg weighs about the same as the results Uddin et al. (2007), Yakubu et al. (2008), Faruque et al. (2010) and Udoh et al. (2012), which ranged from 40.55 to 45.82 g. But lower than the results of the study Rajkumar et al. (2009), Isidahomen et al. (2013) and Usman et al. (2014)
who get egg weight between 52.70 to 57.52 g. Variations in egg weight reported adversely affected by differences in the age of chicken, ambient temperature, nutrient content in the diet, time of feeding and body weight of chickens. According to Rajkumar et al. (2009) egg weight gradually increase with age cock and showed a positive correlation between egg weight and age.

Statistical analysis of the heavy shell of the three treatments was no different due to egg storage period. The mean value of the eggshell weight Naked Neck chicken in the study ranged from 2.41 to 2.79 g, with the heaviest in the treatment eggshell are egg storage period on day 7 in the amount of 2.79 g ± 1.20. This is due to heavy shell has a positive correlation with the weight of the egg (Rajkumar et al., 2009). This is reinforced by the results of the research, in which the storage period of 7 days to get the average egg weight and egg shell weight heavier than the other treatments. However, the average weight of eggshell in this study was lower than the weight of the eggshell Naked Neck chicken raised in Nigeria and India in the amount of 4.48 g (Yakubu et al., 2008) and 5.07 g (Rajkumar et al., 2009).

Eggshell thickness reflects the strength of the egg. Eggshell thickness in the study showed no significant differences due to treatment storage period. Average of eggshell thickness Naked Neck chicken ranged from 0.42 to 0.45 mm, thicker than the thickness of chicken eggshell chicken Wareng Tangerang and Arabic, respectively ranged from 0.30 to 0.33 and 0.33 to 0.35 mm (Iskandar et al., 2007; Sari, 2012).

**Internal quality characteristics of eggs**

Unlike the external quality characteristics, the results of statistical analysis of the internal quality of eggs, there are two variables that are affected by storage period i.e. yolk weight and score Haugh unit (HU) (Table 2). As for the weight of albumen had no differences (P>0.05).

**Table 2.** Internal quality characteristics of eggs Naked Neck chicken according to the storage period (average ± standard deviation)

<table>
<thead>
<tr>
<th>Storage Period (day)</th>
<th>Yolk Weight (g)</th>
<th>Albumen Weight (g)</th>
<th>Haugh Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (fresh)</td>
<td>11.55±2.35</td>
<td>23.23±5.13</td>
<td>62.56±11.11</td>
</tr>
<tr>
<td>3</td>
<td>12.16±2.12</td>
<td>23.83±3.82</td>
<td>54.30±10.19</td>
</tr>
<tr>
<td>7</td>
<td>14.81±3.72</td>
<td>26.36±5.84</td>
<td>56.19±12.76</td>
</tr>
</tbody>
</table>

Description: The letters are not the same as the direction of the columns indicate significant differences (P<0.05).

The percentage of egg yolk around 30 to 32% of the weight of the egg, this is evidenced by the results of the study showed the following results, the treatment 7 days storage yolk weight heavier than the storage period of 3 days and 0 day. Likewise, of 3 day storage period, the egg yolk weight heavier than of 0 day storage period. It is influenced by the weight of the eggs, as already mentioned at the beginning, where the weight of the eggs that get treatment period of 7 days storage heavier compared to 3 days and 0 day, respectively (41.25 vs. 36.24 vs. 35.59 g).The mean weight of yolk in this study was lower than the results Rajkumar et al. (2009) 17.12 g. However, the lower the weight of the egg yolk shows that it has a lower fat percentage (Rajkumar et al., 2009).

Results of research for albumen weight showed no significant differences between egg storage periods ranging from 23.23 to 26.36 g (Table 2), but the 7 days storage period showed the highest albumen weight. The mean weight of albumen in the study is similar to the weight of albumen Naked Neck chicken which was reported Udoh et al. (2012) in the amount of 23.89 g. But higher than the results of the study Yakubu et al. (2008) that the average weight albumen at 20.53 g. Statistical analysis showed that the storage period score HU significantly (P<0.05). The
higher the score HU showed superiority albumen quality. However, a score of HU in this study was lower than the results of the study Uddin et al. (2007) and Yakubu et al. (2008) can achieve a score of 73 to 73.22.

**Score yolk color**

One indicator that can determine the quality of the egg is the color of egg yolks. The higher the score yolk color, the better the quality of the eggs. The results showed that the score of egg yolks Naked Neck chicken vary from 3 to 10 (Table 3).

Variation in the color of the yolk in the study was not caused by the influence of the storage period, but more determined by the presence or absence of xanthophyl. If the feed has a lot of yellow plant pigments known as xanthophyl will be stored in the yolk, causing yolk color becomes soupy (Dunga, 2013). Xanthophyl is pigment carotene from food that was eaten by chicken. The pigment is transferred into the blood stream and egg yolks. As a result, more pigment deposited in the yolk. This has resulted in a layer of light and dark on the yolk material. The total thickness of the dark and bright parts for stockpiling 24 hours is approximately 1.5 to 2.0 mm (Yumna et al., 2014). Isidahomen et al. (2013) says that the egg yolk color was more influenced by environmental rather than genetic factor. The influence of genes is not clear to score yolk color.

**Table 3.** Characteristic of egg yolk color Naked Neck chicken according to the storage period (percentage)

<table>
<thead>
<tr>
<th>Score yolk color</th>
<th>Storage Period (day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 (fresh)</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>-</td>
</tr>
</tbody>
</table>

**CONCLUSIONS**

From the data obtained it can be concluded that the characteristics of the external and internal egg quality Naked Neck chicken foremost influenced by egg storage time period is HU score. HU Score 0 today provide greater value than the HU scores 3 and 7 days.

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Study of the Quality of Multi Probiotic Fermented Milk Made from Cow’s Milk and Goat’s Milk

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ABSTRACT: This objective of this study was to evaluate the growth of multi probiotic bacteria on fermented cow and goat milk including pH, acidity, and some biochemical changes on organic acid and sensory properties. These probiotic bacteria used were Lactobacillus acidophilus, bifidobacterium longum, and lactobacillus casei mixed (abc culture) at 10% v/v. Analysis of pH’s value and acidity were conducted at 0, 3, 6 and 9 hours of incubation using pH meter and titration while organic acid were conducted using HPLC at early and end of incubation. The results showed that the acidity and pH of the product were (0.59; 0.60) and (3.40; 4.30), either cow’s milk or goat’s milk indicated the growth of mixed multi probiotic bacteria. It has also presented that different milks have significantly effects (P<0.05) on values of pH, lactic acid content as well as the quantity of sensory. This study have presented the opportunity to develop new product using multi probiotic bacteria in cow’s and goat’s milk that is considered satisfactory and accepted by consumers.

Keywords: probiotic bacteria, Lactobacillus acidophilus, Lactobacillus casei, Bifidobacterium longum, fermented milk

INTRODUCTION

The main role of diet is to provide nutrients to meet host physiological requirements. As research behind diet and health has evolved, so has the concept of ‘functional foods’ become more and more popular. Foods which are considered as being ‘functional’ are thought to exert certain positive properties over and above their normal nutritional value. The concept has now moved markedly towards gastrointestinal function, in particular the impact of gut bacteria. The gut microflora contains pathogenic, benign and beneficial microbial species. Functional foods directed towards the gut microbiota would serve to influence the composition of activities towards a more positive metabolism (Gibson, 2007).

In recent years, increased knowledge and understanding of gut micro-flora composition and activities has made the concept of functional food move markedly towards gastro-intestinal function which beneficially affect gastrointestinal function by influencing its compositions (Gibson, 2007). It sold mainly as ingredients in fermented food and almost exclusively consumed as fermented dairy products such as fermented milk (Soccol et al., 2013).

Dairy products containing probiotic cultures such as bifidobacteria, Lactobacillus acidophilus, and Lactobacillus casei-selected because of their health-promoting properties-and have been produced for many years. The health and nutritional benefits ascribed to these probiotic bacteria include the alleviation of lactose intolerance, inhibition of pathogenic microorganism and viruses, and prevention of diarrhea. The use of milk (e.g. cow’s and goat’s milk), in combination with bacterial strains having probiotic properties and/or producing physiologically active metabolites, represents one of the technology options for manufacturing new dairy functional beverages (Vinderola et al, 2000).
The development of dairy products containing probiotic bacteria (Bifidobacteria and internal Lactobacilli) is, currently, an important topic with industrial and commercial consequences. Most of the work of probiotic fermented milk has been carried out with bifidobacteria alone, or mixed cultures of Bifidobacteria and L. acidophilus, but L. casei has rarely been used. This objective of this study was to evaluate the growth of multi probiotic bacteria (Bifidobacteria, L. acidophilus, and L. casei) on fermented cow and goat milk including pH, acidity, organic acid, and sensory properties.

MATERIALS AND METHODS

Strain of probiotic bacteria: Lactobacillus acidophilus FNCC 0051, Lactobacillus casei FNCC 0090 and Bifidobacterium longum ATCC 15707 belonging to the culture collection of Pusat Studi Pangan dan Gizi (PSPG) Laboratorium Pangan dan Gizi Universitas Gadjah Mada. Fermented cow and goat milk culture was prepared by heating raw milk at 110°C for 15 minutes. Single and mix cultures developed in Dairy Science and Milk Industry Laboratory (ISO 17025:2005) Universitas Gadjah Mada. The culture cultivated as 10% v/v and incubated at 39°C for 9 hours.

The pH and acidity were detected each 3 hrs of incubation. The pH was measured with a pH meter while acidity was measured in 9 ml of culture after adding 0.5 ml of a 1% solution of phenolphthalein in 95% alcohol, by titrating with 0.1 N NaOH. Organic acid was detected by using HLPC LC column Shin-pack VP-ODS (Shimadzu) at 254 nm wave length, 30°C, flow rate 0.4 ml/minute. The sensory evaluation test had been conducted by twenty entrained panelists using five scale of intensity or score (Murti et al, 1993).

Statistic. Data from growth of bacteria and organic acid were analyzed by Factorial design procedure of SPSS software. The differences among means were detected by Duncan’s multiple range test.

RESULTS AND DISCUSSION

Growth of bacteria

The performance of the growth probiotic bacteria was (Lactobacillus acidophilus, Lactobacillus casei, Bifidobacterium longum) was assessed as the ability of strain to produce organic acids as the primary metabolites, which was measured by pH decline and acidity in various incubation time. The change of pH and titrable acidity during incubation is presented in figure 1. During 9 hours of incubation of mixed culture bacteria in sterile cow’s and goat’s milk, these culture induced pH reduction in various degrees ranging from 6.0 to 3.4.

Figure 1. pH value and titrable acidity during 0, 3, 6 and 9 hours incubation
Growth of mixed culture bacteria can also be represented by an increase of acidity. Moreover, measuring acidity considerable advantage for monitoring or controlling acidification processes. The final acidity value of Fermented cow’s milk and goat’s milk increase to 0.6 % (fig 1). Acidity values during incubation increase as a result of bacterial growth that produce lactic acid or acetic acid depended on type of LAB used (Habibah and Kadhafi, 2011).

The result indicated that mix culture of abc could growth both in goat and cow milk. Growth mix culture abc in cow milk was relatively better than in goat milk. The pH decline depends on the amount of lactic acid and other organic acid released, which is directly linked to the culture metabolic activity. Somr of them produce mainly lactic acid (L. acidophilus and L. casei) while other B. longum produce also acetic acid. Certain lactic acid bacteria strains can utilize lactose fully as opposed to some others than can mainly convert a part of lactose into lactic acid which could have been reason for a slow pH decline (Donkor, 2007).

**Organic acid**

Changes in lactic acid content as determined by HLPC are shown in fig. 2. The amount of lactic acid produced at the end of fermentation depended on the type of milk used, and it ranged from 303.56 (cow’s milk) to 1018.70 mg/L (goat’s milk). Lactic acid content in fermented goat’s milk the increased during fermentation from 913.62 to 1018.70 mg/L. The homofermentative bacteria L. acidophilus and L. casei in pure or in co-culture produced the largest amount of lactic acid bacteria using the Embden-Meyerhof-Parnas pathway (glycolysis), while Bifidobacterium longum is an heterofermentative strain that ferments lactose through a specific route called bifidus pathway. Theoretically, the fermentation of two glucose molecules leads to 3 mols of acetic acid and 2 mols of lactic acid (Cassarotti et al, 2014).

The change of acetic acid that earlier than lactic acid indicated that bacteria producing acetic acid have growth quickly and early than other bacteria. As we know bifidobacteria is the only one bacteria in mix culture that produce acetic acid.

**Figure 2.** Concentration of organic acid during 0 and 9 hours incubation

**Sensory evaluation**

The acceptability of consumers can be seen as in figure 3 in which severally were disliked by consumers. It is showed that goat’s milk sample produced high bitter taste and cow’s milk sample had higher acid taste. Despite of sensory evaluation, it showed that fermented cow milk mix culture of three probiotic bacteria has been accepted better than fermented goat milk.
As the acidity raised milk probably aggregated or coagulated. It is noted that when the acidity reached 4.5-4.6 fermentation of milk would cease and the mineral would release as well as the hydrophobic amino acid giving a possible bitter and salty taste of end products due to the released of the two components (Murti, 1995).

Figure 3. The sensory evaluation of fermented milk samples

*L. acidophilus, L. casei and Bifidobacterium longum* which used as the starter to make fermented milk gave significant effect to consumer acceptance. Acid flavour shown significantly more than other flavour and increased consumer likes.

CONCLUSION

It concluded that mix culture of three probiotic bacteria (abc) have grown in cow and goat milk, lead to change organic acids that produced and sensory acceptance by entrained panelist. It also suggested to the next research making more clearly by biochemical reaction especially cooperation among bacteria, either commensalism or proto cooperation.

REFERENCES


Development of Halal Goat Cheese using Rennet Like from Vegetable Source to Replace Commercial Rennet Source

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ABSTRACT: The production of milk in Indonesia is very low, mainly from Holstein Friesian cows, and still ignore other sources of milk (goat, sheep, buffalo and mare). The purpose of this study was to replace uncertain halal rennet which normally used commercial rennet by rennet like from vegetable sources. Milk from Bligon goat reared by small farmer in mountainous region of Sleman district was used as raw material. Rennet from commercial sources and rennet like from extract leaves of tin (Ficus carica) were used to develop goat cheese and analogue goat cheese. Commercial rennet as well as rennet like has not contained material from pork origin detection using specific kit. Despite it, commercial rennet was still considered uncertain for development of halal goat cheese due to not completely halal certificate and should be replaced by certain halal rennet like sources. Both milk that was used as raw material for making cheese using either commercial rennet as rennet like contain 14.95%; 3.65%; 4.65%; and 85.06% of total solid, fat, protein, and water percentage respectively. Analogue goat cheese have presented 730.1 gr; 30.02%; and 11.97% of curd weight, total solid and protein respectively while commercial rennet cheese have shown 335.5gr; 42.59%; and 15.12% curd weight, total solid, and protein respectively. It was concluded that extract leaves of tin (Ficus carica) could be use as substitution of commercial rennet.

Keywords: Development of Halal Cheese, Goat Milk, Commercial Rennet, Rennet Like

INTRODUCTION

Cheese is the most complex of the dairy products, involving chemical, biochemical and microbiological processes. The steps in all cheese making include milk acidification, milk coagulation, whey removal, packaging and storage. Most cheese making also includes heating the cheese curd and salting the curd. Even slight changes in these processes can lead to significant differences in the final cheese (Christina Coker, Craig Honoré 1997).

The use of animal rennet may be limited for religious reasons (e.g. Judaism and Islam), diet (vegetarianism), or being against genetically engineered foods (e.g. Germany and the Netherlands forbid the use of recombinant calf rennet). More recently, the incidence of bovine spongiform encephalopathy (BSE) has reduced both supply and demand for bovine rennet (Roseiro et al., 2003). Muslims consumer always consider halalness of products since processing stage and as a consequence it is important to pay attention of muslim consumer on the use of halal rennets. It is therefore vegetable source of coagulants could be used.

In spite of animal source rennet to coagulate milk, several plant extracts have reported having the capacity to proteolysise milk. These proteases, such as papain from Carica papaya, ficin from Ficus sp., and cardosins (also called cynarases or cyprosins) from Cynara sp., are sometimes
constituents of latex, fruits, roots, seeds and/or sap (Roseiro et al., 2003). But mainly of their leaves or flowers are commonly used.

Rennet substitutes of plant origin have been increasingly used to manufacture cheese, especially at the artisanal level in Mediterranean areas (Gupta & Eskin, 1977). Application of plant coagulants allows target cheese production, and hence contributes to improve the nutritional input of those populations on whom restrictions are imposed by use of animal rennets (Silva & Malcata, 2005).

The aim of this study was to replace uncertain halal rennet which normally used in commercial with rennet like from vegetable sources.

**MATERIALS AND METHODS**

Milk from Bligon goat reared by small farmer in mountainous region of Sleman district used as raw material. Rennet from commercial sources and rennet like from extract leaves of tin (*Ficus carica*) were used to develop goat cheese and analogue goat cheese (figure 1). Commercial rennet which applied as well as rennet like were tested using kit (Xema) and found negatively from material pork origin after detection using specific kit of immunoassay before used as coagulant agent. Despite it, commercial rennet still considered uncertain for development of halal goat cheese due to not completed by halal certificated and should be replaced by certain halal rennet like sources.

(a) 
(b) 

Figure 1. Image of rennet sources (a) leaves of tin (*Ficus carica*); (b) Commercial rennet

Strain of probiotic bacteria *Bifidobacterium longum* ATCC 15707 belonging to the Food and Nutrition Culture Collection (FNCC) of Universitas Gadjah Mada were used in this study. Before commercial rennet and rennet like added to the milk, fermented Bligon goat milk culture was prepared by heating raw milk at 110°C for 15 minutes. The culture and cheese developed in Dairy Science and Milk Industry Laboratory (ISO 17025:2008) Universitas Gadjah Mada. The culture cultivated as 10% v/v and incubated at 40°C until the pH 5.7. Each milk was added rennet and extract leaves of tin (*Ficus carica*) at 40°C until the whey separated from the curd. The total solid, fat, protein, and water content of Bligon goat milk were measured using proximate analysis. Curd weight and total solid of analogue goat cheese and commercial rennet cheese were measured at 0 month of ripening time at temperature around 2 to 4°C. The pH, protein percentage and soluble protein of cheese were detected each 1 month of ripening time until 3 month. The pH was measured with a pH meter while protein was measured using Kjeldahl method. Cheese and whey soluble protein were measured by the method of Lowry using a formula as below. The result of protein and soluble protein were planned using a model of statistic factorial design and analysed using t-test.

Rendement weight (X) = Total solid of cheese % x cheese weight g
Rendement percentage = X x Milk weight in total solid g x 100%
RESULTS AND DISCUSSION

Bligon goat milk which was used as raw materials has a composition as in (table 1). This is considered difference in total solid, fat and protein than Peranakan Etawa (PE) goat milk which have total solid, fat and protein 13.37%, 4.7%, 3.85% respectively (Murti, 2015). Both commercial rennet and rennet like were successfully coagulated Bligon goat milk, which the Bligon goat milk composition in table 1.

Table 1. Bligon Goat Milk Composition

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Solid (%)</td>
<td>14.94±0.0032</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>3.65±0.07</td>
</tr>
<tr>
<td>Protein (%)</td>
<td>4.66±0.0007</td>
</tr>
<tr>
<td>Water (%)</td>
<td>85.06±0.0032</td>
</tr>
<tr>
<td>Milk density (g/ml)</td>
<td>1.026</td>
</tr>
</tbody>
</table>

Figure 2. Image of goat cheese with different coagulant material (a) leaves of tin (Ficus carica); (b) Commercial rennet

Rendement weight and rendement percentage of cheese using rennet like from extract leaves of tin (Ficus carica) have presented higher than cheese developed using commercial rennet as in table 2. The texture of the cheese are quite same, with cheese using rennet like softer than those of using commercial rennet and shown in figure 2.

Table 2. Cheese Composition

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Commercial rennet</th>
<th>Rennet like</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (g)</td>
<td>355.50</td>
<td>730.1</td>
</tr>
<tr>
<td>Total solid (%)</td>
<td>42.59</td>
<td>30.02</td>
</tr>
<tr>
<td>Rendement weight (g)</td>
<td>151.41</td>
<td>219.18</td>
</tr>
<tr>
<td>Rendement percentage (%)</td>
<td>39.48</td>
<td>57.16</td>
</tr>
</tbody>
</table>

The performance cheese developed using rennet like from extract leaves of tin (Ficus carica) was compared with commercial rennet by estimating the development pH and the protein percentage and soluble protein of cheese in various ripening time. The change of pH during ripening time is presented in figure 3, while protein percentage and soluble protein is in table 3.
Figure 3. pH value during 0, 1, 2, 3 month of cheese ripening

Activity of ripening cheese can also be represented by an increase of pH. Measuring pH considerable advantage for monitoring or controlling ripening processes. It showed that pH values of cheese was decreased at the 0 to 2 month of ripening time and at 2 to 3 month of ripening time the pH was increased (figure 3). pH values during incubation decrease as a result of bacterial growth that produce lactic acid or acetic acid (Habibah and Kadhafi, 2011). Until 2 month of ripening, the pH of both cheese have decreased, followed raised at 3 month of ripening. Probably due to degradation of protein especially between 1 to 2 month of ripening, as indicated in table 3.

Table 3. Cheese Protein in Different Ripening Time

<table>
<thead>
<tr>
<th>Cheese</th>
<th>Parameter</th>
<th>Unit</th>
<th>Ripening Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0 month</td>
</tr>
<tr>
<td>Commercial</td>
<td>Protein</td>
<td>%</td>
<td>39.91 ± 0.044</td>
</tr>
<tr>
<td>Rennet</td>
<td></td>
<td>g</td>
<td>87.47</td>
</tr>
<tr>
<td></td>
<td>Soluble Protein</td>
<td>Curd (mg/g)</td>
<td>96.73 ± 0.006</td>
</tr>
<tr>
<td></td>
<td>(Lowry)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rennet Like</td>
<td>Protein</td>
<td>%</td>
<td>35.49 ± 0.011</td>
</tr>
<tr>
<td></td>
<td></td>
<td>g</td>
<td>53.74</td>
</tr>
<tr>
<td></td>
<td>Soluble Protein</td>
<td>Curd (mg/g)</td>
<td>114.44 ± 0.007</td>
</tr>
<tr>
<td></td>
<td>(Lowry)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Whey (mg/g)</td>
<td></td>
<td>60.17 ± 0.007</td>
</tr>
</tbody>
</table>

CONCLUSIONS

*Ficus carica* have high potential for developing halal goat cheese and could be used as substituted of commercial rennet.
REFERENCES

The Characteristics of Salted Chicken and Duck Egg by Using
Traditional Roasting
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ABSTRACT: Salted egg is one of a traditional egg product that is usually using soil paste containing salt for coating. Further processing of fresh salted egg can be done by traditional method using roasting in heated sand medium. The purpose of this study were to study the effect of roasting and cooking on the characteristics of salted duck and chicken egg. Eggs were coated by a clay paste containing salt for 10 d, and then divided into two groups: 1) roasting group and 2) cooking group. After roasting or cooking, the eggs were analyzed the moisture and salt contents and also the total count of bacteria during storage at room temperature for 0; 7; 14 and 21 d. The data was analyzed statistically by ANOVA. The results showed that there were no significant differences in moisture content of yolk in roasted and cooked salted duck egg, but the moisture content of yolk in roasted chicken egg was lower than salted cooked egg. The moisture content in egg white of roasted was lower than cooked salted egg. During storage, moisture content of yolk in salted egg was increased, but moisture content of egg white was decreased. The salt content in roasted salted chicken egg was higher than salted cooked egg. The salt content of egg white at 21 d storage was higher than 0 d of storage. Total count of bacteria in roasted salted duck and chicken egg were lower than cooked salted egg. There were no significant differences in total count of bacteria in duck or chicken salted egg in 0 and 7 d of storage. However, after 7 d of storage the total count in salted egg was increased significantly. In conclusion, the salted egg by traditional roasting was recommended for processing method with shelf life for 7 day at room temperature.

