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Biscuit Bio-supplement for Increasing Milk Production and Quality in Dairy Goat Farm

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ABSTRACT

This study aims to analyze the effect of biscuit bio-supplement on milk production and quality at dairy goats farm . This research was conducted on June-October 2013 at different dairy goats farm in Bogor, Indonesia.. This research used a factorial completely randomized design 2×2×6 with two treatments and six replications which factor A was level of biscuit bio-supplement (T0 = 0% of biscuits bio-supplement and T1 = 15% of biscuit bio-supplement). Factor B was different location of dairy goat farms (Ciapus farm and Leuwiliang farm). The result indicated that the treatments had significant effect ($p<0.05$) on milk production and calcium content of milk. By feeding of 15% biscuit bio-supplement had milk production 673 mL head^{-1} day^{-1} at Ciapus farm while by feeding without biscuit bio-supplement had milk production 671.99 mL head^{-1} day^{-1}. By feeding of 15% biscuit bio-supplement had milk production 539.75 mL haed^{-1} day^{-1} while by feeding without biscuit bio-supplement had milk production 318.28 mL head^{-1} day^{-1} at Leuwiliang farm. By feeding biscuit bio-supplement did not significant effect ($p>0.05$) on fat, protein and lactose of milk. By feeding 15% biscuit bio-supplement yield milk production 41.03% higher than conventional feed at the farm with using low protein of feed while milk production approximetly only 0.15% higher than conventional feed at the farm with using high protein of feed.

Key words: Biscuit, bio-supplement, dairy goat, quality of test, productivity

INTRODUCTION

For some Indonesian people, milk is considered expensive. Thus, national milk consumption remains below the consumption rate of other Asian countries. In fact, nutritious foods and beverages have been critical elements in improving the human resources quality. One of which, among other things, can be found in dairy commodity.

Based on 2010 data, Indonesian milk consumption rate is only 11.09 L capita^{-1} year^{-1}. While in Malaysia and the Philippines the consumption rate reaches 22.1 L capita^{-1} year^{-1}, Thailand 33.7 L, Vietnam 12.1 L and India reaches 42.08 L (Pramesti, 2013). The low awareness to consume dairy milk of Indonesian people is due to some factors such as low distribution of dairy cow and goat farms which leads to low production of dairy milk.

Dairy goat is a type of goat that can produce milk at the rate exceeding the needs of their babies and the typical dairy goats raised in farms are Etawah Goats (PE) and Saanen. These species are very suitable to rise in tropical countries. The highest population of goats is in Central Java

compared to other provinces, namely 3.033.952 goats in 2006 (Heriyadi, 2008). However, the milk produced each year has never met the demand of national milk . The milk production in the country still needs to optimize the low potential of dairy farms such as dairy cows. One of the considerable potential and prospective dairy farm to develop in Indonesia is dairy goat.

The efforts to improve the productivity of dairy goats is often hampered by the poor quality of feed given by the farmers, so that the milk production is still less than 2 L head^{-1} day^{-1}. The use of forage for goats requires unique strategies in order to continue to increase its productivity (Ibrahim, 2003).

The main constraints of finding ruminant raw materials for animal feed are as follows: (1) The characteristics of the feed basic material that are commonly perishable have caused difficulties in the handling, distribution and processing of livestock feed. (2) The raw material of feed from agricultural waste has low palatability such as papaya leaves with bitter taste (Retnani *et al.*, 2013).

Technology has an important role in feeding livestock (Retnani *et al.*, 2013). Biscuit is a dry product that is relatively long-lasting under normal storage conditions and easy to handle (Whiteley, 1971). Biscuit is a dry product that has a relatively high power durable so it can be stored for a long time and easy to carry while traveling because of the volume and weight of the drying process. Biscuits bio-supplement feed is made of fiber, especially fresh green forage as a replacement for ruminants in order to utilize the fiber when the quality and quantity of forage decreased (Retnani *et al.*, 2013).

This study aims to analyze at the production and quality of milk from different farms by giving biscuits bio-supplement.