Keywords: Roasted, Cooked, Salted egg, Moisture, Salt, Total count

INTRODUCTION

Preserved egg products includes salted and pidan duck eggs are one of the least expensive duck egg products which are widely consumed in most of the South East Asian countries such as, Thailand, Malaysia, Singapore and East Asian countries like China and South Korea (Ganesan et al., 2014). In Indonesia salted duck eggs are also very popular which can be found in some areas in a variety of products such as cooked, roasted, and smoked salted eggs with a variety of flavors. Usually, salted egg can be made by brining eggs in saturated saline or by coating the egg with soil paste mixed with salt. Paste coating method produces more pronounced dehydration and release of lipids in yolk increased with increasing salting time (Kaewmanee et al., 2009a). Salted eggs are rich in proteins, lipids, unsaturated fatty acids and minerals. The salted egg contains 14% of protein, 16.6% of fat, 4.1% of carbohydrate and 7.5% of ash, whereas the fresh duck egg contains a range of 9.30-11.80% of protein, 11.40-13.52% of fat, 1.50-1.74% of sugar and 1.10-1.17% of ash. Furthermore, salted duck egg needs to be heated by pan frying or boiling before consumption (Ganesan et al., 2014).

Salting resulted in an increase in weight proportion of egg white, but a decrease in yolk proportion (Kaewmanee et al., 2009b). After brining, part of the lipids in salted egg yolk became free due to the structural changes of low-density lipoprotein induced by dehydration and increase of salt content, and more free lipids in salted egg yolk were released after the cooking process (Lai et al., 2010).

In a previous study showed that roasted salted duck eggs in higher oven temperature have more shelf life compared with lower oven temperature, even though there were no differences in total count of bacteria (Novia et al., 2012). In addition, the roasting salted duck egg in marine sand after cooking showed that roasting for 5 min could increase the salt content of salted egg (Budiman et al., 2012). The purpose of this study were to evaluated the contents of moisture and salt, as well as the total count of bacteria in salted duck and chicken eggs by using traditional
roasting compared with cooked salted egg during 21 days of storage.

MATERIALS AND METHODS

Materials used in this study were fresh chicken and duck eggs, clay, salt, ash, clean sand, plate count agar (PCA), K,CrO, 5% and AgNO, 0.1 N.

Chicken and duck eggs were coated with paste of salt and clay (1:1), and thenspreaded with ash. The 1000 g paste of clay and salt was prepared by adding of 500 g water. The coated eggs were incubated at room temperature for 10 day. After 10 d of incubation, the eggs were divided into two groups of processing: 1) traditional roasting with sand at 100°C for 1 h, and 2) cooking at 100°C for 1 h. Processed eggs in groups 1 and 2 were stored at room temperature for 0; 7; 14 and 21 days, and then analyzed the egg characteristics including moisture content, salt content and total count of bacteria. Replication of sample in this analysis was performed three times.

Moisture content of roasted and cooked salted eggs were analyzed by oven at 105°C (AOAC, 2000). Salt content in egg samples were also analyzed according to AOAC (2000). Egg samples for salt analysis were mashed and extracted with 50 mL hot water (70°C) for 15 min and filtered, then the filtrate was analyzed for salt content by titration with AgNO, 0.1 N using indicator K,CrO, 5% until the solution permanently pink colour (AOAC, 2000). The total counts of eggs was evaluated using plate count agar (PCA) (Merck) medium. To determine the total counts, the colonies formed were counted and expressed in log CFU/g (Rostita et al., 2011). The data was analyzed statistically by two way ANOVA using SPSS version 17.

RESULTS AND DISCUSSION

Moisture Content. The average of moisture content in roasting chicken and duck salted eggs were lower than cooked salted egg (p<0.01). This was due to in cooking process using water as heating medium, so the diffusion of water into the eggs causing water levels to be higher. On the contrary, the use of sand in roasting process so that no water diffuses into the egg. In the present study, moisture content in chicken roasted salted egg white at 0 and 21 d of storage were 54.00 and 52.29%, whereas in roasted duck salted egg white at 0 and 21 d of storage were 57.38 and 52.15%, respectively (Table 1). This result of this study near to a previous study by Novia et al. (2012), that moisture content of duck salted egg after heating in oven 90-100°C (6 h) at 0 and 25 day storage were 56.68-54.77% and 53.97-48.79%, respectively.

If water is unavailable for pathogenic or spoilage-causing bacteria to multiply, food is better preserved and has a longer shelf life, because bacteria cannot grow without water.

<table>
<thead>
<tr>
<th>Salted egg</th>
<th>Processing</th>
<th>Storage (day)</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Chicken</td>
<td>Roasting</td>
<td>54.00±0.84</td>
<td>54.11±1.58</td>
</tr>
<tr>
<td>egg white</td>
<td>Cooking</td>
<td>57.45±1.35</td>
<td>56.44±1.31</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>55.72±2.09</td>
<td>55.27±1.84</td>
</tr>
<tr>
<td>Duck</td>
<td>Roasting</td>
<td>57.38±3.36</td>
<td>54.18±10.61</td>
</tr>
<tr>
<td>egg white</td>
<td>Cooking</td>
<td>62.65±4.20</td>
<td>60.69±3.82</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>60.01±4.55</td>
<td>57.44±8.33</td>
</tr>
<tr>
<td>Chicken</td>
<td>Roasting</td>
<td>21.42±1.05</td>
<td>20.07±1.04</td>
</tr>
<tr>
<td>egg yolk</td>
<td>Cooking</td>
<td>22.82±0.44</td>
<td>22.98±1.14</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>22.12±1.06</td>
<td>21.52±1.84</td>
</tr>
<tr>
<td>Duck</td>
<td>Roasting</td>
<td>17.32±3.54</td>
<td>15.30±1.42</td>
</tr>
<tr>
<td>egg yolk</td>
<td>Cooking</td>
<td>18.54±2.58</td>
<td>16.87±3.17</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>17.93±3.02</td>
<td>16.09±2.48</td>
</tr>
</tbody>
</table>

Different letter in the same column (a, b) and the same row (p, q, r, s) indicated significant difference (p<0.01) for chicken egg white and yolk and also duck egg white and yolk, respectively.
Thus the water content has a significant effect on maintaining quality of the food. This explains why freezing, dehydration, or concentration of foods increases shelf life and inhibits bacterial growth (Vaclavik and Christian, 2014).

During storage, there were fluctuation in the levels of moisture content in salted eggs, whereas there were no significant differences in the levels of moisture content in duck egg white (Table 1). Moisture contents of both egg white and yolk decreased gradually with concomitant increases in salt and ash contents as the salting time increased. Changes in chemical composition, physical properties and microstructure of duck egg as influenced by salting (Kaewmanee et al., 2009b).

Salt Content. Roasting process could increase the salt content in salted chicken eggs, but could not increase in salted duck egg (Table 2). Chicken has a thinner eggshell than duck egg, then the water easy to evaporate from inner egg. Duck eggs are normally larger with a thicker eggshell and higher egg breaking strength than chicken eggs (Shen and Chen, 2003). The duck eggshell thickness from 0.349 to 0.364 mm (Kokoszynski et al., 2007). The area surrounding the blunt end was the tinnest (0.341 ± 0.025 mm), whereas the area surrounding the sharp end was the thickest (0.367 ± 0.023 mm). It was found that the thickness of the sharp end was the closest to the average thickness of the whole eggshell and could be considered as a valid measurement of eggshell thickness (Sun et al., 2012). Mineral content such as calcium, magnesium, sodium and potassium were significantly increased in pidan yolk irrespective of its cations in pickle solution in comparison to the fresh yolk. It confirmed the migration of minerals from the pickling solution to the egg (Ganesan et al., 2013). According to Ganesan et al. (2014), proteins, lipids, and ash contents are also found to be greatly enhanced during the pickling and salting process of salted duck eggs. During brining, the salt contents of albumen, exterior yolk (hardened portion), and interior yolk (soft or liquid portion) gradually increased accompanied by slight decreases in moisture content (Lai et al., 2010). According to Indonesian National Standard (SNI) (1996), the minimum salt content in salted egg was 2.0%. So that the salt content of salted egg white in the present study still within the standard range.

The salt content of salted egg at 21 d of storage was higher than 0 day (Table 2), due to evaporation of water during storage at room temperature. Long storage period significantly increased levels of NaCl salt (Amir et al., 2014).

Table 2. Salt content (%) of egg white and yolk of salted chicken and duck egg during storage

<table>
<thead>
<tr>
<th>Salted egg</th>
<th>Processing</th>
<th>Storage (day)</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Chicken egg white</td>
<td>Roasting</td>
<td>2.69±0.03</td>
<td>2.69±0.03</td>
</tr>
<tr>
<td></td>
<td>Cooking</td>
<td>2.15±0.03</td>
<td>2.35±0.06</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>2.42±0.29</td>
<td>2.52±0.18</td>
</tr>
<tr>
<td>Duck egg white</td>
<td>Roasting</td>
<td>1.78±0.18</td>
<td>2.04±0.05</td>
</tr>
<tr>
<td></td>
<td>Cooking</td>
<td>1.92±0.06</td>
<td>2.09±0.03</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>1.85±0.14</td>
<td>2.07±0.04</td>
</tr>
<tr>
<td>Chicken egg yolk</td>
<td>Roasting</td>
<td>0.80±0.02</td>
<td>0.85±0.01</td>
</tr>
<tr>
<td></td>
<td>Cooking</td>
<td>0.58±0.01</td>
<td>0.61±0.02</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>0.69±0.11</td>
<td>0.73±0.13</td>
</tr>
<tr>
<td>Duck egg yolk</td>
<td>Roasting</td>
<td>0.69±0.00</td>
<td>0.65±0.02</td>
</tr>
<tr>
<td></td>
<td>Cooking</td>
<td>0.48±0.27</td>
<td>0.67±0.01</td>
</tr>
<tr>
<td></td>
<td>Average ns</td>
<td>0.58±0.21</td>
<td>0.66±0.01</td>
</tr>
</tbody>
</table>

Different letter in the same column (a, b) and the same row (p, q) indicated significant difference (p<0.01) for chicken egg white and yolk and also duck egg white and yolk, respectively.
ns: not significant

Total Count of Bacteria. On Table 3, showed that total count of bacteria in egg white salted duck egg after roasted at 100°C (1 h) and stored at 0 d was 4.67 log CFU/g (4.67 x 10^4 CFU/g). However, after it stored at 21 d the increasing of total count was very high (11.17 log CFU/g) or
1.47 x 10^{11} \text{ CFU/g}. This result different from a previous study that total count of salted duck egg after heating in oven at 90-100°C (6 h) at 0 and 25 d of storage were 6.29 - 9.22 x 10^4 CFU/g and 1.98 - 7.35 x 10^4 CFU/g, respectively (Novia et al., 2012).

Table 3. Total plate count (Log CFU/g) of egg white and yolk of salted chicken and duck egg during storage.

<table>
<thead>
<tr>
<th>Salted egg</th>
<th>Processing</th>
<th>Storage (day)</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Chicken</td>
<td>Roasting</td>
<td>4.75±0.11</td>
<td>5.00±0.06</td>
</tr>
<tr>
<td>egg white</td>
<td>Cooking</td>
<td>5.11±0.06</td>
<td>5.31±0.08</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>4.93±0.20^a</td>
<td>5.16±0.18^a</td>
</tr>
<tr>
<td>Duck</td>
<td>Roasting</td>
<td>4.67±0.11</td>
<td>6.02±0.03</td>
</tr>
<tr>
<td>egg white</td>
<td>Cooking</td>
<td>5.05±0.07</td>
<td>6.11±0.01</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>4.86±0.21^a</td>
<td>6.06±0.05^a</td>
</tr>
<tr>
<td>Chicken</td>
<td>Roasting</td>
<td>4.89±0.10</td>
<td>5.00±0.08</td>
</tr>
<tr>
<td>egg yolk</td>
<td>Cooking</td>
<td>5.28±0.04</td>
<td>5.36±0.06</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>5.08±0.21^a</td>
<td>5.18±0.19^a</td>
</tr>
<tr>
<td>Duck</td>
<td>Roasting</td>
<td>4.84±0.10</td>
<td>5.99±0.03</td>
</tr>
<tr>
<td>egg yolk</td>
<td>Cooking</td>
<td>5.22±0.06</td>
<td>6.07±0.02</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>5.03±0.21^a</td>
<td>6.03±0.04^a</td>
</tr>
</tbody>
</table>

Differences this results due to differences in processing method and duration of heating after salting egg. In the present study after salting egg then roasted for 1 h in sand at 100°C, but in a previous study by heating in oven too long time (6 h), so there were many dead of bacteria. Thus, after 25 d storage the total count of bacteria was still lower than the present study. In salty condition the halophilic bacteria will be able to growth. According to Trongpanich and Dawson (1974), halophilic plate count of duck eggs held in salt brine up to two weeks, then held one month at 3°C were 4.2 x 10^4 CFU/g. In a previous study showed that the average of total bacterial colonies in duck salted egg were 7.35 x 10^4 CFU/g with a shelf life of 38.80 days (Novia et al., 2012). However, the Thai Industrial Standard Institute (TISI, 2003) stated that the microbiological standard of salted egg including total aerobic plate count found is less than 10^4 CFU/g, and that there is no presence of Salmonella spp., S. aureus and C. perfringens in 25g, 0.1g, and 0.1 g of samples, respectively. Furthermore, microbiological quality of locally commercial salted eggs in Thailand were in around of 1.84 x 10^2 – 3.60 x 10^3 CFU/g (Wongvilairat, 2007).

CONCLUSIONS

The salt content of salted chicken and duck eggs were still a good quality according to Indonesian National Standard. However, the salted eggs exceed the maximum limit of total count of bacteria required by Thai Industrial Standard Institute. Thus, further study is required to determine the shelf life of salted egg in various heating time in various method of roasting with various storage temperature under hygienic conditions.

REFERENCES


Capability of Isolates Probiotic Bacteria, Isolated From Spontaneous Fermented goat Milk as Starter In milk Fermentation

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ABSTRACT: The purpose of this research was investigate the capability of Three isolates probiotic bacteria isolated from spontaneous fermented goat milk, as starter in milk fermentation in order to produce a functional food. The isolates namely Lactobacillus plantarum YN 1.1, Lactobacillus plantarum YN 1.3 and Lactobacillus plantarum YN 1.6. This experiment stage consist of three experiments that where selected were the growth of isolates in MRS media and changes of pH during microbial growth. The second experiment was carried out for measuring organic acid produced during isolate growth in MRS media. The third experiment was study the growth capability of isolates in milk fermentation by measuring the isolates viability during growing in 8% skim milk and also measuring the pH changes during fermentation. The results of this experiment showed that L.plantarum isolate of YN 1.1, YN 1.3 and YN 1.6 were able to growth in MRS media and have ability to decreased pH of MRS media. Lactic acid is the highest level of organic produced during fermentation if it was compare to other organic acids produced such as acetic acid, propionic acid and butiric acid. L.plantarum YN 1.3 were produce higher amount of Lactic acid compare to L.plantarum YN 1.6 and L.plantarum YN 1.1. All of Isolates also growth have capability in fermentation of goat milk. The conclution of this study that Lactic Acid Bacteria L.plantarum YN 1.1, YN 1.3 and YN 1.6 it was able to ferment milk and be used as culture starter to produce fuctional goat milk yoghurt.

Keywords: L. plantarum, starter, growth of isolates, pH, Lactic Acid.
Changes in Physico-Chemical and Sensory Characteristics of Concentrated Yogurt Made from Goat Milk during Storage

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ABSTRACT: The objective of the study was to evaluate the changes in physico-chemical and sensory characteristics of concentrated yogurt made from goat milk during storage. Fresh milk of Peranakan Etawah goats was processed into stirred-type fresh yogurt by adding probiotic yogurt cultures. Yogurt was processed into concentrated yogurt using in-bag straining method, cut into blocks, immersed in different vegetable oils (olive, corn, canola and sunflower oils) in capped jars, then stored for up to 30 days under cool temperature. Variables observed consisted of superficial growth of yeast, changes in color, off-flavour, consistency, pH and titratable acidity. Results showed that pH and titratable acidity tended to increase during storage, but the differences were not significant among different immersing oils. No apparent growth of superficial yeast, changes in color and consistency were detected in concentrated yogurt up to day 30 of storage. However, a slight off-flavour was detected at day 30 which could be due to rancidity of oils. It can be concluded that shelf-life of concentrated yogurt can be extended by immersing in vegetable oils, and the decision of which oils to use will depend on the price and local availability.

Key Words: concentrated yogurt, goat milk, shelf-life, vegetable oil

INTRODUCTION

Goat milk in Indonesia is second to cow’s milk in term of production and consumption. Although the biggest portion of goat milk is still being consumed in a fresh form, a wide opportunity is open to process goat milk into various milk products including fermented milk products. Nowadays, yogurt is a common fermented cow’s milk products produced either by industrial or small/home scale manufacturers in the country. Yogurt from goat milk is a popular product in many countries (Tamime et al., 2011). Fresh yogurt can be further processed in concentrated/condensed/strained yogurt by different methods of whey removal (Sumarmono et al., 2014).

Arguably, the easiest and most practical method to manufacture concentrated yogurt is by hanging fresh yogurt in a cloth bag for 15 to 20 hours at 10°C to allow a partial removal of water. The resulting product contains approximately 25% total solid, slightly acidic, thick and creamy but smooth consistency (Ozer, 2006), although NergizSeçkin (1998) reported that nutrients such as water soluble vitamins, minerals and also lactose were loss with the water. Nevertheless, in concentrated form, yogurt has wider food aplicability such as sandwich spread and dressing for salads.

Lengthening the shelf-life of concentrated yogurt is one of major concern, although this product has longer shelf life than fresh yogurt due to lower moisture content and higher lactic acid content. Al-Kadamany et al. (2003) reported that concentrated yogurt underwent decrease in acidity (pH) and increase in titratable acidity during storage. Previously, Abu-JdayilMohameed (2002) reported that the apparent viscosity of concentrated yogurt produced from cow’s milk was increased when stored for 15 days. Keceli et al. (1999) reported that concentrated yogurt can be preserved by storing the product in virgin olive oil. This technique was reported to provide
unaerobic condition, hence prevented the growth of yeast over the surface of the products. Recently, Thabet et al. (2014) also reported the preservative effect of cinammon oil on concentrated yogurt. It seems promising to use different vegetable oils such as corn oil, canola oil and sunflower oil to preserve concentrated yogurt during storage. Therefore, the objective of this study was to determine the physico-chemical and sensory characteristics of concentrated yogurt made from goat milk immersed in vegetable oils during storage.

**MATERIAL AND METHODS**

**Milk preparation and yogurt processing**

Fresh milk produced by Peranakan Etawah goats was obtained from local goat breeders in Banyumas, Central Java, and transported in a coolbox. The milk was pasteurised at 63°C for 30 minutes and then cooled to 40°C. A previously activated powdered yogurt starter containing a mixes of *L. bulgaricus, S. thermophylus, L. acidophilus, L. casei and Bifidobacteria* was added to the pasteurised goat milk and incubated at 40°C for 5 hours. Fresh yogurt was stirred using a mixer for two minutes, cooled in a refrigerator for one hour before further processed into concentrated yogurt.

**Manufacture of concentrated yogurt**

The previously described procedures of concentrated yogurt manufacturing using in-bag straining technique (Sumarmono et al., 2014) was applied in this experiment. In sort, cold stirred yogurt was placed in a cheese cloth and hung inside a specially designed pvc pipe (d=3 inches, without vacuum pump). The whey was allowed to drain for 24 hours in a cold room (± 10°C).

**Figure 1.** Concentrated yogurt from goat milk stored in glass jars immersed in different vegetable oils

**Treatments and variables**

Freshly made concentrated yogurt was cut into blocks of 2x2 cm and placed in 300 ml glass jars. Four different vegetable oils (Ol=olive, Co=corn, Ca=canola, and Su=sunflower oils) were poured to the jars until all blocks of concentrated yogurt were submerged. The jars were tightly capped and stored in a cool room (8-10°C). Observations of variables were conducted at day 15 and 30 of storage. Variables observed included superficial growth of yeast, changes in color, off-flavour, consistency, and also chemical characteristics which were pH and titratable acidity. Each treatment has 6 replicates, hence there were 24 experimental units. Observation of supervisial growth of yeast, changes in color, off-flavour, and consistency was done by an expert panels. Measurement of pH was done by using a pH-meter and titratable acidity (% lactic acid) were determined by procedures described in BongMoraru (2014).
Data analysis

Descriptive analysis was applied data of growth of yeast, color, off-flavour, and consistency, whereas variance analysis was applied on data of pH and titratable acidity. Data processing was done using Minitab Statistics software version 15.

RESULTS AND DISCUSSION

Based on panel’s observation on sensory characteristics of concentrated yogurt (Table 1), no apparent changes were detected in the growth of yeast, color and consistency after 30 days of storage. No superficial growth of yeast indicated that olive, corn, canola and sunflower oils were effective in preventing the growth of yeast, and most probably mould and bacteria. Oil provides anaerobic condition that prevents the growth of yeast over the surface of concentrated yogurt. Previously, Keceli et al. (1999) reported similar results on virgin olive oil. However, a slight off-flavour was detected at day 30, which can be associated with oxidation of the oils.

It is shown in Figure 2 that titratable acidity of concentrated yogurt tended to increase with storage, but the effect of different vegetable oils was not significant (P>0.05). In term of pH (Figure 3), concentrated yogurt stored for 30 days tended to have lower pH than that stored for 15 days, and the effect of different vegetable oils on pH was also not significant (P>0.05). Compared to previous report by Şenel et al. (2011) the means of titratable acidity in this experiment is higher (2.66±0.13 vs 1.86%), and means of pH is lower (3.08±0.08 vs 3.89). Higher degree of acidity in this experiment could contribute to the longer shelf-life of concentrated yogurt.

Table 1. Sensory characteristics of concentrated yogurt from goat milk immersed in vegetable oils during storage

<table>
<thead>
<tr>
<th>Storage time: Media (oil):</th>
<th>Day 15</th>
<th>Day 30</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ol</td>
<td>Co</td>
</tr>
<tr>
<td>Superficial growth of yeast</td>
<td>(=)</td>
<td>(=)</td>
</tr>
<tr>
<td>Changes in color</td>
<td>(=)</td>
<td>(=)</td>
</tr>
<tr>
<td>Off-flavour</td>
<td>(=)</td>
<td>(=)</td>
</tr>
<tr>
<td>Changes in consistency</td>
<td>(=)</td>
<td>(=)</td>
</tr>
</tbody>
</table>

Ol: olive oil; Co: corn oil; Ca: canola oil; S: sunflower oil

(=) no/undetectable; (+) slightly detectable

Figure 2. Titratable acidity of concentrated yogurt stored in different vegetable oils during storage.
Figure 3. pH of concentrated yogurt stored in different vegetable oils during storage.

Prevention the growth of yeast and changes in color and consistency, and minimising the occurrence of off-flavor in addition to acidic nature of concentrated yogurt from goat milk are the contributive factors to the lengthening shelf-life of the products up to 30 days or even longer. As has been reviewed by Nsabimana et al. (2005), fresh concentrated yogurt can only be stored for two weeks.

CONCLUSION

Based on several physico-chemical and sensory characteristics, storing blocks of concentrated yogurt in vegetable oils in a tightly capped jars is promising technique to prolong the shelf-life of concentrated yogurt made from goat milk. Because no apparent differences among vegetable oils, the decision of which oils to use will depend on the price and local availability.

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Development of New Biostarter Medium Using Local Raw Materials for Composting of Elephant Feces

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ABSTRACT: The objective of this research is to develop for a new bio-starter medium for composting of elephant feces and knowing the effect on mature compost quality. Research was also designed to observe the elephant feces compost quality made with the addition of biostarter developed in rice bran fermentation (T1), biostarter made from pineapple fermentation (T2), and banana weevil biostarter (T3). The composting process was performed during a month and in every week compost materials were mixed and turned over to maintenance condition of the composting process is always aerobic. Physical parameters of compost quality were measured during 30 days of composting, chemical properties including water content, organic matter, organic carbon, organic nitrogen, organic calcium and C/N ratio were also measured. Biological observation of mature compost was observed by applying compost product on mustard growth, and the microbiological test was measured by Total Plate Count (TPC). Data were analyzed by One-way ANOVA to calculate differences among the treatments. The result showed that, significant differences (P>0.05) was not observed on water content for all treatment that is T1 58.88%, T2 60.95%, and T3 53.40%. The Research parameter of the organic content was found T1 30.39%, T2 34.97%, T3 28.25%. Total organic carbon in treated compost was observed: T1 17.62%, T2 20.28%, T3 16.39%. Total Nitrogen was T1 0.44%, T2 0.43%, T3 0.51%, total P T1 0.20%, T2 0.22%, T3 0.21%, total K T1 0.77%, T2 0.80%, T3 0.88%, C/N ratio T1 39.56, T2 47.24, and T3 32.81. The biological parameters including height, number of leaves, leaf length, leaf width, root length, and weight of the harvest of mustard was also had no significant differences. Total microbial counts on mature compost were T1 9.6 x 10^4, T2 4.6 x 10^4, and T3 4.2 x 10^4 CFU/g.

Keywords: aerobic composting, banana weevil, bio-starter medium, elephant feces, rice bran

INTRODUCTION

Due to the practice of intensive agriculture worldwide, it was impact on the acidic farmland soils and the lower content of organic matter. It is estimated that each hectare requires 20 tons of organic matter per year to supplement decomposition in the field under the good conditions of high temperature, humidity and microbial activity. Compost application is very popular in Agricultural countries as it has the potential to improve soil physical properties, supply plant nutrition, recycle waste materials, and reduce environmental pollution. Many biological materials show active decomposition accompanied by rise in temperature and are considered suitable for composting, such as agricultural by-products, crop residues, animal wastes, vegetable market wastes, waste mushroom media, food processing wastes, and municipal refuse (Zeng et al., 2012). During composting, thermophilic, thermostolerant and mesophilic microorganisms decompose cellulose, hemicellulose and lignin of substrates. The composting process is an exothermal biological oxidation of organic matter carried out by a dynamic and quick succession of aerobic microorganism populations. The heterogeneous organic matter of the raw material is transformed,
after a suitable composting period which includes bio-oxidative and maturation phases, into a stabilized end-product through partial mineralization and humification (Chen et al., 2007).

Composting typically denote as aerobic treatment of organic wastes from livestock feces, organic municipal wastes, crop residues, and industrial organic by-products to composts. It is a conventional and centuries-old agricultural technique, which are appreciated and used in agriculture land as bio-fertilizers and soil conditioners. Agricultural uses make the nitrogen (N) content in the compost and land field as an important reference to the quality of composts (Zeng et al., 2012).

During organic wastes composting, mineralization of some organic nitrogen ($N_{org}$) containing materials such as proteins, amino acids and urea releases considerable free ammonium ($NH_4^+/NH_3$). For this reason, the mineralization of $N_{org}$ is also termed as ammonification. This transformation is however bilateral since part of $NH_4^+/NH_3$ can be immobilized in turn by biomass to synthesize $N_{org}$ (Sasaki et al., 2005). Since the ability of ammonification is generally greater than that of immobilization, it causes an accumulation of $NH_4^+/NH_3$. The accumulated $NH_4^+/NH_3$ have therefore the potential to be stripped into the atmosphere with the aeration flow. The N losses from composting are mainly due to ammonia ($NH_3$) emissions, which account, respectively for 24–33% and 46.8–77.4% of the initial N of household wastes and manures. These emissions cause meanwhile series of environmental problems because of their odor, toxicity and contribution to eutrophication and acid rains (Paoli et al., 2010).

Elephants are the largest mammals on land which identical with intelligent, human friendly, and easy to control, imply on many attractions that can be performed by this animal to attract the visitors at the zoo or other amusement park. Including in Borobudur Temple, elephant has used as stable. Elephants have big bodies, are able to produce about 110 kg feces per day. The appropriate processing is needed to avoid environmental problems for visitors and residents around the location due to this huge number of feces. Utilization of elephant feces as a compostable material is one of the appropriate processing methods to resolve the problem.

The process of composting can be accelerated by using biostarter. Biostarter containing microbial which degrade of organic material can improve acceleration of the composting process. Commercial Biostarter has been widely found in the market. Even so, it would be better if farmers are able to make their own biostarter. Utilization of local raw materials as biostarter can accelerate the composting process without having to high additional costs so that farmers can made independently. The objective of this research is to develop for a new bio-starter medium from local materials for composting of elephant feces and knowing the effect on mature compost quality.

**MATERIALS AND METHODS**

**Method for making biostarter medium**

**Biostarter medium from banana weevil.** One and half kg of banana weevils was chopped and continued by mashed process. A total of 300 g of molasses was dissolved in 3 liters of washing rice water. Banana weevils that has been destroyed, furthermore mixed into molasses and water in the anaerobic fermentor which provided with pipes connected to the bottle that has been filled with water. The mixture is fermented for 10 days and then filtered, the liquid used as an ingredient in the manufacture of compost (Trubus, 2012). Data of pH measurements were taken in every day. Biostarter medium from pineapple.Tree kg of chopped pineapple was mashed processed. A total of 300 g of molasses dissolved in 3 liters of coconut water. Pineapple that has been destroyed was then mixed into molasses and water in anaerobic fermentor which provided with pipes connected to the bottle that has been filled with water. The mixture is fermented for 10 days and then filtered.
The liquid is used as a starter in the manufacture of compost (Trubus, 2012). pH measurements were taken in every day.

**Biostarter medium from rice bran.** In a total of 3 liters of boiling water was input 600 grams of bran, 150 grams of shrimp paste, and 600 grams of molasses. The mixture was stirred and wait into cold condition, after cold liquid inserted rod which has a rotten banana. The mixture is placed in a closed bucket for 5 days. Mix was opened on the sixth day and stirred for 10 minutes and not too tightly closed. Stirring is performed every day until the 10th (Wahyono, et al., 2010). PH measurements were taken every day.

**Composting**

Aerobic composting is performed in a dry place and protected from the rain. Compost is made by mixing 100 kg of elephant feces and 1 liter biostarter. Compost mixed using a hoe into homogeneous condition. The adding of water was performed if the compost is too dry. The compost is then closed using a covers. There are three treatments in the study and each treatment using three replication. Each pile consist of 100 kg materials with a maximum height of 1 meter in every piles. In order to maintenance water contain and moisture, reversal of compost is performed once a week during four weeks.

**Statistic Analysis**

Non-parametric (descriptive) analysis will be performed on the data of sensoris observation of compost. Arithmetic means, standard deviations and ANOVA which continued with Duncan Multiple Range Test (DMRT) has been employed on the data for physical, chemical, and biology parameters, for their significance.

**RESULTS AND DISCUSSION**

The biostarter medium that fermented for 10 d resulted the low pH condition at about 4. The color was about light brown with the smell of acid. The number of microbes in the medium made from rice brand was $6.7 \times 10^5$ cfu/ml, 24 times higher than the number of microbes’ presence at medium mad from pineapple of banana weevil. It was suggested due to the high nutrient content of rice brand would be useful for starter during the composting period.

**Fig. 1.** The Changes in (A) temperature and (B) pH of the compost over the treatment period; triangle representative for rice brand compost, circle representative for pineapple, and diamond representative for banana weevil compost.

The effect of biostarter medium supplementation on the compost temperature, and pH is shown in Fig. 1. Typically, compost remained at maximum temperature for 3 days, which indicated
The decomposition condition occurred. The maximum temperature reached 53°C for composting made by the addition of rice brand medium, 50°C from pineapple medium, and 53.11°C. The pH increased slowly from about 7 to 8 from the first day to the day 5th. Furthermore, rice brand which has higher nutrition content suggested increased the activities of thermophilic bacteria in compost.

Table 1. Physiochemical characteristics of mature compost made from elephant feces with the addition of various biostarter mediums with 30 days of composting period (dry weight basis determined from triplicate samples)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Biostarter Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rice bran</td>
</tr>
<tr>
<td>Water Content (%)</td>
<td>58.88 ± 3.39</td>
</tr>
<tr>
<td>Organic Content (%)</td>
<td>30.39 ± 6.10</td>
</tr>
<tr>
<td>C Organic (%)</td>
<td>17.62 ± 3.54</td>
</tr>
<tr>
<td>N Total (%)</td>
<td>0.44 ± 0.03</td>
</tr>
<tr>
<td>P Total (%)</td>
<td>0.20 ± 0.02</td>
</tr>
<tr>
<td>K Total (%)</td>
<td>0.77 ± 0.20</td>
</tr>
<tr>
<td>C/N Ratio</td>
<td>39.56 ± 5.31</td>
</tr>
</tbody>
</table>

ns: not significant

Table 1 shows us the chemical properties of mature compost treated with various biostarter medium. The physiochemical properties of mature compost did not show significant differences between each treatment. The highest water content was observed in compost treated with pineapple medium, followed by the rice bran compost and banana weevil compost. Good compost has a range of water content about 40-65% (USDA, 2007). The organic content of compost from all treatments observed appropriate with the standard of range 27-58% (SNI, 2004). Standard for physiochemical characteristics of compost according to SNI 2004 for organic carbon, Nitrogen, Phosphate, Potassium, and C/N ratio are 9.8-32%, minimum 0.5%, minimum 0.10%, minimum 0.2%, and 10-20, respectively. In means that all the parameters of compost are appropriate with SNI standard.

Table 2. The 28 days growth of mustard, planted in soil with the addition of treated compost from elephant feces using various biostarter mediums.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Biostarter Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rice bran</td>
</tr>
<tr>
<td>Plant Height ns</td>
<td>10.24 ± 1.03</td>
</tr>
<tr>
<td>Leave Number ns</td>
<td>4.22 ± 0.55</td>
</tr>
<tr>
<td>Leave Length ns</td>
<td>3.90 ± 0.49</td>
</tr>
<tr>
<td>Leave Wide ns</td>
<td>2.16 ± 0.39</td>
</tr>
<tr>
<td>Root Length ns</td>
<td>7.50 ± 1.42</td>
</tr>
<tr>
<td>Harvest Weigh ns</td>
<td>0.58 ± 0.24</td>
</tr>
</tbody>
</table>

ns: not significant

The biological parameters of mature compost was observed by the addition into the media for planting mustard. The data was shown in Table 2. By the addition of rice brand compost, the growth of mustard showed higher compare to the other treatments in almost all parameters.
Table 3. Microbiology parameter of treated compost with various biostarter medium

<table>
<thead>
<tr>
<th>Biostarter Medium</th>
<th>Number of microbes (x10^4 cfu/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice Bran</td>
<td>9.6</td>
</tr>
<tr>
<td>Pineapple</td>
<td>4.6</td>
</tr>
<tr>
<td>Banana Weevil</td>
<td>4.2</td>
</tr>
</tbody>
</table>

Table 3 shows the number of microbes in rice brand compost that observed twice higher comparing to pineapple and banana weevil compost. Bacteria, actinomycets, and fungi usually dominate microbial population in compost. The higher nutrient content of rice brand medium was suggested become the reason for the acceleration for microorganisms in compost for growing.

CONCLUSION

Elephant feces is an organic material that is quite difficult to composted. Due to the higher fiver content, elephant feces could not be composted during one month. The addition of various biostarter medium on elephant feces during composting does not give a significant difference on the quality of the physical, chemical, and biological characteristics. The physical characteristics and levels of C/N ratio of compost not yet meet the standards of SNI 19-7030-2004. The water content of the compost meets the standards of compost according to the USDA, the levels of organic matter, organic C, total N, total P, and K total of the compost has appropriate to the standard of SNI 19-7030-2004.

REFERENCES


Implementation of Good Manufacturing Practices in Halal Certified Chicken Slaughterhouses in Daerah Istimewa Yogyakarta

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ABSTRACT: The study aims to investigate the implementation of Good Manufacturing Practices (GMP) in halal certified chicken slaughterhouses (RPA) in Daerah Istimewa Yogyakarta (DIY), and to determine the meat derived from quality halal certified RPA in DIY. 20 respondents at of halal certified RPA in DIY were used in the study. They were selected using purposive sampling as much as 50% of all halal certified RPAs in DIY. Date collection were taken using questionnaire. Survey included observations and assess the activities directly in the RPA's the implementation score of RPA 1 (the best score) to 5 (the worst score). The quality of meat was determined total plate count (TPC) test and acidity (pH). The meat of the spearman Rank test was used to determine the correlation between the implementation of GMP and meat quality in terms of TPC and pH test. The results that the average value of GMP implementation was 368.27 with a score of 4.05 showed nearly the correct application of GMP. The average pH meat value was 5.91 and the average TPC value was 3.5 x 10³ cfu/g. There was high correlation between the implementation of the GMP with a pH test the value of the Rank Spearman was 0.666. There was high correlation between the implementation of the GMP with a TPC test the value of the Rank Spearman was 0.782. It could be concluded that the implementation of GMP in halal certified RPA in DIY has not been entirely implemented well. There was a highly significantly correlation between the implementation of the GMP with meat quality (pH value and TPC) on the halal certified to RPA in DIY.

Keywords: Good Manufacturing Practices (GMP), Chicken Slaughterhouses (RPA), Halal Certificate, and Meat Quality.

INTRODUCTION

Population of Indonesia in 2014 of approximately 250 million people and approximately 85% of the majority of the population of Indonesia is Muslim, it requires the willingness of animal food of high quality, safe and lawful consumption. Total meat consumption was a national consists of 56% is chicken meat, beef, 23% 13% 5% of pork, mutton and 3% other (Fajria, 2007). There are four main problems of national food safety and quality (Fardiaz, 1996), namely: first, food products that do not meet the quality requirements of food safety, secondly, there are many cases of food poisoning occur. Third, the low level of knowledge, skills, and responsibilities of food manufacturers about the quality and food safety, which was marked by the discovery of a means of distribution of products and food that does not meet the requirements of Good Manufacturing Practices (GMP) especially on small industries or households. Fourth, consumers lack of quality and food safety caused a limited knowledge and capabilities of the low purchasing power, so they are buying food products with a level of quality and security.

Basic health quality assurance system which is used in food production that is GMP and Analyze the Hazard and Critical Control Point (HACCP). It is emphasized that GMP is a staple
food safety assurance is to be done, especially in the food sector. Global picture concerning the RPA in the Yogyakarta special Daerah there are some who have already done the production process well but there are many some that do less hygienic production process so that the need for supervision and implementasi GMP at a RPA in DIY. This study was conducted to find out the level of knowledge of GMP and know the level of participation of the businessmen in the implementation of GMP in the RPA at DIY.

MATERIAL AND METHODS

This study was carried out during the five month i.e. September 2014 until March 2015. The implementation of this study was conducted at a RPA in DIY. The analysis was conducted at the Faculty of Animal Husbandry, Gadjah Mada University, Yogyakarta. Study material used was the respondent who was the perpetrator of the attempt at DIY RPA. Tool used to test the acidity (pH), namely pH meters and test total total plate count: erlenmeyer flask, magnetic stirrer, test tubes, autoclave, incubators and laminar flow cabinet. Study tools there used, namely: sheets of paper questionnaires, labels, bulpoint and data. Materials used for testing of total plate count that was sterile, aquadest pepton water and medium Plate Count Agar (PCA). Data capture slaughtering process this study respondents by means of purposive sampling of 50% certified halal RPA in DIY. The number of respondents was a RPA in DIY. This criterion was based on study that the respondents have the ability to implement the agreed GMP from the LPPOM MUI to have halal certificate. The variable in this study include: (1) variable x was the implementation of GMP in the RPA certified halal in DIY, (2) the variable y was the quality of the meat at a RPA certified halal in DIY.

Assessment of GMP Aspects

Assessment of aspects of GMP in the RPA was done with the process of charging a question about the State of the place and the production process. Assessment of the parameters refer to the National standards bodies and carried out according to the standard method (Standard National Indonesia, 1999).

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>If it does not meet the requirements</td>
</tr>
<tr>
<td>2</td>
<td>When a quarter of the eligible</td>
</tr>
<tr>
<td>3</td>
<td>If half the eligible</td>
</tr>
<tr>
<td>4</td>
<td>When one-third of eligible</td>
</tr>
<tr>
<td>5</td>
<td>If it meets the requirements</td>
</tr>
</tbody>
</table>

The Quality Of The Meat

Test the pH of the meat was done according to the standard method (Bouton and Harris, 1972) and the test of Total Plate Count (TPC) was done according to the standard method (Fardiaz, 1993).

Date Analysis

Spearman Rank correlation was used to find out the correlation between the implementation of GMP (variable x) with the quality of the meat (variable y). Data collection and analysis was carried out using a questionnaire and standard methods (Singarimbun and Effendi, 1995).
### RESULTS AND DISCUSSION

**Table 2.** The implementation of all aspects of GMP - RPA certified halal in DIY

<table>
<thead>
<tr>
<th>No.</th>
<th>Name RPA DIY</th>
<th>Building</th>
<th>Slaughtering process</th>
<th>Human Resources</th>
<th>Production &amp; Transportation</th>
<th>All Aspects Of GMP</th>
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</thead>
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<tr>
<td></td>
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<td>Value</td>
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<td>Value</td>
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<td>114</td>
<td>4</td>
<td>21</td>
</tr>
<tr>
<td>2</td>
<td>RPA 2</td>
<td>118</td>
<td>3</td>
<td>111</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>RPA 3</td>
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<td>4</td>
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<td>69</td>
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<td>144</td>
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<td>174</td>
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<td>RPA 18</td>
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<td><strong>Total</strong></td>
<td><strong>8102</strong></td>
<td><strong>89</strong></td>
<td><strong>8102</strong></td>
<td><strong>89</strong></td>
<td><strong>8102</strong></td>
</tr>
</tbody>
</table>

**Criterion** | **Score** | **Description**
--- | --- | ---
Not very good | $1 = \leq 101$ | Not applying the correct way
Less Good | $2 = 102 \text{ – } 202$ | Apply a small portion of the right way
Good Enough | $3 = 203 \text{ – } 303$ | Apply half the right way
Good | $4 = 304 \text{ – } 404$ | Almost close to the correct application of the GMP
Very Good | $5 = 405 \text{ – } 505$ | Apply the correct way of GMP

Average | 368.27 | 4.045
The Implementation of GMP Building

The results showed that the percentage of implementation of GMP building on the RPA with a value score of 5 was 15%. At a good value with RPA score 4 was 20%. On the RPA which was pretty good with a value score of 3 was 55%. At a RPA that was less good with a value score of 2 was 10%. The observations showed that in general the location of RPA has already qualified, but the density of population in the vicinity of the RPA can certainly be one of the factors the causes of product contaminants because the population was about free activities in the area of RPA. Building a RPA hygiene techniques and approaches but needs a lot of improvement. In general the RPA structure differences there almost the same, i.e. the amount of space equipment. Although the amount was inadequate compared to PT Daghspap and PT Saliman. The floor is made of material which was waterproof, it is not easy, is not toxic, corrosive resistant to crunch, easily cleaned and disinfected and is not easily peel off (standard National Indonesia, 1999). The walls on the RPA already lined ceramics of about 1 metre from the floor. According to Permentan (2010) the terms High wall at the site of the slaughtering process and manufacture the minimum 3 meters carcass.

The Implementation of GMP Slaughtering Process

The results showed that the percentage of implementation of GMP slaughtering process on the RPA with a value score of 5 was 15%. At a good value with RPA score 4 was 40%. On the RPA which was pretty good with a value score of 3 was 45%. Slaughtering process the chicken without fainting, after the chicken was removed from the basket by the slaughter, then with a certain slaughtering process directly carried out the killing. This slaughtering process was almost all done in RPA DIY. Chicken with fainting slaughtering was done with the electrified water 15 to 25 volts, 0.1 to 0.3 ampere 5 to 10 seconds on the chicken will be deducted as the RPA PT Daghspap Endurance. The purpose of the fainting to make chickens unconscious before slaughter was carried out, so as to relieve pain (animal welfare), ease the process of slaughtering, reducing its shortly after the killing in order to reduce the appearance of blood spots on the carcass and accelerate the process of spending blood (Directorate of veterinary public health and post harvest, 2010). Slaughter performed was in compliance with Islamic jurisprudence which confronts a cow to the Qiblah direction then read basmallah resonate or bismillahi Allahu akbar before the knife cut three channels across the neck. The slaughtering process was done with a disconnected three channels i.e. channel breath, gastrointestinal tract and blood channels (Soeparno, 2005).

The Implementation of GMP Human Resources (SDM)

The results showed that the percentage of implementation of GMP human resources RPA with a value score of 5 was 15%. At a good value with RPA score 4 was 10%. On the RPA which was pretty good with a value score of 3 was 30%. At a RPA that was less good with a value score of 2 was 45%. The basic requirement was that employees can create a good condition make the product, so its existence should not be considered one eye. But it should be a major concern for an industry because employees there directly confronted with the product. Based on observations in field, employee health has become the concern of the company. This is demonstrated by the existence of rules that only healthy employees who may come in the space of production. Employees who have open wounds or showed symptoms of the disease there not allowed entry. Frequently occurring contamination caused by pests entering production in the room i.e. lack of control on the environment or on the room.