MATERIALS AND METHODS

The research was conducted at Laboratory of Feed Industry, Faculty of Animal Science, Bogor Agricultural University and the productivity test conducted on the dairy goat farm at Ciapus and Leuwiliang, Bogor, Indonesia, on June-October 2013. Twenty four heads of thin tail dairy goats were used in this experiment. This research used female dairy goats 3 lactation period with the average milk production arround were 605±333.69 mL at Ciapus dairy goat farm and 435±69.34 mL at Leuwiliang dairy goat farm. The animals were randomly assigned to two dietary treatments (six heads of goat treatment^{-1}). Conventional feed used in the Ciapus and leuwiliang farm are field grass and concentrates. The nuntrient content of conventional feed at Ciapus and Leuwiliang farm has been seen in Table 1 and 2. The crude protein conventional feed at Ciapus Farm 8.78% of field grass and 13.70% of concentrate. While the the crude protein conventional feed at Leuwiliang Farm 6.38% of field grass and 12.77% of concentrate.

Diagram process of biscuit production: Process of biscuit bio-supplement production from raw material i.e., *Carica papaya* L. leaf and *Indigofera* sp. leaf and processed by grinding, mixing, pressing and heating with temperature 100°C for 5 min to form biscuit feed bio-supplement and than cooling in room temperature (Fig. 1) (Retnani *et al.*, 2013).

Experimental design: This research used a factorial completely randomized design 2 ×2×6 with two treatments and six replications which factor A was level of biscuit bio-supplement (T0 = 0% of biscuits bio-supplement and T1 =15% of biscuit bio-supplement). Factor B was different location of

Table 1: Nutrient content conventional feed at Ciapus farm

Feed	Ash (%)	Crude protein (%)	Crude fiber (%)	Crude fat (%)	NFE (%)
Field grass	12.46	8.78	31.63	0.07	47.07
Concentrate	13.30	13.70	20.08	4.35	48.57

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Table 2: Nutrient content conventional feed at Leuwiliang farm

Feed	Ash (%)	Crude protein (%)	Crude fiber (%	Crude fat (%)	NFE (%)
Field grass	9.01	6.38	25.60	1.36	57.65
Concentrate	2.87	12.77	43.25	3.82	37.29

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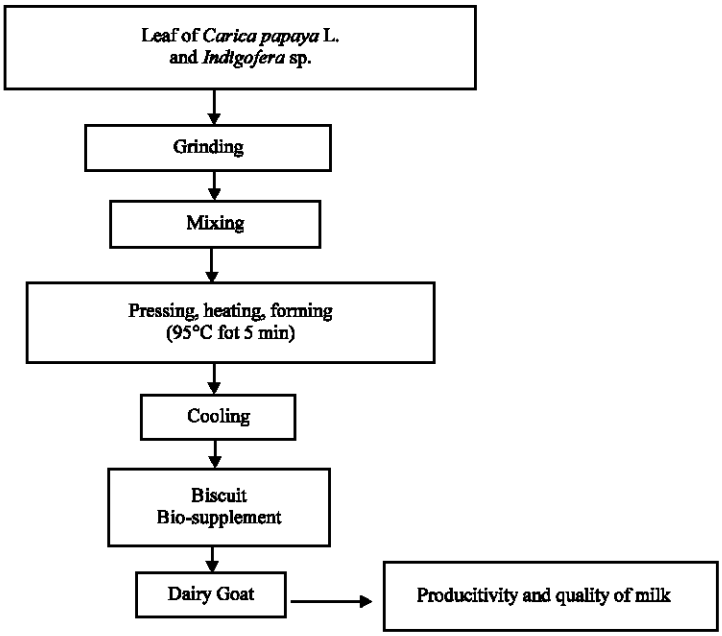

Fig. 1: Diagram process of biscuit bio-supplement production (Retnani *et al.*, 2013)

dairy goat farms (Ciapus farm and Leuwiliang farm). The data was analyzed using Analysis of Variance (ANOVA). The differences among treatments were examined by Duncan test (Steel and Torrie, 1993).

The parameters measured were milk production and quality of milk. Determination of protein content performed by Titration Method Formol (Davide, 1977), fat content was conducted by Gerber (Sudono, 1985), lactose and calcium tasted by Milko tester Milk Analyzing Device model Master Pro.