The Implementation of GMP production and Transportation

The results showed that the percentage of implementation of GMP production and transportation systems on the RPA with a value score of 5 was 20%. At a good value with RPA score 4 was 25%. On the RPA which was pretty good with a value score of 3 was 55%. Each
RPA has the means of transport used to send meat to the depot, meat to markets and customers among others: (1) the car pick up open, (2) a Motor Carrier used as a second car. This has not been in accordance with SNI because according to SNI (1999) armoured vehicle cribs meat for transporting meat should be covered. Layers in the box on the vehicle to transport the meat must be made of materials that are not toxic, not corrosive easily, easily cleaned and disinfected, easily maintained and has good insulation properties. Cribs equipped with refrigerators that can maintain the temperature of the inside of the fresh meat $+7^\circ C$ and the temperature of the inside of the offal $+3^\circ C$.

**The Average Value of Implementation of All Aspects GMP**

The value of the implementation of all aspects of GMP on RPA 11, 12 and 15 was good with a value score of 5, meaning that it has already implemented the right way. At a RPA 5, 6, 9 and 16 there good with a value score of 4, meaning that almost approaches the application the right way. On RPA 1, 2, 3, 4, 7, 8, 10, 13, 14, 17, 18, 19 and 20 there good enough with a value score of 3, meaning that it only apply half the right way. The results showed that the average value of all aspects of the implementation of the GMP at a RPA in DIY was good with a value score of 3, this indicates that the RPA on applying half the right way. The results showed that the percentage of implementation of GMP all aspects on the RPA with a value score of 5 was 15%. At a good value with RPA score 4 was 20%. On the RPA which was pretty good with a value score of 3 was 65%.

**The Quality of The Meat**

The pH value of the meat. The results showed that the percentage of pH value of the meat at a RPA with a value score of 5 was 50%. At a good value with RPA score 4 was 40%. On the RPA which was pretty good with a value score of 3 was 10%. The pH value was one of the criteria in determining the quality of the meat, especially for meat industry such as the RPA. Muscle pH values at the time the animals living around 7.0-7.2 (pH neutral). After slaughter animals (dead), meat pH values will decrease due to the accumulation of lactic acid. The decline in muscle pH value of healthy animals and dealt with well before the cuts will run in stages, i.e. from the pH around 7.0-7.2 pH value will reach decreased gradually from 7.0 to 5.6-5.7 within 6-8 hours postmortem and would reach the final pH value of around 5.5 to 5.6. Final pH value (ultimate pH value) is the lowest pH values achieved in the muscle after the slaughtering process (of death). The pH value of the meat will never reach the value under 5.3. This is because at pH values below 5.3 enzymes involved in anaerobic Glycolysis is not actively working (Soeparno, 2005). PH values on this study has been in the good category in accordance with the opinion of Soeparno (2005) as average pH test 1 and test 2 was pH 5.6.

The Value Of TPC Meat. The results showed that the percentage of the value of TPC in a RPA with a value score of 4 was 40%. The percentage of the value of TPC in RPA which was pretty good with a value score of 3 was 60%. Testing of Total Plate Count (TPC) according to Bsn (1994) intended to indicate the number of microorganisms on a product, which in principle if the microbial cells are grown on agar medium, then the Microbe cells will proliferate and form colonies that can be seen with the eye. Based on the test results look 18 table TPC chicken meat products showed good results because of the above number of TPC standard (1x105 cpu/g) despite the RPA UD Samijan there on the threshold of the number of standards and meets the requirements of the TPC was included. Microbiology in the flesh can affect the quality, safety and durability of these foodstuffs. Microbiology on food animal products there bacteria, molds, and yeasts. In case of damage of food, food becomes unpleasant because of the color, flavor and appearance after the change, though it may do no harm (Gaman and Sherington, 1992).
The Correlation Between Implementation Of The GMP With The pH Values and TPC

Rank correlation analysis results showed that there were Spearman very real relationships between GMP implementation with pH values on the RPA at DIY. Spearman Rank correlation was used to find out the GMP implementation relationships with keeratan pH values. The data collected as rank after the observation. These relationships can be seen in table 2.

Table 2. The correlation between the implementation of the GMP with the pH values and the value of TPC

<table>
<thead>
<tr>
<th>Name of Test</th>
<th>Correlation Rank Spearman</th>
<th>t-count</th>
<th>t 0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acidity Test (pH)</td>
<td>0.655</td>
<td>2.454*</td>
<td>2.306</td>
</tr>
<tr>
<td>Test of TPC</td>
<td>0.637</td>
<td>2.337*</td>
<td>2.306</td>
</tr>
</tbody>
</table>

Description: * very real relationships

Spearman correlation values of the GMP implementation with pH values i.e. 0.666 and t-test results from the retrieved value t calculate i.e. 2.526, value t calculate t value was compared to a table on probability 5% free by degrees N – 2 = 10-2 = 8. The results were values t count greater than t 0.05 table this means there are relationship very closely and positive influence between the implementation of GMP with the pH of the meat. That was when the positive influence the implementation of GMP quality meat was good, it was also good in terms of the pH Test. Based on the results of the study there shows the influence between the implementation of GMP with pH values of meat. These influences indicate that implementation of GMP has already approached the slaughtering proces and facility but needs a lot of improvement.

The value of the correlation of GMP implementation Spearman Rank with TPC, namely 0.782, t test results obtained the value t calculate i.e. 2.545, this value was compared with the value of t a 5% probability on a table with a degree of non N-2 = 10-2 = 8, the results were values t count greater than the value of the table t 0.05 means there was a relationship very closely and positive influence between the implementation of the GMP by total plate count. That was when the positive influence the implementation of GMP quality meat was good, it was also good in terms of test of TPC.

CONCLUSIONS AND SUGGESTIONS

The conclusions of the study results was the implementation and application of GMP in the halal-certified RPA in DIY have not entirely done well. The results of the quality of the meat was either still in accordance with the SNI. There was a significant correlation between the implementation of GMP quality meat (pH values and TPC) on certified halal RPA in DIY. It was suggested the existence of further study as to the implementation of good manufacturing practices to the quality of the meat is physically (color, power tie, and texture), chemical (moisture, protein, fat, and ash) and level of knowledge. Need for scrutiny are serious about the implementation and application of GMP in the RPA certified halal at DIY so that it can be done well. Needs improvement and quality as there are places of influence between the implementation of GMP quality meat at a RPA certified halal in DIY.
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The Influence of Tanning Material Difference on the Physical Quality of the Skin of Puffer Fish (*Arothon reticularis*)

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ABSTRACT: The aim of study was to investigate the influence of tanning material difference on the physical quality of the skin of puffer fish (*Arothon reticularis*) in relation with the usage of Natural Resources, particularly fishes, i.e. puffer fish skin. Puffer fishes are famous for being toxic, very dangerous and have many bones in the skin, which is being its characteristic and specification. To make the bone not too sharp, two types of tanning are performed, i.e. chrome and vegetable tanning. To discover any tensile strength and elongation difference between vegetable skins and chrome skins, independent t test was performed. The result of the test $|t \text{ count}|$ of tensile strength = 3.511, and elongation 6.098 $> t \text{ table (0.05:16)} = 2.119$ or by comparing significance value which is bigger than error level (0.05) it was concluded that there was tensile strength difference between vegetable skins and chrome skins, and there was elongation difference between vegetable skin and chrome skins.

Keywords: Puffer Fish, tanning material, Physical Test.

INTRODUCTION

The implementation of the ASEAN Economic (AEC) in 2015 and the Asia-Pacific free trade, make every country prepares to face the free trade market, including Indonesia. Human Resources (HR) of Indonesia is still left behind to face the free market; it is because Indonesia has not prepared it maximally. Natural Resources (SDA) in Indonesia is very abundant, but has not been utilized effectively. One of the big challenges is to embed the collective awareness as a Nation which has to work hard to reach its advancement, to catch up with other countries in many aspects. It needs an effective strategy to improve the performances of national industries as well as to protect the domestic industries in facing the goods and services flows from the ASEAN countries. Therefore, Indonesia will emphasize its industries on the benefits of natural resources and the workers. One of the problems which is always be faced by this industry is the limitedness of its raw material which is the fresh leather.

The numbers of tanning industry which utilizes the fish leather as its raw material is still low. The alternative which can be taken by utilizing the fish leather as the raw material of tannery. Tanned fish leather is very potential to be developed but it has a very slow progress. The tanned fish leather business is not only giving an additional value for the leather wastes but also as an alternative in sufficing the leather materials for tanning industry in Indonesia which had been applied in producing the leather material products such as, bags, shoes, and sandals.

In utilizing the fishery products as one of the supplies to tanning industry is still facing some constraints and problems. First, the fishery products are the quickly-rot commodity, including the fish leather. Both the chemical composition and physical structure of the fish leather are different from the terrestrial animal leather. The fish leather is more easily decayed. The consequence to get the fish leather which is able to be tanned, it should be from the superfine-fresh fish. Therefore, the fish should be treated well. Similarly, the tanned leather needs a well treatment and is should be
processed as soon as possible. The scarcity of fish leather supply in tanning industry is primarily on the difficulties to get the high-quality fresh fish leather for the tannery. Besides, it should consider the impact to the environment, so that the chemical substances used should be environmentally friendly.

The purpose of this research is to find out the differences of the physical strength of puffer fish leather which had been used for vegetable tanning (environmentally friendly tanning) and chrome tanning. Besides, it should consider that the characteristic of puffer fish leather histology as an alternative of raw materials of tannery industry.

MATERIALS AND METHODS

Research Method

The materials used in this research were 36 sheets of puffer fish leather obtained from Rembang. 18 sheets were for the vegetable tanning and 18 others were for chrome tanning. Then, from the crust leather results, there were observed histologically. In the making of this histology preparation, the tissue of fish leather which would be observed was pickled by using formalin, then it was sliced thin (with a thickness of few micron), sticked up to the glass object, colored, and then covered by the glass cover (Suntoro, 1983). For the assessment of tensile strength was conducted based on the Indonesian standard of SNI 06-1795 -1990.

RESULTS AND DISCUSSION

Physical Quality

Leather has the physical properties and chemical composition that is different (Kanagy, 1977). Physical strength according to Roddy, (1978) is the power to influence the environment, among others, the effect of storage power, physical strength can be measured quantitatively, e.g. tensile strength, elongation, temperature wrinkles and rigidity. The physical strength according to Tuck (1981) correlated with tissue structure and the levels of chemicals on the leather, so that the amount of physical strength of the leather can be expected from the tissue structure and the levels of chemicals leather.

![Tensile Strength Chart](image)

**Figure 1.** The testing result of the tensile strength of the vegetable and chrome leather.

Figure 1 shows the results of tensile strength testing of the puffer fish leather tanned with chrome tanning materials where the value indicates a higher value than the tanned using vegetable materials. The tensile strength of the chrome tanned leather is 85.04 N/cm² while the puffer
fish leather vegetable is 51.65 N/cm² this is due to the nature of the tanned leather using the chrome tanning materials will produce more supple skin/soft, and more resistant against the high heat, higher tensile strength. Leather tanned with chrome tanning materials also have a high wrinkle temperature thereby the leather will produce high tensile strength values as well. Besides, the leather which is tanned with chrome tanning has a high wrinkle temperature as described by Covington (2009), that the chrome tanning gives a high hydrothermal stability, so that the chrome tanned leather will reach a wrinkle temperature to 110 °C. Wrinkle temperature is the temperature at which the structure of collagen in the leather experiencing shrinkage. Shrinkage occurs due to rupture woven collagen fibers due to extreme conditions such as heating at a high temperature (Astrida et al., 2008).

According to Purnomo (1985), chrome tanning materials are most important minerals tanner materials. This is caused by special-quality related to the molecular structure of chromium which allows trivalent chromium salts to form materials that have a strong appeal for complex leather material. Chrome has a high tannic power shown through its binding to the carboxyl group of leather so the leather structure becomes more compact and strong and it can be seen in Figure 2.

![Figure 2. The reaction between chromium and carboxylic acid in the leather collagen (Covington, 2009)](image)

In Figure 3, the results of the tensile strength testing in puffer fish leather tanned with vegetable tanning materials indicates that the test value is lower than the puffer fish leather which is tanned with chrome tanning materials. The lower tensile strength values can be caused by the bonding that occurs in the vegetable tanned leather is in the form of hydrogen bonding so that the leather tanned with vegetable tanning materials has lower wrinkle temperature than the chrome tanned.

![Figure 3. The elongation of Vegetable and chrome tanned of Puffer Fish Leather](image)
To determine whether there is a difference in tensile strength and elongation between vegetable and chrome leather, the independent t test is carried out. The results of the test showed that there is a difference in strength attraction between vegetable and chrome leather (P>0.05), as well as there is an elongation difference between vegetable and chrome leather.

**Histological Structure**

Long, et al (1996) states that the naturally arrangement of the leather dermis can make the fish leather in the tensile strength testing is quite high because its arrangement is trans parallel. The dermis is composed and organized as parallel fiber layers which is oriented forming an angle (oriented helically) in the opposite direction. Fish does not have scales mucus which is produced more than fish that have scales. The slime function on the fish is to reduce the friction between the body and water that makes the fish can swim faster (Omar, 1987). While the dermis, the leather layer will be thicker than the outer leather layer. The dermis contains blood vessels, nerves and connective tissue. This layer also plays a role in the process of formation of the scales on a fish with scales.

Based on the figure 5, it is explained that the vegetable tanning leather affects the spines on its surface that is not as sharp as on the basis of chrome tanning. Although it is state that the chrome tanning has good softness properties but it has no effect on the prickly softness, it is proved from the handle after the chrome tanned leather is still sharp prickly than vegetable tanned puffer fish leather.
CONCLUSION

1. The tensile strength and the elongation of the puffer fish leather which is tanned by chrome has the higher value than the puffer fish leather which is tanned by the vegetable.
2. It is seen from the histological, the vegetable tanning affect the softness spines of puffer fish

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The Effect of Composting Liquid Organic Fertilizer Processing Residues on Compost Quality

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ABSTRACT: The Quality of compost can be described with a content of total N, P\textsubscript{2}O\textsubscript{5} and K\textsubscript{2}O. Liquid organic fertilizer processing residues still contain organic material that can be decomposed by microbes into inorganic materials needed by plants. C/N ratio affects the activity of the bacteria decompose organic matter. This study aims to determine the content of N, P, and K compost from integrated processing beef cattle waste with a various C/N. The experiment using completely randomized design with 3 treatments of C/N ratio: T\textsubscript{1} (C/N 20), T\textsubscript{2} (25), T\textsubscript{3} (30). The composting process is carried out for 35 days. Mixture used rice straw as a carbon source. Statistics analysis with ANOVA and difference of influence between treatments studied to use Tukey’s test. The results showed that: (1) total N content in each treatment were significantly different, with a total N content of each treatment of 2.31% (T\textsubscript{1}), 2.80% (T\textsubscript{2}), and 2.48% (T\textsubscript{3}). (2) P\textsubscript{2}O\textsubscript{5} content between treatments did not show significant differences, with P\textsubscript{2}O\textsubscript{5} content of each successive treatment of 1.31% (T\textsubscript{1}), 1.14% (T\textsubscript{2}), and 1.13% (T\textsubscript{3}). (3) the content of K\textsubscript{2}O show significant differences between treatments, with K\textsubscript{2}O content of each successive treatment 11,1% (T\textsubscript{1}), 11,8% (T\textsubscript{2}), and 11,29% (T\textsubscript{3}).

Keywords: compost, organic, fertilizer, C/N ratio, N, P\textsubscript{2}O\textsubscript{5}, K\textsubscript{2}O

INTRODUCTION

Currently it has developed a livestock waste treatment methods in an integrated manner, so that the various outcomes such as liquid organic fertilizer, solid organic fertilizer, biogas, and probiotics can be produced in a series that begins with the initial decomposition process. Decomposition early (pre-decomposition) aims to remodel the organic material into simpler compounds, breed microorganisms decomposing biomass as a raw material liquid organic fertilizer, and reduce pathogenic microorganisms (Hutchison, et al., 2005; Mupondi, 2011; Singh et al., 2011). Decomposing microorganisms will grow quickly within 24-72 hours and the substrate temperature reaches 49-60 °C (Cooperband, 2000). Upon entering the phase of fermentation mesophilic dismissed, then dried to 15 % moisture content. The result of pre-decomposition namely ‘decomposan’.

Liquid organic fertilizer is made through a process of extraction ‘decomposan’ dried so that would be obtained filtrate which is the raw material for liquid organic fertilizer, and residue in the form of residual solids extraction. POC residue contain of organic material not decomposed yet, so that the composting process can be continued. There are several requirements that the composting process is going well, including C/N ratio. The composting process is well on the C/N 20-40 (CSIRO, 1979; Singh et al., 2011) Residue Composting POC has C/N 13.43 (Marlina,
2014), therefore the necessary additional material as a carbon source in order C/N ratio is ideal, one of which is rice straw. Rice straw is an agricultural waste which have C/N ratio of 44.5 (Marlina et al., 2014).

The content of nitrogen (N), phosphorus (P), and potassium (K) as the primary macro nutrients in the compost is an indicator of the quality of compost. Compost quality standards in Indonesia, which contains elements of N minimum of 0.40 percent, 0.10 percent minimum P, and K minimum 0.20 (National Standardization Agency, 2004). This research studied the effect of C/N ratio of the content of N, P, and K on the compost residue liquid organic fertilizer.

MATERIALS AND METHODS

Composting preparation. Residues of liquid organic fertilizer mixed with rice straw to produce the C/N ratio of 20: 1; 25: 1; and 30: 1 in accordance with the treatment. The content of C and N were analyzed at the Laboratory of Research and Services Padjadjaran University Chemistry Department. Water content is 50% for ideal composting. Compost temperature measurement is done every day. Composting is carried out for 30 days.

Statistical Analysis. To compare the difference in N, P, K content of different treatments, the data were analyzed by analysis of variance with a test criterion (F statistic). The Tukey multiple-comparison procedure of the Statistical Analysis System (2001); SPSS was used.

Analyzing factors on Parameters. N content was analyzed by Kjeldahl method, analysis of P by measuring phosphate (P$_2$O$_5$) using a spectrophotometer, and K analysis using AAS (Atomic Absorption Spectrophotometer).

RESULT AND DISCUSSION

N total Content

Total nitrogen is an essential nutrient for plants and animals. Total nitrogen is the sum of total kjeldahl nitrogen (ammonia, organic and reduced nitrogen) and nitrate-nitrite. Total Nitrogen in compost from liquid fertilizer residues varied between treatments. Achieved the highest N content in C/N 25 is 2.80% and the lowest N content in the C/N 20 is 2.31% (Table 1). Composts typically have low N content, ranging from 0.8 to 2.0% (Stoffella and Kahn, 2001). Consequently, additional N must be supplied from other sources, which may include legume cover crops (Millner et al., 2009).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>N  (±SD)</th>
<th>P$_2$O$_5$  (±SD)</th>
<th>K$_2$O  (±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>2.31±0.27</td>
<td>1.31±0.49</td>
<td>11.10±0.56</td>
</tr>
<tr>
<td>T2</td>
<td>2.80±0.32</td>
<td>1.14±0.27</td>
<td>11.80±0.73</td>
</tr>
<tr>
<td>T3</td>
<td>2.48±0.37</td>
<td>1.13±0.35</td>
<td>11.29±0.68</td>
</tr>
</tbody>
</table>

*) T1 = C/N 20; T2 = C/N 25; T3 = C/N 30;

*) The higher the C/N ratio greater carbon content and the smaller N content in the substrate. C/N ratio is ideal for the composting process 25-40 (Millner et al., 2009), but the C/N is optimal for rapid composting process is 25: 1 with water content of 45-60% (Cooperband, 2000). The supply of carbon relative to nitrogen (C/N ratio) determines whether net mineralization or
immobilization of nitrogen will occur. Mineralization is conversion of organic nitrogen to mineral forms (i.e., ammonium and nitrate). Immobilization is incorporation of nitrogen into microbial biomass (Cooperband, 2000). In the high C/N ratio, microbes will immobilize nitrogen into their biomass, while the C/N ratio is low nitrogen can be lost to the atmosphere as ammonia gas (Gaskell and Smith, 2007). Because the residual processing liquid fertilizer already passed the initial decomposition process, then partially degraded organic material by microorganisms. Therefore, the process of composting for 30 days, the compost has reached a good maturity that is reflected by the high N content in the C/N 25. In general, the benefit of fertilizer is to provide nutrients for plants. Therefore there are requirements that must be met as fertilizer quality standards contained in the Indonesian National Standard (BSN, 2004).

P$_2$O$_5$ Content

Phosphorus (P) and potassium (K) are plant macronutrients. These results provide an indication of the nutrient value of the compost sample. The content of phosphate (P$_2$O$_5$) in each treatment did not differ significantly (P>0.05).

The content of phosphorus in fertilizers described with the number of total phosphate (P$_2$O$_5$). C/N ratio in the substrate will affect microbial activity. The ideal ratio would lead to the reform process to be efficient organic material. However, the amount of Phosphorous content is not related to the amount of N content in composting. Degradation of organic material on the substrate and or phosphorus mineralization processes occur because the role of phosphatase enzymes produced by microorganisms (Poincelot; Stofella and Kahn, 2001). In the process of composting, P element will be largely used by microorganisms to build cell. Availability of C and N are the ideal bacteria and fungi can remodel lecithin and nucleic acids and liberate phosphorus as phosphate (Sutedjo, 1996).

K$_2$O Content

The content of potassium (K$_2$O) on the C/N ratio of 20:1 to 30:1 each treatment did not differ significantly (P>0.05). In general, C/N ratio below 35:1 resulted in the composting process is better when it contains nitrogen stable (Darlington, 2013). Compost quality is determined by the substrate material. Compost derived from livestock waste will contain elements of Phosphorous (P) and Potassium (K) is high, while the compost derived from the forage contains high potassium. Research materials derived from animal waste with a mixture of forage that potassium content reaches 11.80% in treatment C/N 25.

Potassium in the finished compost is much more available for plant uptake than nitrogen because potassium is not incorporated into organic matter. However, some of the potassium can be leached from the compost it is water soluble. Therefore, the study was designed to use a rice sack bag placed in a sheltered spot out of the stream of rain, and the pores in the sack of rice makes the aeration is maintained.

CONCLUSION

Liquid fertilizer residue still contains organic material that can be converted by microorganisms into inorganic material through the composting process. The content of N, P, and K in compost is still qualified as organic fertilizer. Although the nutrient compost is low compared to synthetic fertilizer products, compost is usually applied as greater rates and therefore nutrient contribution can be significant.
REFERENCES


Utilization of Bee Nest Waste as A Natural Disinfectant on Hatching Eggs Poultry

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ABSTRACT: Sanitation hatching eggs are essential to achieve a high level of hatchability and produce healthy chicks. Sanitation activities are carried out within the hatching eggs is to clean up using naturally based disinfectant can be used, such as waste bee nest, the election bee nest as a disinfectant because it contains approximately 50% resin compounds (flavonoids and phenolic acids). The purpose of this research was to determine how much influence the use of chemical disinfectants and disinfectant from waste bee nest to changes in the amount of bacteriain air space hatching eggs and disinfectant against bacterial inhibition obtained from the air hatching eggs. The method used is the Open petri dish Method; the data were analyzed descriptively with 5 treatments, Control, Water, Bee nest + Alcohol 70%, KMnO₄ + Formalin 40% and Alcohol 70% with four replications. Variables measured is the amount of air space bacteria and inhibition of disinfectant against bacteria obtained from the airspace hatching eggs. These results indicate that the bee nest can suppress the growth of bacteria by 41.03% and provide more inhibitory zone of 20 mm, which indicates that the disinfectant used is very strong.