Mathematical model: Mathematical model of this design is:

$$Y_{ijk} = \mu+\alpha_i+\beta_j+(\alpha\beta)_{ij}+\epsilon_{ijk}$$

Information:

Y_{ij} = Observations treatment to-i, observations treatment to-j and replications to-k
μ = The average value of the observations
α_I = Effect treatment to-i
β_j = Effect treatment to-j
$(\alpha\beta)_{ij}$ = Effect treatment interaction to-I and treatment to-j
ϵij = Error treatment to-I, treatment ke-j and replications to-k

RESULTS AND DISCUSSION

Bio-supplement biscuits is a solid biscuit. This form is very advantageous because of ease in transportation, storage, handling, administration to livestock so as to increase the level of consumption since it has a rough texture as the bio-supplement biscuits feed consists of a combination of raw materials such as the leaves of papaya, indigofera leaves milled and then mixed with the concentrate. The nutrient content of biscuit bio-supplement were 7.34% of ash, 33.56% of crude protein, 13.85 of crude fiber, 2.61% of crude fat and 42.55 of NFE. The bio-supplement biscuits have a high protein content.

Bio-supplement biscuits are produced using pressure and heating. Change of feed substances may take place during such production process. Changes that occur during processing is generally caused by protein denaturation, Maillard reactions and amino acid racemization (Muchtadi *et al.*, 1993). Chemical properties test aims to see the change of feed substances after a heating process (Table 3).

Table 3 shows the nutritional content of bio-supplement biscuits before and after production. Heating effects cause no damage to the protein. Feed ingredients prior to molding contain 33.93% protein and after the molding it remains 33.56%. The processing has just decreased the protein in the biscuits by 1:09%. This suggests that during the heating process bio-supplement biscuits do not undergo protein denaturation and Maillard reactions. Denaturation of proteins is a fundamental confirmation of the molecular changes in all parts of the protein that causes perfect loss of biological activity and natural function (Davidek *et al.*, 1990). While the Maillard reactions are reactions between proteins and reducing sugars which are the main source of protein nutritional devaluation during processing and storage (Muchtadi *et al.*, 1993).

Milk production: The results of variance analysis showed that the treatment significantly affects ($p<0.05$) on milk production at farms at Ciapus and Leuwiliang. This suggests that by feeding of bio-supplement biscuits in different farms have different effects on each farm. One of the reasons is that by feeding of different feed patterns on each farm. The farms providing feed with low protein pattern upon addition of 15% bio-suplement biscuits tend to be more responsive in increasing milk production compared to farms that provide a pattern with a high protein feed. Table 4 shows that the administration of bio-supplement biscuits at Ciapus farm does not have a significant influence on the increase of milk production. By feeding of 15% bio-supplement biscuits yields around 0.15% higher milk production compared to conventional feed. While the by feeding

Table 3: Nutrient content of biscuit bio-supplement before and after process production (%dry matter)

Treatment	Ash (%)	Crude protein (%)	Crude fiber (%)	Crude fat (%)	NFE (%)
Before processing	7.13	33.93	14.54	3.50	40.90
After processing	7.43	33.56	13.85	2.61	42.55

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Table 4: Effect of biscuit bio-supplement on milk production at Ciapus and Leuwiliang farm (mL head^{-1} day^{-1})

Treatment	Ciapus farm	Leuwiliang farm
T0	671.99±229.17^{a}	318.28±64.62^{bX}
T1	673.28±248.41^{a}	539.75±67.23^{bY}

Superscript different on the same line indicate highly significant difference ($p<0.05$). T0 = 0% of biscuits bio-supplement; T1 = 15% of biscuit bio-supplement