Keywords: bee nest, disinfectants, bacteria, hatching eggs, poultry

INTRODUCTION

Efforts implementation of hatching eggs by using the incubator should be noted hygiene eggs or incubator. One factor that is very influential in the process of hatching is the cleanliness of eggshell, given as part of the outer shell are easily contaminated with dirt, especially feces is a source of bacteria and fungi that can attack the embryo. Hygiene eggs would be better if the eggshell is clean and not contaminated with any dirt. Contamination of eggs can occur since the egg is still in the hen through the air and can be outside once the eggs are in the open air. At hatching, the inner and outer equally affect the outcome of the hatch (M. Rasyaf, 2008). The cause of the spread of disease and death of the embryo was one of which resulted from poor sanitation and less than perfect. During the hatching process should be kept as minimal as possible presence of microorganisms. It is therefore necessary to minimize the disinfection of microorganisms that cause death of the embryo. Types of disinfectants that are less precise, including the dosage is too high, or the improper implementation of the disinfection can cause hatchability and mortality low (Mahfouz, 1998). Sanitation or a purge of hatching eggs and equipment can be done by fumigation. Types of disinfectants are widely used in the hatching process is KMnO₄ + Formalin 40% gaseous. Fumigation with a concentration of three times the power that is with a dose of 120 ml of 40% formalin, KMnO₄ 60 grams, for each volume of 2.83 m³ chamber for 20 minutes will kill approximately 97.5% to 99.5% of the organisms on brown egg shell, and around 95% to 98.5% of the organisms in eggshell white, the difference may be caused by the fact that the brown egg shell has a thick cuticle that absorb more gas (North and Bell, 1990).

Sanitation hatching eggs are essential to achieve a high level of hatchability and produce healthy chicks (Fueng-Lin Wo, 1996). Beehive consists of approximately 50% resin compounds (flavonoids and phenolic acids), 30% beeswax, 10% aromatic oils, 5% pollen, and 5% of various aromatic compounds (Fatoni, 2008). Propolis is a disinfectant (antibacterial) that kills germs into the nest. In general, propolis works as guard bee colonies from invading microorganisms and
their products (Salatino et al., 2005). Propolis extract 70% ethanol can be used as antibacterial compounds, both gram-positive bacteria (Staphilococcus aureus and Bacillus subtilis), as well as gram-negative bacteria (Escherichia coli), (Hasan, 2006). The minimum inhibitory concentration (MIC) of each extract of propolis for each bacterium was 0.39% against Staphilococcus aureus, Bacillus subtilis 0.78% against, and 0.78% against Escherichia coli (Fearnley, 2001).

Propolis also contains flavonoids that are so high that many researchers prefer propolis as flavonoids (Chinthapally et al., 1993). The presence of flavonoids, which are pharmacologically flavonoids, function as an anti-inflammatory, antioxidant, analgesic and anti-bacterial (Manoi, 2009). Flavonoid extracts have antibacterial activity against bacteria test with minimum inhibitory concentration (MIC) of the bacteria Bacillus cereus is 0.1% and against Escherichia coli was 0.5%. Flavonoid extract inhibits the growth of gram-positive bacteria (Staphylococcus aureus, Bacillus subtilis) and gram-negative (Escherichia coli, Pseudomonas aeruginosa, Salmonella typhi) (Ogbulie, 2007). Similar studies indicate that flavonoids extract can inhibit the growth of Staphylococcus aureus and Pseudomonas aeruginosa with the value of MIC (Minimum Inhibitory Concentration) of 2 mg/ml (Ngemenya, 2006). Waste from beekeeping that can be utilized is expected to be one of the solutions to reduce the pollution to the environment. Waste utilization beehive has flavonoid compounds into value the benefits of waste beehive applicative in the community. With the flavonoid compounds are expected to use the beehive can benefit through changes in population size of bacteria by inhibiting the growth of bacteria.

MATERIALS AND METHODS

The method used to calculate the number of bacterial population, in this study is the Disc Plate Method, is a method of calculating the number of microbes from the air that falls on a surface such as flooring, appliances, tables, etc.

Variables Observed
The parameters observed in this study are:
1. The number of bacteria in the airspace hatching and a decrease in the number of bacteria early and late
2. Inhibitory test, which is calculated by measuring the clear zone formed around the dish paper units (mm).

Data Analysis
Data analysis used is descriptive analysis. The data is calculated by finding the average value, standard deviation and coefficient of variation with 5 treatments and 4 replications.

RESULTS AND DISCUSSION

Table 1. Total Population Bacteria in Poultry Incubator

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Control</th>
<th>Water</th>
<th>Bee Nest</th>
<th>Formalin</th>
<th>Ethanol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (…..x 104cell/Cm2)</td>
<td>5.51</td>
<td>4.06</td>
<td>2.40</td>
<td>0</td>
<td>3.17</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>1.60</td>
<td>1.20</td>
<td>0.76</td>
<td>0</td>
<td>0.22</td>
</tr>
<tr>
<td>Coefficient of variation</td>
<td>29.03%</td>
<td>29.56%</td>
<td>31.67%</td>
<td>0%</td>
<td>6.94%</td>
</tr>
<tr>
<td>A decrease in the number of bacteria</td>
<td>–</td>
<td>25.23%</td>
<td>41.03%</td>
<td>100%</td>
<td>33.96%</td>
</tr>
</tbody>
</table>

The beehive base material as a natural disinfectant can inhibit even decrease the amount of bacteria populations on poultry incubator. Active compound contained in the beehive are
flavonoids that work to inhibit the growth of microorganisms. This is supported by Manoi (2009) statement that the presence of flavonoids, which are pharmacologically flavonoids function that is antibacterial. The working mechanism of these compounds is by forming complex compounds against extracellular proteins that disrupt the bacterial cell membrane integrity. While the group of ethanol is commonly used as a disinfectant in line with the statement Chin, et al (2002) that ethanol can inhibit or kill microbial bacteria, viruses, and fungi, but not spores. Ethanol groups working with and powered denaturation mechanism of action in the range of seconds to minutes and for the virus takes over 30 minutes. The alcohol group is not effective for spore bacteria and viruses are less effective for non-lipid. The advantage of this type of ethanol is its stable, does not damage the material, biodegradable, sometimes suitable for skin and slightly lower activity when interacting with the protein. While some of the disadvantages is the high risk of fire or explosion and very quickly evaporate. Cleaning the machine using water fowl hatching, the quick action that is often done by the poultry farmers. This is because the availability and ease of obtaining water. Incubator used should be cleaned of various types of dirt egg dust. In line with the statement Ratna (1993) that bacteria are everywhere: in the soil, air, water, dust, surface and in all sorts of places and environments. Although water does not have properties to inhibit or kill bacteria, the water can be used for cleaning of various kinds of impurities contained in the incubator poultry such as, dust, feathers, hatching egg shell, and others. Such efforts can reduce the amount of bacteria populations on poultry incubator.

Table 2. Clear Zone of various kinds of disinfectants against bacteria from poultry incubator

<table>
<thead>
<tr>
<th>Code</th>
<th>Bacteria Group</th>
<th>Bee Nest (mm)</th>
<th>Formalin (mm)</th>
<th>Ethanol (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Gram +</td>
<td>29.0</td>
<td>34.6</td>
<td>21.0</td>
</tr>
<tr>
<td>B</td>
<td>Gram +</td>
<td>21.3</td>
<td>67.3</td>
<td>0.0</td>
</tr>
<tr>
<td>C</td>
<td>Gram -</td>
<td>25.6</td>
<td>59.6</td>
<td>27.0</td>
</tr>
<tr>
<td>D</td>
<td>Gram +</td>
<td>32.3</td>
<td>44.6</td>
<td>26.0</td>
</tr>
<tr>
<td>E</td>
<td>Gram +</td>
<td>25.0</td>
<td>43.6</td>
<td>27.3</td>
</tr>
</tbody>
</table>

Criteria categorized antibacterial power of feeble show inhibition zone ≤ 5 mm, is said to be moderate when it shows the inhibition zone of 5-10 mm, said to be strong when it showed inhibitory zone of inhibition of 10-20 mm and is said to be very powerful when it shows the inhibition zone of more than 20 mm (Davis and Stout, 1971). Beehive extracted using 70% ethanol is proven to inhibit the growth of microorganisms, it can be seen in Table 2. which shows the clear zone. According Harbone (1987) states that 70% alcohol can extract flavonoids which are the highest and most important active compounds in propolis. An advantage of ethanol as a solvent is because it has a low boiling point and volatile, thus minimizing the numbers in the extract. This is in line with Angraini (2006) that the 70% alcohol aresemipolar so that all active components with different polarity in propolis can be extracted. According to Pelczar and Chan (1988) flavonoids, phenolic compounds hydroquinone and tannins classes of compounds including phenols, because all three of these compounds act as an antibacterial. The third type of disinfectant that is effective for use as a disinfectant, although natural disinfectant with a beehive base material has not been able to inhibit or kill bacteria optimally like mixing KMnO₄ + Formalin 40%.

CONCLUSIONS

Extracting the beehive is able to reduce the amount of bacteria in the incubator of 41.03% with a relatively very strong inhibition zone.
REFERENCES


Quality Vermicompost (Content N, P, K) from Beef Cattle Waste Treatment through Integrated

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ABSTRACT: This study aims to determine the effect of C/N ratio from feces of beef cattle and hay on the vermicomposting to quality vermicompost (content of N, P, K) through integrated processing. This study was conducted using Completely Randomized Design (CRD). Treatments were three treatment T1 = C/N ratio 20, T2 = C/N ratio 25, T3 = C/N ratio 30, with each 6 repetitions. Initial decomposition process conducted for 1 weeks, vermicomposting process carried out for 2 weeks. Data were analyzed using analysis of variance and to determine the effect of treatments performed Duncan test. The results showed that: the C/N ratio significantly affect the content of N and P in vermicompost, and give effect non significant to K in vermicompost. The C/N ratio 20 produces the best quality vermicompost( N = 3.18%; P = 1.17% and K = 0.85%)

Keywords: beef cattle feces, rice straw, the C/N ratio, vermicompost

INTRODUCTION

Beef cattle are usually fattening cattle, which will produce primary products such as meat and produce waste which is waste products of metabolism such as feces and urine, but it also is residual feed in the form of rice straw. Faeces produced from beef per cow per day some 5-10% of body weight cattle. Fattening beef cattle will result in waste concentrated in one place, it will be a source of contamination, for it is necessary to manage the waste produced from beef cattle fattening.

Beef cattle waste management can be done in various ways, including processing can be done by way of vermicomposting. This processing is the process of decomposition of organic waste that utilizes the activity of earthworms and microorganisms (bacteria and fungi) (Catalan, 1981). There are several factors that must be considered in vermicomposting including C/N ratio substrate to be described, the content of microorganisms, moisture content, pH, temperature, oxygen, density of population. This study used the difference in C/N ratio as a treatment. Vermicomposting will produce vermicompost which can be used as organic fertilizer. Degradation process will run if conditions are good substrates in accordance with the conditions required by earthworms and microorganisms as decomposers of the substrate, and this will affect the quality vermicompost produced. Vermicompost quality indicators include Nitrogen (N), phosphorus (P₂O₅) and potassium (K₂O).

Nitrogen (N) in vermicompost derived from the overhaul of organic material rich in N an excretion mixed with soil microbes in the digestive system of earthworms (Lee, 1985); According to Stofella and Kahn (2001) states that when earthworms digest organic materials decrease the amount of carbon in the substrate, while the amount of nitrogen is only a slight change.

The content of phosphorus (P₂O₅) in vermicompost is in line with the number N of the vermicompost. According to Kahn (2001) stated that during vermicomposting lasts microorganisms whose role will issue a phosphatase enzyme that spurs organic P mineralization. The greater
Nitrogen phosphorus contained in the multiplication of microorganisms that remodel will increase, so that the phosphorus content in vermicompost will also increase.

Potassium is not a mineral directly in the formation of organic matter, potassium plays a role only helps the formation of proteins and carbohydrates. Microorganisms utilizing potassium in the substrate as a catalyst, bacterial activity will greatly affect potassium content. Potassium tied up and kept in a cell by bacteria and fungi, if decomposed back then potassium will be available again (Kahn, 2001).

According to SNI: 19-7030-2004 minimum standards of quality compost containing nitrogen (N) 0.40%, Phosphor (P$_2$O$_5$) 0.10% and Potassium (K$_2$O) 0.2%.

**MATERIAL AND METHODS**

The research materials used were beef cattle feces, rice straw, chemicals to analyze the content of nitrogen (N), phosphorus (P$_2$O$_5$) and potassium (K$_2$O).

The method used in this study is the experimental method in the laboratory. This research is completely randomized design (CRD) with three kinds of treatment, i.e T1=C/N ratio 20, T2=C/N ratio 25 and T3=C/N ratio of 30 and repeated 6 times. Variables measured are Nitrogen (N), phosphorus (P$_2$O$_5$) and potassium (K$_2$O), vermicompost. To determine the effect of treatment, the data were analyzed with ANOVA and Duncan test.

Procedures of Vermicomposting In Beef Cattle Feces and Rice straw:
1. Determination of faecal beef mixture and rice straw according to treatment (C/N ratio 20, C/N ratio 25, and C/N ratio 30) as the substrate material
2. Then the two ingredients were thoroughly mixed and incubated for 1 week (initial degradation)
3. After the initial degradation process is complete, the substrate incubated for 24 hours, for the preparation of vermicomposting
4. Preparation of earthworms (Lumbricusrubellus), weighed according to the needs that have been established
5. Then the earthworm (Lumbricusrubellus) put in the stocking on a substrate which has been prepared, and incubated for two weeks (vermicomposting)
6. After vermicomposting was completed, an analysis on Nitrogen (N), phosphorus (P2O5) and Potassium (K2O) vermicompost was conducted.

**RESULTS AND DISCUSSION**

The average contents of total N, P$_2$O$_5$ and K$_2$O vermicompost on a variety of treatments was shown in Table1.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>T1</td>
<td>3.18a</td>
</tr>
<tr>
<td>T2</td>
<td>2.84b</td>
</tr>
<tr>
<td>T3</td>
<td>2.58c</td>
</tr>
</tbody>
</table>

Description: T1=C/N ratio 20; T2=C/N ratio 25; T3=C/N ratio 30
The same letter indicates no significant difference (P>0.05)
In Table 1 it appears that the total N content of vermicompost ranging from 2.58 to 3.18%, P$_2$O$_5$ content ranged from 0.6 to 1.1%, and K$_2$O content ranged from 0.85 to 1.0% average of the total N content, and P$_2$O$_5$, in each treatment showed significant differences (P <0.05), and K$_2$O contents in each treatment did not show significant differences.

N content in the substrate T1 (C / N ratio 20) is higher than T3 (C / N ratio 30), the result vermicomposting N content in vermicompost at T1 (C / N ratio 20) was also higher, it is alleged that vermicomposting is determined by the quality of the initial substrate and the activity of microorganisms and earthworms (Lumbricusrubellus) as decomposer. This is in line with (Lee, 1985) which states that the content of nitrogen (N) in vermicompost derived from the overhaul of organic material rich in N and excretion mixed with soil microbes in the digestive system of an earthworm. Strengthened also by Stofella and Kahn (2001) which states that when earthworms digest organic material decline in the number of carbon in the substrate, while the amount of nitrogen is only a slight change.

The content of P$_2$O$_5$ in treatment (T1) C / N ratio 20 was significantly higher compared to treatment T2 C / N ratio 25 and T3 C / N ratio 30. This is presumably because the content (P$_2$O$_5$) in vermicompost related to N content in the substrate. The greater the nitrogen content, the multiplication of microorganisms that remodel phosphorus will increase, so that the phosphorus content in vermicompost also increased. The content of phosphorus in the substrate will be used by the majority of microorganisms to build cell. Overhaul of organic matter and phosphorus assimilation process occurs because of the phosphatase enzyme produced by most microorganisms. This condition is in line with Kahn (2001) which states that during vermicomposting lasts microorganisms that act will issue a phosphatase enzyme that spurs organic P mineralization. The more nitrogen contained in the multiplication of phosphorus by microorganisms that remodel will increase, resulting in the increase of phosphorus content in vermicompost.

The content of K$_2$O in vermicompost at T1 (C / N ratio 20) = 0.85%; T2 (C / N ratio 25) 0.9% and T3 (C / N ratio 30) 1.0%, did not show significant differences in each treatment. Potassium content in vermicompost derived from the content of potassium in the substrate, although the potassium content of each treatment is different, but the presence of potassium in the vermicompost did not show significant differences, it is suspected due to potassium in the substrate utilized by microorganisms in the metabolism of growth will then affect the activity of microorganisms in degrading organic material. This is in line with Kahn (2001) which states that the mineral potassium is not directly in the formation of organic matter, potassium plays a role only helps the formation of proteins and carbohydrates. Potassium utilizing microorganisms in the substrate as a catalyst, bacterial activity will greatly affect the increase in the potassium content. Potassium tied up and kept in a cell by bacteria and fungi, if decomposed back then potassium will be available again. Research, quality vermicompost (vermicompost total N content ranged from 2.58 to 3.18%, P$_2$O$_5$ content ranged from 0.6 to 1.1%, and K$_2$O content ranged from 0.85 to 1.0%, according to the Indonesian standards (SNI), a quality compost should be minimal containing nitrogen (N) 0.40%, Phosphor (P$_2$O$_5$) 0.10% and Potassium(K$_2$O) 0.2%.

**CONCLUSION**

The C/N ratio 20 produces the best quality vermicompost (N = 3.18%; P$_2$O$_5$ = 1.17% and K$_2$O = 0.85%)
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Application of Natural Dye Substances on Crust Suede Sheep Skin by Dyeing Methods Using Jumputan Techniques

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ABSTRACT: The research aims to apply natural dyes on crust suede sheep leather by dyeing methods with jumputan techniques to produce jumputan motif on tanned leather. Secang (Caesalpinia sappan L) wood materials are used on tanned crust suede sheep leather. The procedure consists three steps: 1. Secang wood extraction methods; 2. The application of the secang dye on the Crust sheep suede leather by dyeing method with Secang material (dry/fermentation) concentration variation (5%; 10%; 15%); dyeing time (1 hour; 2 hours; 3 hours); jumputan techniques (bonding technique; suture technique); 3. Testing of color resistency of jumputan motif. The tested result produces 4 score, it means good on secang fermentation, 2 hours dyeing duration time; 10% dye concentration, ikat jumputan motif, croupon part crust suede sheep leather, and the tested result produces 4 score on secang dry, 3 hours dyeing duration time, 15% dye concentration, ikat jumputan motif, croupon part crust suede sheep leather. It can be concluded that the secang wood can be applied on crust suede sheep leather by jumputan techniques to produce unique and exclusive motif as raw material for handicraft leather products.

Keywords: Secang wood dye, Crust suede Sheep skin, dyeing methods, jumputan techniques

INTRODUCTION

Jumputan motif can be developed rapidly in Indonesia and even began to be known abroad, jumputan pattern making process has certain characteristics because of its beauty and uniqueness. Jumputan not only be used as goods that has magic value but jumputan also has a motives variety. It is not only loved by the people of Indonesia but also foreign tourist. Therefore jumputan should be developed with a variety of motives, to add value to the richness of Indonesian culture.

Jumputan is counteraction technique of color in certain places is not penetrated by the dye solution caused the bond / traction sutures, usually Jumputan media is cloth or other media marked motif, pinch (drawn or pulled) and then tied with a rope and then dyed. Basically jumputan formed through binding of specific parts of the surface of the fabric and then dyed with natural dyes or synthetic. (Larsen, 2004: 123-150). In the coloring process jumputan, ancient dyes used natural dyeing. Natural dyeing process is more complicated than the synthetic dyeing, this is the challenge to explore the potential of color-producing plants to produce natural dyes that are practical to use and environmentally friendly (Lemmen, 2008: 3-8).

On the other hand, the leather industries has produce tanned leather which has been used as a skin product/leather. Crust suede leather is ready colored tanned leather to provide a base color in order to use for leather clothing (Abrahart, 2005: 123-145). Sheep skin types based on its quality as follows: 1. Part Croupon, is part of the skin that is located on the back and having the most compact network structure, the extent of 40% of the total area of the skin; 2. The neck skin is rather thick, very compact but there are a few wrinkles; 3. Part shoulders skin is thinner, the quality is good, just sometimes there are wrinkles that may reduce quality; 4. The abdomen and thigh tissue structure less compact, thin and stretchy skin. (Covington, 2009: 269-278; Ding Zhiwen, 2008: 45-63).

In rare color dyeing process using jumputan motif on crust leather suede sheep has a great chance to increase the wealth by using the motif media of jumputan tanned leather to be used as a
new business opportunity. (Glory, 2012: 3-8).

In Indonesia the Government advocated the use of dyes that are environmentally friendly (green chemistry), which are safe for health and the environment. Prompting to do research, the research goal to obtain dye eco-label on the product jumputan media tanned leather with suede crust sheep, produce colors that ethnic motifs that can be socialized on business opportunities / SME. Natural dye that can be produced as an alternative substitute synthetic dyes that can reduce the environmental impact caused, low toxic properties and is safe for humans and the environment. (Pitojo, 2009: 10-16).

Based on the description above, this research aims to investigate the following: 1. Assessing the physical properties and chemical dyes cup (Caesalpinia sappan L) so that it can be applied on crust leather suede sheep; 2. Assessing the factors that affect the application of the dye cup on crust suede sheep skin using dipping method with jumputan ikat techniques; 3. Assessing absorption color fastness of jumputan motif. The advantages is expected as a basic consideration in the selection and use of environmentally friendly dyes on media tanned leather, as an alternative to synthetic dyes substitution which can reduce environmental pollution and have lower toxic effects for humans (Sastrawijaya, 2009: 3-18).

MATERIALS AND METHODS

The experiments are conducted in the laboratory, the material used is bark cup (Caesalpinia sappan L) with the dry ingredients and fermentation treatment, Crust tanned suede sheep skin. The procedure is as follows: 1. dye Extraction from the bark of the plant Secang (Caesalpinia sappan L); 2. Dye secang application on tanned leather sheep suede dyeing method (dyeing) with fastening techniques with a variety of dyes jumputan cup (dry; fermentation); immersion time (1 hour, 2 hours; 3 hours); ikat technique (bonding technique; stiching technique); 3. Knowing absorption color fastness by means chrockmater and observed with greyscale (fastness test SNI No. 0039.73).