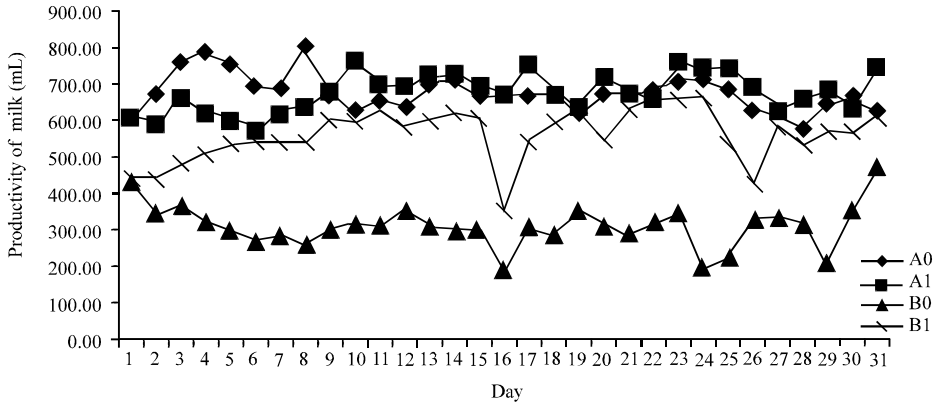

Fig. 2: Productivity of milk in Ciapus and Leuwiliang farm

of 15% bio-supplement biscuits gives higher milk production approximately 41.03% compared to conventional feed at Leuwiliang farm.

Dairy goat milk production is around 0.45-2.2 L head^{-1} day^{-1} (Obst and Napitupulu, 1984; Sutama *et al*., 1995). Result of the research, Katipana (1986), daily milk production of dairy goats is 0.787-0.941 L head^{-1} day^{-1}. Milk production of dairy goats is 0.57 L head^{-1} day^{-1} (Titis, 2011) Fig. 2 shows that the production of milk at Ciapus and Leuwiliang farms tend to be different. Milk production at Leuwiliang farm increased significantly with the addition of bio-supplement biscuits.

According to Ensminger *et al*. (1990) goats may consume more quality forage quality and they are happy browser. Based on the analysis of variance it shows that the consumption of dry matter and protein at Ciapus and Leuwiliang farms is significantly different ($p<0.05$). The administration of bio-supplement biscuits feed at Leuwiliang farm is more responsive to milk production, this is because Leuwiliang farm uses low-protein feeding pattern. The protein consumption at Ciapus farm is 679-720 g head^{-1} day^{-1}, whereas in Leuwiliang is 331.96-358.27 g head^{-1} day^{-1} (Table 5).

One of the factors that affect the level of milk production is in terms of feeding and drinking. Feed given to cattle goats should be able to meet the basic needs for life and reproduction (Ensminger, 2002). According to National Research Council (NRC, 2006) nutritional needs of goats include energy, protein, minerals, vitamins and water. The amount of feed given depends on the size of the body, the condition of the goat (growth, pregnant and lactation), the sex (Sudono and Abdulgani, 2002), age and production capacity (Gall, 1981). Feed substantially exceed the necessities of life will be utilized for higher production (Davendra and Burns, 1994). Dry matter consumption needs for lactation dairy goats weighing 60 kg is 1.95 kg day head^{-1} while protein intake is 114 g head^{-1} day^{-1} (NRC, 2006).

Quality test of milk: Milk is a food which is composed of nutrients with balanced proportion. Its main ingredients are water, protein, fat, minerals and vitamins. Milk quality is an important part

Table 5: Comsumption dry matter and crude protein of dairy goats (g head^{-1} day^{-1})

	Ciapus farm		Leuwiliang farm	
Treatment	Comsumption DM	Comsumption CP	Comsumption DM	Comsumption CP
T0	4840^{a}	720^{x}	951.80^{b}	358.27^{y}
T1	4710^{a}	679^{x}	883.16^{b}	331.96^{y}

Superscript different on the same line indicate highly significant difference ($p<0.05$). T0 = 0% of biscuits bio-supplement; T1 = 15% of biscuit bio-supplement

Table 6: Effect of biscuit bio-supplement on fat (%)

Treatment	Ciapus farm	Leuwiliang farm
T0	8.96±0.92	8.55±1.19
T1	7.98±1.24	7.68±1.40

Superscript different on the same line indicate highly significant difference ($p<0.05$). T0 = 0% of biscuits bio-supplement; T1 = 15% of biscuit bio-supplement

in milk production. The degrees of the milk quality can only be maintained for a certain time which in turn will decrease and ends with the decay of the milk. Goat composition may vary it is because of the differences between the nations as well as individuals within a species (Haris and Hitcher, 1972).