RESULTS AND DISCUSSION

Identification of the secang dye and dry secang fermentation of physical and chemical properties of dry secang: color (red -violet); pH 4-5; density (1-3) OBE, brazilin content, yield of 8.5%; and from fermentation secang material: color (violet-red), density (3-5) OBe, brazilein content, yield 12.8%, and the yield of the color difference caused by the length of time of fermentation for 6 days, giving a high level of solubility and changes the dye brazillin be brazilein (red), secang acidic dyes that can be as dye tanned leather, figure 1.

![Figure 1](image)

**Figure 1.** Chemical structure Brazilin and Brazilein in the bark Secang (Caesalpinia sappan L)

Application of substance dyes results secang on tanned crust suede sheep skin immersion using jumputan ikat technique.

Using samples of crust sheep suede leather with a size of less is more (4-5) ft / lb consists of the back (Croupon), neck, shoulders, abdomen and thighs. Further weighing is done to the basic formula of making the dyeing process, and before the dyeing process is done, wetting and neutralizing is a process of managing the skin by soaking and play them in a solution of alkaline salts with a view to adjusting the properties of the skin for a basic coloring process. Jumputan ikat technique (mechanical bonding; stiching techniques)
There are three basic bonds of mechanical fastening jumputan recognized: 1. Mechanical single bond a bonding technique that is done by members of bonds on tanned leather with one bond alone, in order to get a binding motif; 2. Double bond techniques, the bonding techniques given a bond of more than one bond in order to get more than one binding motif or double; 3. Mechanical cross-linking, bonds performed cross each other, so we get motif shape crossed the line. The strap used can be vary yarns / polyester, raffia rope or elastic cord, in this study using elastic strap. Fig. 2

Figure 2. The method of bonding techniques (a) and suture technique (b) jumputan the tanned leather Crust Sheep Suede.

In Jumputan application of bonding techniques in media tanned leather, there is a high degree of difficulty compared to the fabric, because it is influenced by the thickness of the skin of the back (Croupon), neck, is thicker than the shoulder, abdomen and thighs, tail so that greatly affect the bond. Skills to create works motif requires high creativity and skills to obtain beautiful creation. The degree of difficulties (%) influenced by the thickness of tanned leather and its network structure, the order is as follows highest degree of difficulty is the cross-linking (70% ); the double bond being the degree of difficulty (50%) and the easiest is a single bond (10%), to form jumputan motif.

Sewing baste technique is to sew tanned leather material by using sewing baste method in order to create pattern on the color line using yarn and thread. Pull the thread tightly to wrinkle the leather. At the dying process the meeting yarn will block the color entry to the skin, the thread used should be thick and strong thread such as plastic threads / synthesis, jeans threads, or bounded nylon threads. Results of jumputan Sewing baste will form connecting dots that create the motif. The difficulty level is high (80%). The thickness of leather material and needle used in sewing baste technique will affect the pattern/motif result.

Formula and Dyeing Process

In the dyeing process yan amount of dye used with various concentrations of dye cup (5%; 10%; 15%) of the weight of crust tanned leather, and 150% of warm water (60°C), the percentage is calculated from the weight of crust leather. Dyes secang already weighed dissolved in cold water to become a paste, then diluted with hot water (60°C), included in the bucket of the skin and the water, and in doing dyeing with variation of time (1 hour; 2 hours; 3 hours). Testing the dyeing process is considered sufficient if the liquid in the bucket / container has been clear and the skin surface of both parts of the meat or parts of the tattoo when held color does not fade, figure 3.
Figure 3. Results of immersion in the dye cup tanned leather Suede Sheep Crust the method of fastening techniques jumputan.

Dyeing obtained by variation of time produced three different colors. Red-violet produced by dry secang in three hours immersion. Secang fermentation gives older color or violet-red caused by concentration of dyes material. The greater presentation of color concentration, the stronger color on the skin produced. Using a large amount of dye is not always a good thing because it can cause uneven color. Length of immersion will affect the penetration of the dye into the skin.

Secang color absorption by concentration variations (%) and time immersion (hours)

Table 1. Absorption secang color of the skin of sheep Suede Crust variations in the concentration (%) and immersion time (hours)

<table>
<thead>
<tr>
<th>Secang</th>
<th>Concentration (%)</th>
<th>Length (1 hour)</th>
<th>Length (2 hour)</th>
<th>Length (3 hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>5.0</td>
<td>Light – red</td>
<td>Dark - Red</td>
<td>red-violet</td>
</tr>
<tr>
<td></td>
<td>10.0</td>
<td>Light – red</td>
<td>Dark - Red</td>
<td>red-violet</td>
</tr>
<tr>
<td></td>
<td>15.0</td>
<td>Light – red</td>
<td>Dark - Red</td>
<td>red-violet</td>
</tr>
<tr>
<td>Fermentation</td>
<td>5.0</td>
<td>red</td>
<td>Red - violet</td>
<td>Violet - red</td>
</tr>
<tr>
<td></td>
<td>10.0</td>
<td>red</td>
<td>Red - violet</td>
<td>Violet - red</td>
</tr>
<tr>
<td></td>
<td>15.0</td>
<td>red</td>
<td>Red - violet</td>
<td>Violet - red</td>
</tr>
</tbody>
</table>

Differences in the color absorption are affected by the type of tanning, concentration and immersion of time. Secang dye acidic group containing anions which bind anionic with cationic amino acid groups of proteins of the skin. skin chromium salts tanned will bind the carboxylic acid groups of the protein of the skin, so the skin is tanned chrome tends to increase the amount of cationic charge. Furthermore, the salt will be hydrolyzed by removing acids also increase the acidity of the tanned skin, bonding happens very quickly when using acid dyes.

Jumputan motif towards secang absorption on tanned Crust Suede sheep skin by ikat method with bonding techniques (Single, Double, Cross). Bonding techniques are part of the tie, toned it when dyed colors are not affected, so that after the bond is released the image will be formed, the tied median will cause motif / pattern, the tie should be tight, so that when dyed colors are not affected, so that after the bond is released will form an image in the form of motifs. Ikat technique is done by holding the fabric surface / other media with a fingertip, then the surface of the tanned leather belt with a clearly better with a single bond, a double and a cross. How to tie is diverse, flat, sideway, folding combination, folding and rolling.

Figure 4. Results jumputan dye motif cup on Suede leather Crust Sheep bonding technique (single, cross).

Counteraction technique of color on the skin is not pierced by the media dye solution which caused bond, tanned leather that has been marked as a motive, pinch (drawn or pulled) and then tied with a rope and then dyed. Basically, jumputan formed through binding of specific parts of the surface of the cloth is then dyed with dye. At the time of that meeting dyed yarn would block
entry to skin color, motif jumpukan against absorption of color, value = 3.0 means a pattern of lines / curved translucent good; value = 2.0 means that a pattern of lines / curved translucent medium and value = 1.0 means that a pattern of lines / curved translucent less, figure 4.

![Figure 4.](image)

**Figure 5.** Motif jumpukan and power translucent dye bonding technique Dyes secang (dried and fermented), 3 hours.

The best color results of jumpukan motif obtained on the technique of secang dye colors (fermentation), three hours translucency. The value = 3, it showed that either translucent curved line pattern at a concentration (15%; 10%) is good. Results of translucent color motif for optimal power on ikat dye techniques cup (dry), three hours translucency value = 2.4 means motif curved lines being at a concentration (15%) on a single ikat technique. The degree of difficulty (%) of jumpukan motif for creating a single ikat technique is 10%; double ikat technique is 50% and cross-belt techniques is 70% in the medium crust leather suede sheep skin.

**Jumputan Motif on crust suede sheep skin by dipping method with bonding stitches technique**

Motif stitch sewing technique using a needle and a plastic strap, generate the appropriate motif image creation with baste motif images result.

![Figure 6.](image)

**Figure 6.** Results jumputan motif on on crust suede sheep skin by dipping method with bonding stitches technique

![Figure 7.](image)

**Figure 7.** Graph motive power jumputan and stitch bonding technique translucent dye Dyes secang (dried and fermented), time 3 hours

The jumputan motif optimal results for secang dye fermentation towards color penetrating is obtained by bonding techniques using in three hours length. The value is 2.6, it means transparent curved line pattern is at 10%; 15% concentration. The best results on color penetration produced by secang dry dye stitch bonding technique in three hours length. The value is 2.4, it means motif
curved lines is at 15% concentration. The degree of difficulty to create jumputan motif for bonding stitch techniques is 80%, the media used is crust suede sheep skin, image 6.

**Jumputan motifs and Secang colors**

![Jumputan motifs and Secang colors](image)

**Figure 8.** Results of secang dry color motif / fermentation on tanned Crust Suede Sheep skin

Differences in color motif penetration is influenced by the structure of the sheep skin, the skin of the back (Coupon), located at the back and has the most compact structure; the extent is 40% of the total area of the skin. It produced the most penetrating color than the neck skin. The neck part is rather thick, very compact but there are some wrinkles. The shoulder skin is thinner, the quality is good, but there are wrinkles that may reduce quality; as well as the belly part and thighs structure is less compact, thin and stretchy skin.

**Power testing fastness of color on the absorption of crust suede sheep skin**

![Power testing fastness of color on the absorption of crust suede sheep skin](image)

**Figure 9.** Graph of the results of applying the dye fade resistance on the secang Crust Suede sheep skin with immersion method.

From the color fastness test obtained four (4) value, it means good, there is a little color change to the original color in secang dye fermentation in two hours length; Concentration of dye is 10.0% using bonding technique on crust suede sheep skin coupon parts, and color endurance test results obtained four (4) value, it means good, the coloring agent concentration is 15.0% on dry secang using bonding technique on crust suede sheep skin coupon parts in three hours time immersion. Figure 9.

**CONCLUSIONS**

**The extraction of dye secang**

The study indicated that there is a different result obtained between dry secang dye and fermentation secang dye. Dry secang dye produced red–violet color with pH 4-5; density (1-3) °Be, brazilein content, yield 8.5%, while, secang dye fermentation produced violet-red color with density (3-5) °Be, brazilein content, yield 12.8%. This difference is caused by the high level of solubility fermentation time so that it changes brazilein becomes brazilin. Secang dyes has acidic nature that can be a dye for tanned leather.

**Applying the results of secang dye on suede crust sheep skin using dyeing method with jumputan fastening techniques**

There is an optimal difference found on fermentation secang dye with bonding technique in three hours immersion. The value is three (3), it means the curved line pattern is good in
concentration of 15% or 10%. The degree of difficulty to create motif or pattern applied on crust suede sheep skin by using single bonding technique is 20%, double bonding is 50%, cross bonding is 70%, and bonding stitches technique is 75%. Different motifs and colors influenced by the structure of the skin of sheep, the skin of the back (Croupon), produces the most penetrating power and color than both the cross-section of the neck, shoulders, belly and thighs.

**Absorption Test results Secang to power fastness**

The test results secang color fastness (fermentation) obtained a value of 4, it means good, a little color changes to its original color, dyeing time is two (2) hours; The concentration is 10% using bonding technique on crust suede sheep skin on croupon part, and the results color endurance of dry secang dye obtained a value of 4, it means good with concentration of 15.0% using bonding technique on crust suede sheep skin on croupon part in three (3) hours time immersion.

**SUGGESTIONS**

There should be a further study conducted on natural color consistency with improved dyeing process, emphasized on the influence of temperature and concentration of natural dyes to color durability by adding a suitable mordant and developed jumputan techniques motif creation on tanned leather.

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A New Technique to Detect Pig Hair by Immunochromatographic Rapid Test

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ABSTRACT: Pig hair can be used as brush to smear bread/cookies/other food or to clean devices for example a baking pan, so the food can be contaminated by haram stuff. As a brush, pig hair has no root of hair. If root of hair with some blood and skin are examined, DNA typing usually can be performed by molecular biological technique. But, hair ends of the brush contain a lot of protein. Thus, the objective of the research is to develop a new technique to detect pig hair. The samples were pig hair ends without their root. The protein of the hair was biochemically extracted, and then protein was detected by immunochromatographic rapid test kit. Hair was rinsed by SDS 2% and PBS, and digested by H2SO4 10%. The protein content was estimated by Nynhydrin 5%, and was tested for pig species by Xema pork rapid test. The result showed that the protein could be collected, and the sample was detected positively as pig species.

Keywords: pig, hair, protein, extraction, Xema rapid test

INTRODUCTION

Paint brush can be made of pig hair and used to clean devices for example a cake baking pan or to smear bread/cookies/other food. The food will be contaminated by pig hair and then declared to be haram for moeslems. Most Indonesian are moeslems, so a method for detection of species hair of brush should be created. The study was an initial research by detection of origin pig hair.

Hair consists of three concentric layers. The innermost layer is known as the medulla; the middle part of the hair, known as cortex; and the outer is known as the hair cuticle (Hughes, 2013). The most content of cortex is keratin and keratin-associated protein (KAPs). The KAP proteins interacted with each other and preferentially bound to hair keratins, but not to epithelial keratins (Fujikawa et al., 2012). Hair is a part of the skin that grows out of a structure known as the hair follicle. The length of a hair extends from the root, continues into a shaft, and terminates at the tip. The hair shaft is the part of the hair that protrudes out of the scalp. The hair shaft is part of the hair that is usually used as materials for brushes. The shaft does not consist of any nuclear DNA for a DNA test (Fujikawa et al., 2012). Some new techniques which allow DNA typing to be performed without a root need a lot of hairs.

In hair being absence of a root with skin or blood, color and structure (morphology) of hair is used to diagnose in the forensic feature. But, hair products, such as paint brush might be changed in color and structure. Another analysis, proteomic analysis based on protein is an alternative way to study on characterization of hair (Rouse and .Van Dyke, 2010). Some protein extraction methods have been performed with solution of Tris-HCl, thiourea, urea, and mercaptoethanol (Fujii and Li, 2008; Han et al., 2007; Nakamura et al., 2002). The objective of the research is to create a new technique to detect pig hair by extraction of protein by SDS and tested for pig species by Xema pork rapid test.
MATERIALS AND METHODS

Pig hair ends (hair shaft) were examined. The methods of the research used biochemically protein extraction, and the detection of pork species was carried out by immunochromatographic rapid test kit. The protein extraction methods were modified from an experimental procedure of Lee et al. (2006). The hair cut of 1 g in weight were rinsed in 10 ml solution of 2% SDS for ten minutes and drained by filtered paper. The hair was then immersed in 10 ml solution of 2% SDS, and the supernatant was discarded. The hair in 10 ml of phosphate buffer saline (PBS) and 10 ml solution of 2% SDS was incubated at 65 °C for overnight. On the next day, the hair was homogenized by magnetic stirrer for an hour at room temperature. Soluble and insoluble materials were separated by centrifugation at 8000 rpm for 5 minutes. Supernatant was collected into a tube. Protein was then digested with 5 ml solution of 10% sulfuric acid and put into waterbath at 40 °C for an hour. The bubble was neutralized by dropping a solution of 50% ammonium bicarbonate (NH4 HCO3). The tube was kept into freezer. The solution in the bottom was analyzed for pork species by pork rapid test (Xema, Malaysia). The protein content could be estimated by a reaction with 5% ninhydrin after dropping ammonium bicarbonate.

RESULTS AND DISCUSSION

The extraction produced two layer of solution in which protein was shown to be in the bottom (Figure 1) and the pork rapid test resulted in 2 colour line considering positive (Figure 2). The extraction was modified from the method used to analyze human hair shaft by Lee et al. (2006) to be a simple extraction method. The modified methods just need SDS without DTE and take 3 days to do extraction process, while Lee’s method need at least 10 days (Table 1). According to Lee et al. (2006), protein identified from soluble fraction consists of mostly disulfide-cross-linked keratins and KAPs. Keratin associated proteins of human hair shaft served to distinguish individual profiles of Caucasian, African-American, Korean, and Kenyan (Laatsch et al., 2014). That of pig hair may also serve to distinguish hair species by immunoassay, such as a Xema pork rapid test.

Figure 1. Extraction of protein
Figure 2. Xema pork rapid test
Table 1. The differences between Lee’s and the modified extraction methods.

<table>
<thead>
<tr>
<th>The method according to Lee et al. (2006)</th>
<th>The modified method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extraction:</td>
<td>Extraction:</td>
</tr>
<tr>
<td>- 40 mg of human hairs were rinsed in 5 ml</td>
<td>- 1 g of pig hairs were rinsed in 10 ml</td>
</tr>
<tr>
<td>solution of 2% SDS, 50 ml solution of</td>
<td>solution of 2% SDS for 10 min.</td>
</tr>
<tr>
<td>sodium phosphate (pH 7.8).</td>
<td>- It was drained by filter paper, then</td>
</tr>
<tr>
<td>- It was drained, then immersed in 5 ml</td>
<td>immersed in 10 ml solution of 2% SDS.</td>
</tr>
<tr>
<td>solution of 2% SDS, 50 ml solution of</td>
<td>- The hairs in PBS and 10 ml of 2% SDS</td>
</tr>
<tr>
<td>sodium phosphate (pH 7.8), and 20 ml</td>
<td>were incubated at 65 °C for overnight,</td>
</tr>
<tr>
<td>solution of DTE.</td>
<td>then pulverized by magnetic stirrer for</td>
</tr>
<tr>
<td>- The mixture was incubated overnight at</td>
<td>an hour at room temperature.</td>
</tr>
<tr>
<td>65 °C, then pulverized by magnetic stirrer</td>
<td>- The soluble and insoluble materials were</td>
</tr>
<tr>
<td>for an hour at room temperature</td>
<td>separated by centrifugation.</td>
</tr>
<tr>
<td>- The soluble and insoluble materials</td>
<td>- The insoluble material was resuspended in a</td>
</tr>
<tr>
<td>were separated by centrifugation.</td>
<td>solution of 2% SDS, 50 ml solution of sodium</td>
</tr>
<tr>
<td>- The insoluble material was resuspended</td>
<td>phosphate (pH 7.8), 20 ml solution of DTE.</td>
</tr>
<tr>
<td>in a solution of 2% SDS, 50 ml solution</td>
<td>- The insoluble material was then incubated overnight at 65 °C; and then extracted as the</td>
</tr>
<tr>
<td>of sodium phosphate (pH 7.8), 20 ml</td>
<td>procedure before (five extractions).</td>
</tr>
<tr>
<td>solution of DTE.</td>
<td></td>
</tr>
</tbody>
</table>

Xema pork rapid test is immunoassay technique that can be used in the field of food technology. The principle of this technique is soluble antigen (usually a protein) diffused to the antibody. If the antibodies is in accordance with antigens, then the reaction is indicated by a line of sediment (Ahmad, 2005). In this research showed that protein of pig hair shaft and antibody diffuse into each other forming a line.

CONCLUSIONS

The conclusion showed that protein could be collected by a modified extraction method, and the pig hair shaft was detected positively.

REFERENCES


Isoptericola sp. A10-1, Chitinase Producing Actinobacterium Isolated from Indonesian Tropical Shrimp Pond Waste Water

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**ABSTRACT:** The purpose of this study was to obtain superior chitinolytic bacteria capable of degrading chitin from the waste water of tropical shrimp pond. The bacterium characterization was conducted to yield high-activity chitinase isolates, while bacterium identification was carried out based on morphology, physiology, biochemistry and molecular. The 16S rRNA method was used to identify strain *Isoptericola* sp. A10-1, similarity (99%). This strain was able to produce extracellular chitinase in media containing colloidal chitin a carbon source. Results of morphological identification, biochemical and molecular identified as *Isoptericola* sp. A10-1 including the genus *Isoptericola* showed chitinase activity in medium containing chitin as a carbon source. Chitinolytic bacteria *Isoptericola* sp. A10-1 are able to degrade chitin specifically into the monomer in the form of glucosamine. They are widely used in the fields of agriculture, food and health industries.

**Keywords:** Isolation, *Isoptericola* sp., Chitinase, Shrimp Waste

**INTRODUCTION**

The growth of shrimp farms in marine areas of Java and Lampung, Indonesia is growing rapidly. Small-scale shrimp farms also grown in Bantul, Yogyakarta. So that the potential of shrimp waste very much, which is a material for producing chitin.

Chitinase (EC 3.2.11.14) enzyme can hydrolyze insoluble chitin from oligomers and monomer. Chitin can be found in a variety of organisms including bacteria, fungi, insects, higher plants, and animals. They play important physiological roles depending on their origin (Gooday, 1990). Chitinase has a wide-range of applications such as preparation of pharmaceutically relevant chito-oligosaccharides. Chitin waste can be altered into N-acetyl-D-glucosamine, treatment of chitinase waste, and functional food (Dahiya et al., 2006). Chito-oligomers produced by enzymatic hydrolysis of chitin are used in various function for agricultural and industrial applications, such as antibacterial, antifungal, and as a food quality enhancer (Bhattacharya et al., 2007).

The first step in the degradation of chitin, which is mainly carried out by microbes, is the hydrolysis of the glycosidic bond between N-acetyl-glucosamine residues by chitinase (EC 3.2.1.14) (Cottrell et al. 1999). Chitinase hydrolyze chitin polymer into oligosaccharides, particularly kitobiosa (GlcNAc), a dimer of subunit N-acetylglucosamine. β-N-asetilase (EC 3.2.1.52) hydrolyze (GlcNAc) to produced the final product, N-acetylglucosamine (GlcNAc). Hydrolysis β-(1,4)-glukosidik chitin bond can resume activity endokitinase and eksokitinase (Cabib, 1987).

*Actinomycetes* are a group of microorganisms that have morphology and growth properties are located between fungi and bacteria. In the book Bergey’s Manual, Actinomycetes are grouped into groups of Gram-positive bacteria with filament yarns in the form of short branched mecelium with a diameter of 0.05 to 2 μm (Holt et al., 1994).

This study aimed to gain superior isolates chitinolytic bacteria capable of degrading chitin
from shrimp waste, especially in the tropical shrimp pond. Characterize isolates with the highest chitinase activity based on morphology, physiology, biochemistry and molecular identified isolates.

**MATERIALS AND METHODS**

The isolates were analyzed for species identity using the 16S rRNA gene sequencing method according to Rochelle et al., (1995). The gene sequencing was performed at Genomics Research (Gifu Univ). DNA sequences were aligned using DNA star & Data Collection v3.1 Communication Patch1. Bacterial 16S rRNAs were amplified by using the following universal bacterial 16S rRNA primers. Forward primer 27 F (5’-AGAGTTTGATCMTGGCTCAG-3’) and reverse primer 1792 R (5’-TACGGYTACCTTGTACGACTT-3’) (Gomaa, 2012).

**RESULTS AND DISCUSSION**

Identification of the isolates A10-1 based on biochemical, morphological and molecular. Cells are Gram-positive-staining, coccoid- or rod-shaped, non-motile and have no spores. Colonies on TSA are orange, circular, convex, smooth and 1.0–2.0 mm in diameter after 48 h incubation at 30 °C. Optimum growth occurs at 35 °C, at pH 8.0 and with 2% (w/v) NaCl. In addition to the characteristics presented in Table 1. The Gram staining showed Gram positive on (Figure 1). Oxidase positive biochemical test results, using the substrate D-trehalosa, sucrosa and maltosa. Enzyme test β-N-Acetyl-Glucosamine positive and oxygen requirements are aerobic and facultative anaerobic.

![Figure 1](image)

**Figure 1.** a). Isolate A10-1 grown on chitin agar plates 1% and showed clear zones. The culture was incubated at 30°C for 5 days

b). Gram staining of bacteria showed coccoid and gram-positive
The phylogenetic tree showed that A10-1 is closely related to members of the species *Isoptericola* sp. A total of 1177 bp of the 6S rRNA gene sequence was sequenced. Comparative 16S rRNA gene sequence analysis showed that strain A10-1 was most closely related to members of the genus *Isoptericola*.

Similarities between the 16S rRNA gene sequences of strain A10-1 and *I. jiangsuensis* strain CLG, *I. dokdonensis* strain DS-3, *I. nanjingensis* strain H17 and *I. hypogeus* strain HKI 0342 were 99, 99, 98 and 98 %, respectively. In a phylogenetic tree based on the neighbour-joining algorithm (Saitou & Nei, 1987), strain A10-1 and *I. dokdonensis* strain DS-3 formed an independent cluster at a bootstrap value of 98% (Figure 2).

**Table 1.** Morphological, biochemical, and physiological characteristics of isolates A10-1

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Coccoid or rod</th>
<th>Utilization of:</th>
<th>API ZYM test:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td></td>
<td>D-Fructosa</td>
<td>β-N-Acetyl-glucosamine</td>
</tr>
<tr>
<td>10°C</td>
<td>+</td>
<td>D-Trehalosa</td>
<td></td>
</tr>
<tr>
<td>42°C</td>
<td>-</td>
<td>Sucrosa</td>
<td></td>
</tr>
<tr>
<td>Gram stain</td>
<td>+</td>
<td>Maltosa</td>
<td></td>
</tr>
<tr>
<td>Sporulation</td>
<td>-</td>
<td>Acetat</td>
<td></td>
</tr>
<tr>
<td>Motility</td>
<td>-</td>
<td>L-Glutamat</td>
<td></td>
</tr>
<tr>
<td>Colonies morphology</td>
<td>Circular, orange</td>
<td>Alkaline phosphatase</td>
<td></td>
</tr>
<tr>
<td>Aerob, anaerob facultatif</td>
<td>+</td>
<td>Trypsine</td>
<td></td>
</tr>
<tr>
<td>NaCl 2% (w/v)</td>
<td>-</td>
<td>α-galactosidase</td>
<td></td>
</tr>
<tr>
<td>Oxidase</td>
<td>+</td>
<td>Acid phosphatase</td>
<td></td>
</tr>
<tr>
<td>Hydrolysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urea</td>
<td>+</td>
<td>Valine arylamidase</td>
<td>Trypsine</td>
</tr>
<tr>
<td>Gelatin</td>
<td>+</td>
<td>Cystine arylamidase</td>
<td></td>
</tr>
<tr>
<td>Casein</td>
<td>-</td>
<td>Lipase (C14)</td>
<td></td>
</tr>
<tr>
<td>Starch</td>
<td>-</td>
<td>Esterase (C4)</td>
<td></td>
</tr>
<tr>
<td>Hypoxanthine</td>
<td>-</td>
<td>Type peptidoglycan</td>
<td>L-Lys-D-Asp</td>
</tr>
<tr>
<td>Xanthine</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tyrosine</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

VITEX system was used; +, positive; -, negative,

CONCLUSION

The strain A10-1 was selected among those giving maximum enzyme production in the shortest time. It was further identified as *Isoptericola* sp. A10-1. The chitinase enzyme that was produced by this strain has chitinase activities.

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Production and Application of Keratinase Enzyme from 4 Strains of 
*Bacillus* spp. Isolated from Yogyakarta and Garut City

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**ABSTRACT:** Processing of waste chicken feathers can be used as a biological treatment with keratinase enzyme. Keratinase enzyme can be produced by microorganisms. Keratinase enzyme expected to be produced from *Bacillus* spp. which has been previously isolated from Yogyakarta and Garut City. The purpose of this research was to determine the production of keratinase enzyme produced from *Bacillus* spp. and apply the keratinase enzyme in the process of degradation of chicken feathers. Research consists to measuring the growth of *Bacillus* spp. and investigation of degradation of chicken feathers by *Bacillus* spp. were analyzed descriptively, while data of digested protein by *Bacillus* spp. analyzed using a split plot design, if there are differences followed by Duncan New Multiple Range Test (DMRT). The results obtained bacterial growth and the ability of degradation was found on *Bacillus* sp. TD5B. Increasing of growth rate was followed by faster degradation time. Concentration soluble protein by *Bacillus* megaringium capable of producing higher compared with any others strains. *Bacillus* megaringium has had highest soluble protein (2,030 mg/ml). The longer degradation time followed by highest concentration soluble protein of feathers. The best incubation time at 8 hours that containing 2,256 mg/ml of soluble protein.

**Keywords:** *Bacillus* spp., Feathers, Keratinase Enzyme

**INTRODUCTION**

Poultry feathers contain more than 90% of crude protein in keratin form, found as wastes or by-products at poultry processing plants (Howie et al., 1996). Increasing quantities of feathers could effect to the environmental pollution (Rajput and Gupta, 2013). The crude protein content in feather wastes could have a great potential nutrient value and may have some advantage as a protein sources for substitute from more expensive dietary ingredients for animal feed such as poultry and ruminant animal (Xie et al., 2010). Worldwide, commercial poultry processing generates 5 millions of tons of feathers per year, which are currently converted to feather meal through steam pressure and chemical treatment (Freeman et al., 2009). Including in Indonesia, poultry industries are growing faster comparing to the other livestock industry due to the high demand of poultry meat as cheap and high quality protein sources for human consumption. Furthermore, making keratin waste more digestible, established chemical treatment process such as alkali hydrolysis and steam pressure cooking, is both high cost processes and destructive to certain amino acids from feathers such as methionine, lysine, and tryptophan (Tork et al., 2012). The nutritional upgrading of feather as animal feed, especially amino acids content with the treatment of microbial keratinase might lead to a significant increase in the availability of certain amino acids in feather keratin (Joshi et al., 2007).

**MATERIALS AND METHODS**

**Source of Keratin and Preparation of chicken feathers as substrate**

Chicken feathers (whole feathers) were collected from chicken slaughterhouse at Yogyakarta district. Feathers were then extensively washed in tap water continued by sterilization with...
autoclaved and then dried in hot air oven for 48 h. They were stored at 28°C until used.

**Microbial Culture**

The organisms was grown in basal salt medium (g/L): meat extract, 1.0; biological peptone, 1.0; NaCl, 0.5; and feathers, 1.0. For submerged fermentation, 24 h grown seed culture was used at 5% (v/v) concentration. The cultivation was performed at 28°C at 120 rpm on a shaking incubator for 24 h. Every 6 h, sample was grown by spread plate methods. After 3 d incubation, the bacteria were able to count of colonies.

**Feathers Degradation**

The success rate of substrate degradation was measured by medium turbidity and amount of feathers in medium. Feathers 0.5 g/L to be completed degraded by four strain bacteria in different time. The cultivation was performed at 28°C at 120 rpm on a shaking incubator for 3 d.

**Keratinase Production**

The cultivation was performed at 28°C at 120 rpm on a shaking incubator for 8 h. Every 2 h, sample was centrifuged at 4°C at 3,000 rpm for 15 min. The supernatant was used as crude enzyme source. Crude enzyme protein assayed using Lowry methods.

**Data Analysis**

Data from protein concentration of hydrolyzed feather produced were analyzed using a split plot design. Furthermore, if there are differences between the mean, analyses will be continued with Duncan’s New Multiple Range Test (DMRT).

**RESULTS AND DISCUSSION**

According to the measurement of the growth in liquid medium of four-isolated strains, which confirmed to be belong to *Bacillus spp.*, it was showed different profiles from one to the others. Without the addition of feather as substrate, the growth of *Bacillus sp. TD5B* showed higher pattern in liquid medium compared to *Bacillus sp. TD5K*. Furthermore, *Bacillus sp. LS2B* showed higher growth compare with *Bacillus megarhizium* (Figure. 1).

![Figure 1](794)

**Figure 1.** Comparison the Growth of bacteria *Bacillus sp. TD5K* (square), *Bacillus sp. TD5B*.
CFU/ml (Figure 2). This was due to the addition of feather substrate that causes isolates of *Bacillus spp.* regenerate faster against the time. After 24 h incubation, the color in a liquid medium was changes from yellow into a murky brown on medium.

![Figure 2](image)

**Figure 2** Comparison of bacterial growth a) *Bacillus* sp. TD5K; b) *Bacillus* sp. TD5B; c) *Bacillus* sp. LS2B; d) *Bacillus* megaritrium with feathers (square) and without feathers (diamond) in the culture medium

Bacterial growth can be measured by calculation of bacteria growth in the agar medium or colony forming units (CFU). Discoloration on medium with the addition of chicken feathers a sign that chicken feathers contained in the medium hydrolyzed by isolates of *Bacillus spp.* Keratinolitik extracellular enzyme produced by each isolate *Bacillus spp.*, keratin found in chicken feathers will be hydrolyzed into peptides and amino acids that dissolve (Mazzoto et al., 2011).

**Feather substrate degradation by Bacillus spp.**

Results of the feather degradation by *Bacillus spp.* showed the different in the degradation time. *Bacillus* sp. TD5B showed degraded the feathers at about 65 hours, it was more quickly in degrading from *Bacillus* sp. TD5K that completely degraded the feathers at about 68 hours. The substrate degradation by *Bacillus* sp. LS2B was performed at about 71 hours, and *Bacillus megaritrium* need about 72 hours to completely degraded the feathers.

In addition of poultry feathers, which completely degraded by the keratinase enzyme, was also indicated by the changed of the color in a liquid medium. It was suggested that the murky yellow which appear in the medium as the result of hydrolysis process of proteins into peptides and amino acids. It was totally different in color medium at 0 hour which appears as clear yellow (Figure 3).

*Bacillus spp.* both can multiply and produce a keratinase enzyme in medium supplemented with chicken feathers, because the feathers are one of the extra nutrients for bacterial cells of as a source of carbon and nitrogen. Carbon and nitrogen are needed by cells of *Bacillus spp.* to produce more keratinase enzyme that can break down keratin contained in chicken feathers (Ali et al., 2011). Keratinase will be produced in large quantities when there is a keratin substrate in the medium (Gupta and Ramnani, 2006).
Figure 3. Degradation of chicken feathers by 4 *Bacillus* strain. 

- a₁) *Bacillus* sp. TD5K at 0 hours; a₂) *Bacillus* sp. TD5K at 68 hours; b₁) *Bacillus* sp. TD5B at 0 hours; b₂) *Bacillus* sp. TD5B at 65 hours; c₁) *Bacillus* sp. LS2B at 0 hours; c₂) *Bacillus* sp. LS2B at 71 hours; d₁) *Bacillus* megarunnerum at 0 hours; d₂) *Bacillus* megarunnerum at 72 hours

**Concentration of soluble protein by *Bacillus* spp. keratinase**

Investigation of feather digested protein by keratinase from all strains was performed in submerge fermentation in liquid meat extract medium containing poultry feathers. The digested protein in the medium from feathers suggested as the action of keratinase activity against feathers keratin. The result was shown in Figure 4.

![Graph of enzyme keratinase production](image)

**Figure 4.** Graph of enzyme keratinase production by *Bacillus* sp. TD5K, *Bacillus* sp. TD5B, *Bacillus* sp. LS2B, and *Bacillus* megarunnerum

The data were then analyzed using split plot design. Based on the results, the different types of *Bacillus* strain effect on concentration of soluble protein (mg/ml) degraded from feather by keratinase enzyme. Furthermore, it has showed significant interaction between the substrate and the addition of different types of *Bacillus* strain. It is stated that the addition of the substrate treatment factors significantly influence the concentration of soluble protein by the strains. *Bacillus* megarunnerum was significantly different (P>0.05) with *Bacillus* sp. TD5K, *Bacillus* sp. TD5B, and *Bacillus* sp. LS2B. The difference in incubation time effect on concentration of soluble protein (mg/ml), and showed significant interaction between the addition of the substrate and the difference in incubation time. It is stated that the addition of the substrate treatment factors significantly influence the concentration of enzyme keratinase produced by the strains. The incubation time of 2 hours, incubation time of 4 hours, 6 hours of incubation time and incubation time of 8 hours was significantly different (P<0.05). The enzymes can be produced by making more cultures of bacterial isolates. The feather substrate suggested to be a carbon and nitrogen sources for the living of the cells. This indicates that the isolates of *Bacillus* spp. affect the concentration of enzyme produced associated with log phase in the growth phase of each strain. The increasing of incubation times, resulted in the acceleration of microbial activity and the number of microbes (Ali et al., 2011).

**CONCLUSIONS**

In conclusion, *Bacillus* spp. can be produced keratinase enzyme. Bacterial growth and the ability of degradation was found on *Bacillus* sp. TD5B. Isolates and incubation time work on concentration soluble protein of feathers.
REFERENCES


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Differences Effect on the Quality of Organic Fertilizer Fermentor of Ongole Crossbred Cattle’s Feces

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ABSTRACT: The research aimed to determine differences quality of organic fertilizer from cow feces PO (Ongole Crossbred Cattle) in pilot project Napis’s Village Tambakrejo’s district Bojonegoro’s Regency East Java by using two fermentors, such as EM4 and biofermo/biofaster. The research method uses a sample survey and secondary data analyzed descriptively based on the results of laboratory analysis. The results showed that organic fertilizer with fermentor biofermo/biofaster better quality compared to using EM4 fermentor. Organic fertilizer composition is pH (6.97 ± 0.15), organic matter (16:14 ± 5:51%), nitrogen (N) (0.96 ± 0.16%), carbon (C) (9:33 ± 3:18%), phosphorus (P) (0:31 ± 0:12 %), C / N ratio (9.67 ± 1:53), potassium (K2O) (0:39 ± 0.91%), calcium (Ca) (8.55 ± 2.96%), magnesium (Mg) (0:55 ± 0:31%) and sodium (Na) (0.37 ± of 0.02%). The conclusion is the process of organic fertilizer from cow feces, the quality is better to use the fermenter biofermo/biofaster. Suggestions from this study is further research to determine the results of the use of organic fertilizer when applied to agriculture.

Keywords: organic fertilizer, EM4, biofaster, Crossbred Ongole Cattle’s feces.

INTRODUCTION

Farm waste such as animal manure, can be used to increase the value by processing with technology into new products. New products such as organic fertilizer or compost that is much needed at this time due to broken ground conditions when using chemical fertilizers in the long term. Organic fertilizer that is easy and inexpensive with the basic ingredients of animal manure and other materials, is an attempt to improve conditions, soil fertility and improve soil structure because it can add macro nutrients (nitrogen, phosphorus, potassium, calcium, magnesium and sulfur) and micro (zinc, copper, cobalt, barium, manganese and iron) in the soil. Anonymous (2012) said fertilizer is a material that is added to the growing media and plants to provide for the necessary plant nutrient so as to produce well. There are two types of fertilizers are fertilizers organic/natural fertilizer/manure and chemicals fertilizer, based on the physical form of the solid fertilizer and liquid fertilizer while based on a single ingredient, namely fertilizer and compound fertilizer. The advantages of organic fertilizers one is able to improve the physical condition of the soil as it helps the binding of water effectively. Sudirja (2007) said that organic fertilizers are fertilizers that mostly composed of organic materials derived from plants and or animals that have been through the process, it can be solid or liquid that is used to supply organic matter, improved physical properties, chemical and soil biology.

Fermentor

The process of making organic fertilizers from animal feces which make easy and low cost. Raw materials and other organic material composted with the help of microorganisms. Organisms involved in the composting process contents microflora (microflora bacterial 108-109 g/compost, actinomicetes 105-108 g/compost, fungi 104-106 g/compost, microfauna (protozoa 104-105 g/compost, macroflora (mushrooms) and macrofauna (earthworms, termites, ants, fleas and others) (Isroi, 2012). The composting process takes place immediately after the mixed raw materials are divided into two phases, the active phase and stage of maturation. During the early stages of the
process, oxygen and degradable compounds will be utilized by mesophilic microbes. Temperature and pH of the compost pile will increase rapidly. Temperature rising to over 50°C-70°C. The microbes are active in this condition is a thermophilic microbes are active at high temperature causing decomposition of organic matter are very active. Microbes using oxygen in the compost will decompose organic materials into CO$_2$, water vapor and heat. After most of the material has been dispersed, the temperature will gradually decrease. At the time this happened compost maturation advanced, namely the formation of clay humus complex. During the composting process will be shrinking volume and biomass materials. This reduction can reach 30-40% of the volume / weight of initial materials. Composting process depends on the characteristics of the materials composted, composting activator used and the method of composting is done. While the factors that affect the composting process the C/N ratio, particle size, aeration, porosity, water content, temperature, pH, nutrient content and the content of hazardous substances (Isroi, 2012).

EM is a mixture of beneficial microorganisms which consists of five groups, 10 genera, 80 species and once on land to 125 species. EM is a solution with a pH of 3.5 to 4.0, brown, consisting of aerobic and anaerobic microorganisms. The content of EM consists of photosynthetic bacteria, lactic acid bacteria, actinomycetes, yeast and fungal fermentation. Photosynthetic bacteria forming beneficial substances that produce amino acids, nucleic acids and bioactive substances from harmful gases and serves to bind nitrogen from the air. Lactic acid bacteria fermentation of organic material functions to be lactic acid, speeding reshuffle organic matter, lignin and cellulose, and suppress pathogens by lactic acid produced. Actinomycetes produce antimicrobial properties of the resulting amino acids of photosynthetic bacteria. Yeast produces an anti-biotic, produces enzymes and hormones, secretion of yeast to be effective substrates for microorganisms actinomycetes lactic acid bacteria. Fungi capable of fermenting organic materials decompose quickly that produce alcohol esters anti-microbial, deodorize, prevent harmful insects and worms by eliminating feed. EM function to enable bacteria solvent, increasing the humus content of the soil so it can ferment lactobonillus organic material into amino acids.

The types of existing EM as a form of media EM1 granular solid containing 90% actinomycetes. EM2 consists of 80 species were prepared based on a certain ratio. Shaped cultured in fish broth with a pH of 8.5. the issuing of antibiotics to suppress soil pathogens. EM3 consists of 95% of photosynthetic bacteria to pH 8.5 in a fish broth that serves to help the task of EM2. Saccharides and amino acids are synthesized by photosynthetic bacteria that are directly absorbed by plants. EM4 consists of 95% lactobacillus that serves organic materials decompose without incurring high heat for anaerobic microorganisms to work with the power of enzymes. EM5 form of organic pesticides. EM4 is a mixed culture of beneficial microorganisms, namely fermentation and synthetic microorganisms consisting of lactic acid, photosynthetic bacteria, Actinomycetes sp, Streptomycetes sp, yeast and fungi decomposing cellulose. This EM4 healthy livestock, reducing stress on livestock, balance of microorganisms in the digestive tract of cattle, increase appetite and reduce pollution or odor and environmental enclosure (Cloud, 2004). Yani (2006) examined the use of EM4 in drinking water, 1.5 ml per liter of drinking water for NZW rabbits breed, which can increase body weight gain. Others fermenters are biofermo and biofaster. Anonymous (2010a) explains that the way organic fertilizer with fermentation system using cow dung or goat as much as 50%, 20% phosphate, 10% dolomite, ziolit 10%, 5% ash and chicken manure (dry) 5%, can be used biofermo 1 can and biofaster 5 cans.

Feces

Farm waste such as feces or manure is an organic source that can be used for the manufacture of organic fertilizer. Waste pollution by dairy farms such as smell or pollution of river water. Poor waste management will be a serious problem on the farm, but when the waste is properly managed can provide added value. Hidayatullah et al., (2005) conducted a study on the system of dairy farm waste management can reduce the concentration of Total Solid Suspension (TSS) 26.60%, Chemistry Oxygen Demand (COD) 83.33%, Nitrite: 57.14% and 54.15% H2S. Triatmojo (2001)
explained by the findings that the quality of compost produced from dairy cattle feces and waste tannery sludge could reduce levels of Cr (VI) due to the existing microbial activity during the composting process. Argo et al., (2012) found that goat waste biogas and compost can be used as an alternative raw material for organic fertilizer granules. The best formula is to compost the goat as the main ingredient nutrient most likely have national standards with the minimum cost.

The results showed that the effects related to the composition of manure nutrients contained. The choice between manure and inorganic fertilizers because nutrient considerations, economic, transportation and accessibility. Dried manure has a nitrogen content varies, 2.41% cows, buffaloes, 1.09%, 2.11% pigs and broilers 3.17%. Nitrogen content was never stable and change over time. Waste from livestock enclosure is quite a lot, especially in the villages, still using livestock as processing power or livestock as one effort to improve agricultural activities in an integrated manner. Livestock waste was used for manure, but there are also burned. These materials are all considerable potential as a source of nutrients for crop residues mixed at composting. The critical factors that need to be understood in the composting process is the nitrogen content, C/N ratio and base materials are composted.

MATERIALS AND METHODS

The research was conducted in the Village District Napis Tambakrejo Bojonegoro. The samples were analyzed organic fertilizer made from natural material with cow feces PO fermenters EM4 and biofaster of some farmers built a Cooperative “Lembu Seto” (KSU Lembu Seto) and organic fertilizer made a cooperative itself. Compost samples were taken from 5 and 3 farmer, and then it were analyzed at the Laboratory of Agriculture Faculty of Brawijaya University. Descriptive data analysis was conducted based on the results of laboratory analysis.

RESULTS AND DISCUSSION

Results of analysis of C, N, P, K, C / N and OM organic fertilizer with EM4 and Biofaster fermenters organic fertilizer can be seen in Table. 1 and the results of the full analysis in Table. 2.

Table. 1. Analysis of C, N, P, K, C / N and OM organic fertilizer with EM4 and Biofaster fermenters.