Fat: Results of analysis of variance showed that the treatment did not significantly affect milk fat. The average fat content at people farms is 7.68-8.96% (Table 6).

Fat content is quite high in this research. According to Davendra and Burns (1994) the range of goat milk fat content in the tropics is 2.6-7.8%. The fat content ranges between 3-8%. Various studies have shown varying fat content of goat milk is 5.9-6.9% (Ramadhan *et al*., 2013), 5.05% (Katipana, 1986) and 4.92% (Ernawati, 1989).

Protein: Results of analysis of variance showed that treatment did not significantly affect ($p>0.05$) milk protein. The range of milk protein in this study is 5.30 to 5.59% (Table 7). Milk protein content varies depending on the nation, milk production, lactation level, quality and quantity of feed, protein levels in the ransom. Various studies have shown that goat milk protein content varies from 2.64 -5 % (Jenness, 1980), 4.10% (Davendra and Burns, 1994), 4.33% (Katipana, 1986) and 4.36% (Ernawati, 1989).

Lactose: Results of analysis of variance showed that treatment did not significantly affect ($p>0.05$) milk lactose. The range of lactose in this study is 3.37 to 3.54% (Table 8). According to Sumudhita (1989) lactose content of dairy goat milk is 4.9%, 2.57% (Katipana, 1986), 4.40% (Van den Berg, 1990), 3.80% (Davendra and Burns, 1994) and 4.73% (Ernawati, 1989).

Calsium: Results of analysis of variance showed that the addition of 15% biscuit gives significantly ($p<0.05$) on calcium of milk at Ciapus and Leuwiliang farms. However, the treatment does not significantly affect ($p>0.05$) the calcium in each farm. Average Calcium at Ciapus and Leuwiliang farms with and without the addition of biscuits gives the same result. Average calcium at Leuwiliang by feeding of 15% biscuits is the highest namely 0.18% (Table 9). The result of the research (Setiawan and Tanius, 2003) calcium in Etawah dairy goat is 0.134%.

Table 7: Effect of biscuit bio-supplement on protein (%)

Treatment	Ciapus farm	Leuwiliang farm
T0	5.47±0.96	5.30±0.17
T1	5.59±0.19	5.41±0.13

Superscript different on the same line indicate highly significant difference ($p<0.05$). T0 = 0% of biscuits bio-supplement, T1 = 15% of biscuit bio-supplement

Table 8: Effect of biscuit bio-supplement on lactosa (%)

Treatment	Ciapus farm	Leuwiliang farm
T0	3.54±0.28	3.37±0.21
T1	3.54±0.22	3.41±0.15

Superscript different on the same line indicate highly significant difference ($p<0.05$). T0 = 0% of biscuits bio-supplement, T1 = 15% of biscuit bio-supplement

Table 9: Effect of biscuit bio-supplement on calcium (%)

Treatment	Ciapus farm	Leuwiliang farm
T0	0.11±0.01^{a}	0.17±0.06^{b}
T1	0.09±0.04^{a}	0.18±0.05^{b}

Superscript different on the same line indicate highly significant difference ($p<0.05$). T0 = 0% of biscuits bio-supplement, T1 = 15% of biscuit bio-supplement

Milk calcium levels are also influenced by the levels in the blood. According to Kocabagli *et al.* (1995) during lactation the calcium content in the milk is constant. This is presumably due to the body will prioritize the calcium present in the body to produce milk. This is in line with the statement (Kusumarini and Kiranadi, 1993) that the physiological and metabolic state of the mother during lactation will change where the priorities will be focused on the udder gland. If the need of calcium for milk production during lactation is not fulfilled, then the body will mobilize calcium from bone without affecting milk yield as well as the content. Calcium in milk is derived from the blood directly absorbed by the secretion cells (Haenlein, 1980). Calcium is directly derived from the blood without change it is the concentration that changes. The level of calcium in milk is 13 times greater than in the blood (Akers, 2002).

CONCULSION

By feeding 15% biscuit bio-supplement yield milk production 41.03% higher than conventional feed at the farm with using low protein of feed while milk production approximetly only 0.15% higher than conventional feed at the farm with using high protein of feed.

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