<table>
<thead>
<tr>
<th>Fermentor</th>
<th>Sample</th>
<th>C organic (%)</th>
<th>N total (%)</th>
<th>C/N</th>
<th>Organic matter (%)</th>
<th>P (%)</th>
<th>K (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EM4</td>
<td>1</td>
<td>5.38</td>
<td>0.51</td>
<td>11</td>
<td>9.31</td>
<td>0.12</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>6.51</td>
<td>0.63</td>
<td>10</td>
<td>11.26</td>
<td>0.26</td>
<td>1.10</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>10.45</td>
<td>1.25</td>
<td>8</td>
<td>18.08</td>
<td>0.35</td>
<td>0.88</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>4.34</td>
<td>0.70</td>
<td>6</td>
<td>7.50</td>
<td>0.35</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>2.59</td>
<td>0.48</td>
<td>5</td>
<td>4.48</td>
<td>0.31</td>
<td>1.03</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>5.86±2.95</td>
<td>0.71±0.31</td>
<td>8.00±2.55</td>
<td>10.13±5.10</td>
<td>0.28±0.10</td>
<td>0.75±0.38</td>
</tr>
<tr>
<td>Biofaster</td>
<td>1</td>
<td>11.31</td>
<td>1.00</td>
<td>11</td>
<td>19.56</td>
<td>0.36</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>11.00</td>
<td>1.11</td>
<td>10</td>
<td>19.04</td>
<td>0.45</td>
<td>1.52</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>6.14</td>
<td>0.82</td>
<td>8</td>
<td>10.62</td>
<td>0.45</td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>12.50</td>
<td>1.13</td>
<td>11</td>
<td>21.63</td>
<td>0.22</td>
<td>0.56</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>21.30</td>
<td>1.89</td>
<td>11</td>
<td>36.84</td>
<td>0.76</td>
<td>0.60</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>12.45±5.51</td>
<td>1.19±0.41</td>
<td>10.20±1.30</td>
<td>21.54±9.53</td>
<td>0.45±0.20</td>
<td>0.91±0.39</td>
</tr>
</tbody>
</table>
Table 2. The results of a complete analysis of organic fertilizer with EM4 and Biofaster

<table>
<thead>
<tr>
<th>Fermentor</th>
<th>Sample</th>
<th>pH 1:2.5 H2O</th>
<th>C organic</th>
<th>N total</th>
<th>C/N</th>
<th>Organic matter (%)</th>
<th>P (%)</th>
<th>K (%)</th>
<th>Na (%)</th>
<th>Ca (%)</th>
<th>Mg (%)</th>
<th>KTK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>6.7</td>
<td>10.45</td>
<td>1.25</td>
<td>8</td>
<td>18.08</td>
<td>0.35</td>
<td>0.88</td>
<td>0.4</td>
<td>12.53</td>
<td>1.81</td>
<td>38.33</td>
</tr>
<tr>
<td>EM4</td>
<td>2</td>
<td>7.2</td>
<td>10.45</td>
<td>1.25</td>
<td>8</td>
<td>18.08</td>
<td>0.35</td>
<td>0.88</td>
<td>0.66</td>
<td>13.87</td>
<td>0.43</td>
<td>49.32</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>7.8</td>
<td>2.59</td>
<td>0.48</td>
<td>5</td>
<td>4.48</td>
<td>0.31</td>
<td>1.03</td>
<td>1.72</td>
<td>14.47</td>
<td>1.45</td>
<td>37.2</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>7.23</td>
<td>7.83</td>
<td>0.99</td>
<td>7.00</td>
<td>13.55</td>
<td>0.34</td>
<td>0.93</td>
<td>0.93</td>
<td>13.62</td>
<td>1.23</td>
<td>41.62</td>
</tr>
</tbody>
</table>

Table 3. The composition of organic fertilizers with EM4, biofaster and fertilizer quality standards

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter</th>
<th>EM4</th>
<th>Biofaster</th>
<th>SNI(^a)</th>
<th>NASA’S organic fertiliser(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min</td>
<td>Max</td>
<td></td>
<td>Min</td>
</tr>
<tr>
<td>1</td>
<td>pH</td>
<td>7.23±0.55</td>
<td>6.97±0.15</td>
<td>6.80</td>
<td>7.49</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.77±4.13</td>
<td>4.60±3.98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Organic matter(%)</td>
<td>13.55±7.85</td>
<td>16.14±5.51</td>
<td>27</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>Nitrogen (N) (%)</td>
<td>0.71±0.31</td>
<td>0.96±0.16</td>
<td>0.40</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Carbon (C) (%)</td>
<td>7.83±4.54</td>
<td>9.33±3.18</td>
<td>9.80</td>
<td>32</td>
</tr>
<tr>
<td>5</td>
<td>Phosfor (P) (%)</td>
<td>0.34±0.02</td>
<td>0.31±0.12</td>
<td>0.1</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>C / n ratio</td>
<td>7.00±1.73</td>
<td>9.67±1.53</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>7</td>
<td>Potassium (K2O) (%)</td>
<td>0.75±0.38</td>
<td>0.91±0.39</td>
<td>0.20 *</td>
<td>0.31</td>
</tr>
<tr>
<td>8</td>
<td>Calcium (Ca) (%)</td>
<td>13.62±0.99</td>
<td>8.55±2.96</td>
<td>*</td>
<td>25.5</td>
</tr>
<tr>
<td>9</td>
<td>Magnesium (Mg) (%)</td>
<td>1.23±0.72</td>
<td>0.55±0.31</td>
<td>*</td>
<td>0.6</td>
</tr>
<tr>
<td>10</td>
<td>Sodium (Na) (%)</td>
<td>0.93±0.70</td>
<td>0.37±0.02</td>
<td>0.15</td>
<td></td>
</tr>
</tbody>
</table>

Note: * Value is greater than the minimum or less than the maximum.

\(a\) = standard quality organic fertilizer/compost, SNI 19-7030-2004

\(b\) = Anonymous (2010)\(^a\) NASA’s organic fertilizer\(^b\)

The table 3, can be explained that the compost with biofaster biofermo better than EM4 and closer quality standards (ISO) and NASA compost. Organic matter content is lower than the SNI and fertilizer NASA, both with fermenters biofermo biofaster and EM4. Siburian (2010) said that the different composting time will produce a different quality organic fertilizer, the effect on N, P and K. Some farmers in the Napis village produce organic fertilizer and applied to the fields. For example, to treat an area of 1 Ha rice fields require chemical fertilizers (urea) by 7 quintals, but when using a 5 quintals of organic fertilizer and chemical fertilizer use only 3 quintals. Rice crop need only 8 tons, now increased to 25%. Awali (2012) said that the use of organic fertilizers in maize farming in the Lamongan District in East Java can increase their farm income. Revenue/Ha organic fertilizer users corn growers higher than that do not use organic fertilizers, because total cost farmers less organic fertilizer users.
CONCLUSIONS

PO cow dung in the Napis village Tambakrejo district Bojonegoro East Java, can be used as raw material for organic fertilizer, quality organic fertilizer produced by using fermenters biofaster and biofermno better than using EM4.

REFERENCES

Implementation of Good Manufacturing Practices in Halal Certified Cattle Slaughterhouses in Daerah Istimewa Yogyakarta

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ABSTRACT: The study aims to investigate the implementation of Good Manufacturing Practices (GMP) in Halal Certified Cattle Slaughterhouses (RPH) in Daerah Istimewa Yogyakarta (DIY), to determine meat quality halal certified cattle slaughterhouses in DIY and to determine the relationship of the implementation of the GMP and meat quality halal certified cattle slaughterhouses in DIY. The respondents consisting of halal certified cattle slaughterhouses in DIY were used in the study. The number of respondents were 20 cattle slaughterhouses. They were selected using purposive sampling as much as 50% of halal certified slaughterhouses in DIY. Data collection was carried out using questionnaire. Survey includes observations and assess the activities directly in the assessment with a score of RPH 1 to 5. To determine the quality of meat is done Total Plate Count (TPC) test and acidity (pH). The Spearman Rank test was used to determine the correlation between the implementation of GMP and meat quality in terms of TPC and pH test. The results that the average value of GMP implementation is 368.3 with a score of 4 which shows nearing the correct application. The average pH meat value is 5.9 and the average TPC value is 2.6 x 10³ cfu/g. In terms of the correlation between the implementation of the GMP with a pH test was the value of the Rank Spearman was 0.655, it indicates that there was a highly significantly correlation. In terms of the correlation between the implementation of the GMP with a TPC test was the value of the Rank Spearman was 0.637, it indicates that there was a highly significantly correlation. It could be concluded that the implementation and application of GMP in halal certified RPH in DIY has not been entirely implemented well. There was a highly significantly correlation between the implementation of the GMP with meat quality (pH value and TPC) on the halal certified to cattle slaughterhouses in DIY.

Keywords: Good Manufacturing Practices (GMP), Cattle Slaughterhouses (RPH), Halal Certificate, and Meat Quality

INTRODUCTION

Population of Indonesia in 2014 of approximately 250 million people and approximately 85% of the majority of the population of Indonesia is Muslim, it requires the willingness of animal food of high quality, safe and lawful consumption. Total meat consumption is a national consists of 56% is chicken meat, 23% of beef, 13% of pork, 5% of mutton and 3% other (Fajria, 2007). There are four main problems of national food safety and quality (Fardiaz, 1996), namely: first, food products that do not meet the quality requirements of food safety, secondly, there are still many cases of food poisoning occur. Third, the low level of knowledge, skills, and responsibilities of food manufacturers about the quality and food safety, which was marked by the discovery of a means of distribution of products and food that does not meet the requirements of Good Manufacturing Practices (GMP), especially on a small industrial or household. Fourth, consumers lack of quality and food safety caused a limited knowledge and capabilities of the low purchasing power, so they are still buying food products with a low level of quality and security.
Basic health quality assurance which is used in food production that is GMP, GHP, and HACCP. It is emphasized that GMP is a staple food safety assurance to be done, especially in the food sector. Global picture concerning RPH in DIY there are some who have already done the production process well but there are still many some that do less hygienic production process so that the need for supervision and implementasi GMP at RPH on DIY. This study was conducted to find out the level of knowledge of GMP and know the level of participation of the businessmen in the implementation of GMP in RPH at DIY.

**MATERIAL AND METHODS**

This study was carried out during the five month i.e. September 2014 until March 2015. The implementation of this study was done at the LPPOM MUI and RPH at DIY. The analysis was conducted at the Faculty of Animal Science, Gadjah Mada University, Yogyakarta. Study material used was the respondent who was the perpetrator of the attempt at DIY RPH. Tool used to test the acidity (pH), namely pH meters and test total total plate count: erlenmeyer flask, magnetic stirer, test tubes, autoclave, incubators and laminar flow cabinet. Study tools are used, namely: sheets of paper questionnaires, labels, bulpoint and data. Materials used for testing of total plate count that was sterile, aquadest pepton water and medium Plate Count Agar (PCA). Data capture techniques this study respondents by means of purposive sampling as much as 50% of RPH certified halal in DIY. The number of respondents is 10 RPH at DIY. This criterion is based on study that the respondents have the ability to implement the agreed GMP from the LPPOM MUI to have halal certificate. The variable in this study include: (1) variable x is the implementation of GMP in halal certified RPH at DIY, (2) the variable y is the quality of the meat at a Kosher certified RPH at DIY.

**Assessment of GMP Aspects**

Assessment of aspects of GMP in the charging process was carried out by RPH questions about the State of the place and the production process. Assessment of the parameters refer to the National standards bodies and carried out according to the standard method (Standard National Indonesia, 1999).

**Table 1. Indicator assessment of GMP aspects**

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>If it does not meet the requirements</td>
</tr>
<tr>
<td>2</td>
<td>When a quarter of the eligible</td>
</tr>
<tr>
<td>3</td>
<td>If half the eligible</td>
</tr>
<tr>
<td>4</td>
<td>When one-third of eligible</td>
</tr>
<tr>
<td>5</td>
<td>If it meets the requirements</td>
</tr>
</tbody>
</table>

**The Quality Of The Meat**

Test the pH of the meat was done according to the standard method (Bouton and Harris, 1972) and the test of Total Plate Count (TPC) was done according to the standard method (Fardiaz, 1993).

**Date Analysis**

Spearman Rank correlation was used to find out the correlation between the implementation of GMP (variable x) with the quality of the meat (variable y). Data collection and analysis was carried out using a questionnaire and standard methods (Singarimbun and Effendi, 1995).
RESULTS AND DISCUSSION

Table 1. The implementation of all aspects of GMP RPH certified halal in DIY

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>Building</th>
<th>Slaughtering</th>
<th>Human Resources</th>
<th>Production &amp; Transportation</th>
<th>All Aspects Of GMP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Value</td>
<td>Value</td>
<td>Value</td>
<td>Value</td>
<td>Number</td>
</tr>
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<td></td>
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<td>Criterion Score</td>
<td>Criterion Score</td>
<td>Criterion Score</td>
<td>value</td>
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<td>3</td>
<td>114</td>
<td>4</td>
<td>21</td>
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<tr>
<td>2</td>
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<td>3</td>
<td>111</td>
<td>4</td>
<td>20</td>
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<tr>
<td>3</td>
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<td>4</td>
<td>141</td>
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<td>15</td>
</tr>
<tr>
<td>5</td>
<td>RPH 5</td>
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<td>4</td>
<td>112</td>
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<td>6</td>
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<td>144</td>
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<td>7</td>
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<td>8</td>
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<td>RPH 15</td>
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<td>RPH 16</td>
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<td>174</td>
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<td>59</td>
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<td>21</td>
<td>RPH 21</td>
<td>208</td>
<td>5</td>
<td>174</td>
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<td>59</td>
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<tr>
<td>22</td>
<td>RPH 22</td>
<td>208</td>
<td>5</td>
<td>174</td>
<td>5</td>
<td>59</td>
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Total 8102 89 368,27 4,045

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not very good</td>
<td>1 = ≤ 101</td>
<td>Not applying the correct way</td>
</tr>
<tr>
<td>Less Good</td>
<td>2 = 102 – 202</td>
<td>Apply a small portion of the right way</td>
</tr>
<tr>
<td>Good Enough</td>
<td>3 = 203 – 303</td>
<td>Apply half the right way</td>
</tr>
<tr>
<td>Good</td>
<td>4 = 304 – 404</td>
<td>Almost close to the correct application of the</td>
</tr>
<tr>
<td>Very Good</td>
<td>5 = 405 – 505</td>
<td>Apply the correct way</td>
</tr>
</tbody>
</table>

The Implementation of GMP Building

The results of this study show that the value of the implementation of the GMP RPH building on 15, 16, 17, 18, 19, 20, 21 and 22 was very good with a value score of 5, meaning that it has already implemented the right way. RPH on 3, 5, 6, 8, 9, 10, 11 and 13 there good with a value score of 4, meaning that it’s almost approaching the implementation of that right. RPH on the 1, 2, 7, 12, and 14 there fairly good with a value score of 3, meaning that it only apply half the right
way. On RPH 4 was less good with a value score of 2, meaning that it only apply a small portion of the right way. The floor was made of material which was waterproof, it was not easy, was not toxic, corrosive resistant to crunch, easily cleaned and disinfected and was not easily peel off (standard National Indonesia, 1999). The wall at RPH already coated ceramic tile about 1 metre from the floor, while according to Permentan (2010) the terms High wall at the site of the slaughtering process and manufacture the minimum 3 meters carcass. Almost all of the RPH all doors not equipped draperies plastic that serves to inhibit entry of insects or other foreign matter except RPH Giwangan.

The Implementation of GMP Slaughter Processing

The results showed that the value of the implementation of GMP engineering cuts on RPH 3, 6, 10, 11, 15, 16, 17, 18, 19, 20, 21 and 22 was very good with a value score of 5, meaning that it has already implemented the right way. RPH on the 1, 2, 5, 8, 9, 12, 13, and 14 there good with a value score of 4, meaning that it’s almost approaching the implementation of that right. On RPH 4 was pretty good with a value score of 3, meaning that it only apply half the right way. On RPH 7 was less good with a value score of 2, meaning that it only apply a small portion of the right way. Based on the results of the study shows that most still RPH equipment manuals from the overthrow of livestock, livestock Agency, adoption and the slaughtering process a carcass, this means means largely unresolved by SNI. On RPH Giwangan already has connected restainbox, adoption agency cattle with machinery, and carcass slaughtering process with this machine was in compliance with the standard, where each RPH should already have a complete equipment and well as carcass, restrain penggantung tool box and others (standard National Indonesia, 1999).

Slaughtering Process. The slaughtering process was done with a disconnected three channels i.e. channel breath, gastrointestinal tract and blood channels (Soeparno, 2005). The killing was done in accordance with the Islamic Shari’a which confronts a cow to the Qiblah direction then read basmallah resonate or bismillahi Allahu akbar before the knife cut three channels across the neck. The slaughtering process was process which is very important to do the production process as the process of slaughtering and processing to be a carcass. This relates to the Halal and quality of a product.

The Implementation of GMP Human Resources

The results showed that the value of the implementation of the GMP HR RPH 15, 16, 17, 18, 19, 20, 21 and 22 was very good with a value score of 5, meaning that it has already implemented the right way. RPH on 3, 5, 6, 8, 9, 10, 11, 13 and 14 was quite good with a value score of 3, meaning that it only apply half the right way. RPH on the 1, 2, 4, 7, and 12 there less well with a value score of 2, meaning that it only apply a small portion of the right way. Human resources (HR) was an important factor to do well because the production process with a good HR was expected to easily be directed to become better at work and have knowledge about sanitation, surveillance and capability as the process of slaughtering and processing until it becomes the product. This has to do also with the Halal and quality products so that the resulting products are safe, healthy, whole, healthy and delicious. Some employees have provided training on RPH importance of slaughtering of animals especially in Islamic organized by related Service. Each livestock can slaughter only employees who have attended training on slaughtering of animals, so that the quality of the resulting meat is safe, healthy, intact and lawful. Training of sanitation in the RPH generally haven’t done nearly as well except RPH couple Giwangan and. Every employee has provided training on the importance of sanitation in RPH.

The Implementation of GMP production and Transportation

The results showed that the value of the implementation of GMP production and transport on RPH
1, 3, 6, 9, 10, 11, 13, 15, 16, 17, 18, 19, 20, 21 and 22 was good with a value score of 4, meaning that it’s almost approaching the implementation of that right. RPH on 2, 4, 5, 7, 8, 12 and 14 was quite good with a value score of 3, meaning that it only apply half the right way. Each of the RPH has a means of transport used to send meat to the depot, meat to markets and customers that was open pick up cars and motorcycles. This has not been in accordance with SNI because according to SNI (1999) armoured vehicle cribs meat for transporting meat should be covered. Layers in the box on the vehicle to transport the meat must be made of materials that are not toxic, not corrosive easily, easily cleaned and disinfected, easily maintained and has good insulation properties. Cribs equipped with refrigerators that can maintain the temperature of the inside of the fresh meat +7 0c and the temperature of the inside of the offal +3 0C.

The Average Value of Implementation of All Aspects GMP

The results showed that the value of all aspects of the implementation of the GMP on RPH 15, 16, 17, 18, 19, 20, 21 and 22 was very good with a value score of 5, meaning that it has already implemented the right way. RPH on 3, 5, 6, 8, 9, 10, 11 and 13 there good with a value score of 4, meaning that it’s almost approaching the implementation of that right. RPH on the 1, 2, 7, 12 and 14 was quite good with a value score of 3, meaning that it only apply half the right way. At RPH on DIY in RPH 4 was less good with a value score of 2, meaning that it only apply a small portion of the right way.

The Quality of The Meat

The pH value of the meat

The results showed that the value of the pH of the meat in RPH 9 votes less well with a value score of 3 when compared to other value RPH 1 lowest, meaning only apply half the right way. RPH on 2, 4, 7 and 8 there good with a value score of 4, meaning that it’s almost approaching the implementation of that right. RPH on 3, 5, 6, 9 and 10 was very good with a value score of 5, meaning that it has already implemented the right way. The pH value was one of the criteria in determining the quality of the meat, especially for the meat industry as RPH. PH value of the meat by the time the animals living around 7.0 to 7.2 (pH neutral). After slaughter animals (dead), the value of pH in muscles (the pH of the meat) will decrease due to the accumulation of lactic acid. The decline in the value of pH in muscles of healthy animals and dealt with well before the cuts will run in stages, i.e. from pH values of approximately 7.0 to 7.2 will reach pH values decreased gradually from 7.0 to 5.6 to 5.7 within 6 to 8 hours postmortem and would reach the final pH value of around 5.5 to 5.6. Final pH value (ultimate pH value) was the lowest pH values achieved in the muscle after the slaughtering process (of death). The pH value of the meat will never reach the value under 5.3. This was because at pH values below 5.3 enzymes involved in anaerobic Glycolysis was not actively working (Soeparno, 2005).

The value of TPC meat

The results showed that the value of TPC in RPH 1, 2, 4 and 8 was quite good with a value score of 3, meaning that it only apply half the right way. RPH on 3, 4, 5, 6, 7, 9 and 10 was good with a value score of 4, meaning that it’s almost approaching the correct application and still in accordance with the standards of the SNI, although there are some are approaching a threshold LEVEL. Microbiology in the flesh can affect the quality, safety and durability of these foodstuffs. Microbiology on food animal products are bacteria, molds, and yeasts. In case of damage of food, food becomes unpleasant because of the color, flavor and appearance after the change, though it may do no harm (Gaman and Sherington, 1992).

The Correlation Between The Implementation Of The GMP With The pH Values and TPC

Rank correlation analysis results showed that there were Spearmen very real relationships between GMP implementation with pH values at RPH on DIY. Spearman Rank correlation was
used to find out the GMP implementation relationships with keeratan pH values. The data collected as rank after the observation. These relationships can be seen in table 2.

Table 2. The correlation between the implementation of the GMP with the pH values and the value of TPC

<table>
<thead>
<tr>
<th>Name of Test</th>
<th>Corelation Rank Spearman</th>
<th>t-count</th>
<th>t 0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test of Acidity (pH)</td>
<td>0.655</td>
<td>2.454*</td>
<td>2.306</td>
</tr>
<tr>
<td>Test of TPC</td>
<td>0.637</td>
<td>2.337*</td>
<td>2.306</td>
</tr>
</tbody>
</table>

Description: *Superscript the correlation between the implementation of GMP with the pH values was significant.

Spearman correlation values of the GMP implementation with pH values i.e. 0.655 and t-test results from the retrieved value t calculate t value, i.e. 2,454 count compared to the value of the t table on probability 5% free by degrees N–2 = 10-2= 8. The results were values t count greater than t 0.05 table this means there are relationship very closely and positive influence between the implementation of GMP with the pH of the meat. That was when the positive influence the implementation of GMP quality meat was good, it was also good in terms of the pH Test. Based on the results of the study there shows the influence between the implementation of GMP with pH values of meat. These influences indicate that implementation of GMP has already approached the technique and facility but still needs a lot of improvement. This was indicated by the condition of the space supplies still inadequate except in Giwangan RPH and Mancasan. The value of the correlation of GMP implementation Spearman Rank with TPC, namely 0,637, t test results obtained the value t calculate i.e. 2,337, this value was compared with the value of t a 5% probability on a table with a degree of non N-2 = 10-2 = 8, the results were values t count greater than the value of the table t 0.05 means there was a relationship very closely and positive influence between the implementation of the GMP by total plate count. That was when the positive influence the implementation of GMP quality meat was good, it was also good in terms of test of TPC.

CONCLUSIONS AND SUGGESTIONS

The conclusions of the study results is the implementation and application of GMP in the halal certified RPH in DIY have not entirely done well. The results of the quality of the meat is either still in accordance with the SNI. There is a significant correlation between the implementation of GMP quality meat (pH values and TPC) on RPH certified halal in DIY. It is suggested the existence of further study as to the implementation of good manufacturing practices to the quality of the meat is physically (color, power tie, and texture), chemical (moisture, protein, fat, and ash) and level of knowledge. Need for scrutiny are serious about the implementation and application of GMP in the halal certified RPH at DIY so that it can be done well. Needs improvement and quality as there are places of influence between the implementation of GMP quality meat at a Kosher certified RPH at DIY.

REFERENCES

Bouton, P. E. And P. V. Harris. 1972. The effect of cooking temperature and time on some mechanical properties of meat. J. Food Sci. 97:140-144


