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Increase of Milk Production and Calcium Content by Feeding Biscuit of *Carica papaya*

Yuli Retnani, Idat Galih Permana, Nur R. Komalasari and Taryati
Department of Nutrition and Feed Technology, Faculty of Animal Science, Bogor Agricultural University, Jl. Agatis, Campus Darmaga, Bogor, 16680, Indonesia

Corresponding Author: Yuli Retnani, Department of Nutrition and Feed Technology, Faculty of Animal Science, Bogor Agricultural University, Jl. Agatis, Campus Darmaga, Bogor, 16680, Indonesia

ABSTRACT
In Indonesia, Ettawa crossbreed goat is one of common milk goat that categorized low production goat. Bio-supplement biscuit is one of feed industry to increase milk production. This study aims to evaluated milk production and calcium content. The used 10 Ettawa crossbreed in Bangun Karso Farm. Research design used t-test with treatments: T0 = Mix forage+concentrate and T1 = Mix forage+concentrate+biscuit 15%. Parameters were milk production and calcium content. The research resulted that biscuit bio-supplement affected milk production and calcium content significantly ($p<0.05$). Biscuit bio-supplement contained papaya leaves increased calcium content until 174.832 mg/100 g. Active compounds in papaya leaf was proved increases milk production and calcium content. Biscuit bio-supplement increased 43.35% milk production and 48.27% calcium content.

Key words: Ettawa goat, biscuit bio-supplement, milk production, calcium content

INTRODUCTION
Goat milk is one of in famous farm commodity in Indonesia although it has a prospect to develop. Commercially goat milked in Indonesia is Ettawa crossbreed from Ettawa goat (origin from India) and Kacang goat (origin from Indonesia) (Attabany, 2001). These breed produce only about 1.12 L of milk per head per day (Marwh et al., 2010) that categorized low producer, unfortunately.

The increasing of milk production should be balanced with calcium content, due to it is important mineral for human body (Mahan and Escott-Stump, 2000). Sodiq and Abidin (2002) reported that calcium content in goat milk is 134 mg/100 g. Calcium content in goat milk derived from feed quality.

Calcium needed for each person is different depend on age and health condition (Tagliaferri et al., 2007). Dietary Reference Intakes (1997) suggested 2500 mg calcium per day for children (1-8 years), 3000 mg per day for adult (9-30 years) and 2000 mg per day for old people (>50 years), although Indonesian only consume calcium about 254 mg per hari. Calcium is important mineral to help bond development and prevent from osteoporosis (Lopez-Huertas et al., 2003).

The major constraints of ruminant feed are as follows: Low quality of forage; the level of palatability and digestibility is lower (Retnani et al., 2014a). Goat nutrition and feeding is extremely important to the success or failure of milk production. Feed supplement contained high energy, protein and mineral is one of solution to increase rumen fermentation product that provide nutrient for milk production. Milk production and composition affected by ewe age, feed, season,
animal health, geographic position and management pattern (Mardalena et al., 2011). In tropic, 
low soluble carbohydrate in forage (Tillman et al., 1986; Morand-Fehr and Sauvant, 1980) reduces 
the quality and consumed forage could not fulfill animal needed (Devendra and McLeory, 1982).

Biscuit bio-supplement is one of supplement feed to increase milk production (Retnani et al., 
2014b). Biscuit form is innovated product in feed industry to increase feed quality based on 
durability, easy to store, distribute and consume by animal (Whiteley, 1971). This feed type is 
important for animal in fluctuated quality and quantity ransom. Biscuit bio-supplement were 
processed by pressing and heating to form compact feed. It has a purpose to easier transportation, 
storage and animal supply that increases consumption.

This study aimed to evaluate milk production and calcium content in Bangun Karso farm after 
biscuit bio-supplement consumed.

MATERIALS AND METHODS
Equipment: This research used digital scales, chopper machine, hammer mill and biscuit machine 
to prepare biscuit; milko tester Milk Analyzing Device Model Master Pro to analyzed milk quality.

Feed material: Composition for biscuit bio-supplement were papaya leaves, Indigofera sp. leaves, 
molasses and concentrate. Conventional feed of Bangun Karso farm were grasses and concentrate. 
The nutrient content of conventional feed in Bangun Karso farm has been seen in Table 1.

Animal and cage: This study used 10 female Ettawa crossbreed in woody cage completed with 
feed and water container.

Time and location: This study conducted in Bangun Karso farm, Bogor in 3 month (June-August) 2014. Calcium content analyzed in Laboratory of Dairy Cattle, Faculty of Animal Science, Bogor Agricultural University Indonesia.

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 to temperature 100°C for 5 min to form biscuit feed bio-supplement and then cooled at room 
temperature. Diagram process of biscuit bio-supplement production was presented in Fig. 1 
(Retnani et al., 2014c).

Procedure of milk calcium analysis: Milk calcium analyzed by Atomic Absorption 
Spectrophotometer (AAS). Sample preparation involved wet destruction used HNO₃, H₂SO₄ and 
HClO₄, warming sample by hotplate and filtration.

Statistical analysis: A statistical analysis was carried out on two data set used t-test in order to 
compare control (T0) and treatment (T1). The treatments were:

<table>
<thead>
<tr>
<th>Table 1: Nutrient content of conventional feed in Bangun Karso farm</th>
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</thead>
<tbody>
<tr>
<td>Feeds</td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td>Grasses</td>
</tr>
<tr>
<td>Concentrate</td>
</tr>
</tbody>
</table>

Analyzed in Laboratory Feed Technology and Science, Faculty of Animal Science, Bogor Agricultural University, CP: Crude protein, CF: Crude fiber, C-Fat: Crude fat.
Fig. 1: Process of biscuit bio-supplement production (Retnani et al., 2014c)

T0:  Mix forage+Concentrate  
T1:  Mix forage+Concentrate+Biscuit 15%

Parameters in this study were milk production and calcium content.

RESULTS AND DISCUSSION

Milk production: Nutrient content of bio-supplement biscuit are 7.43% ash, 33.56% crude protein, 13.85% crude fiber, 2.61% crude fat and 42.55% Beta-N (Retnani et al., 2014a).

Biscuit bio-supplement increased milk production almost along this study (Fig. 2). Fluctuation of milk production in each day depends on stage of lactation (Kuchtk et al., 2008) and season (Pollott and Gootwine, 2004). Seasonality effects commonly found in other sheep production systems include the effect of variation in nutrition from feed material. Milk production was associated with number of secretory cells in mammary, activity cell and subtract availability for milk synthesis. Milk synthase in secretory cells mammary used nutrient from consumed feed (Manalu et al., 2000).

Data analyses resulted that bio-supplement biscuit increased milk goat production, significantly (p<0.05). Effect of biscuit bio-supplement on milk production at Ciapus and Leuwiliang Farm (mL/head/day) has been shown in Table 2. Biscuit bio-supplement increased milk production until 137 mL per head per day (43.35%). Milk production average for each ewe was lower than Mardalena et al. (2011) and Ramadhan et al. (2013) that reported their ewe produced 440 mL per head per day or and 320.60-340.16 mL per head per day. Milk production in each day has been shown in Fig. 2.

Milk calcium content: Milk calcium content in the end of the research increased to 174.84 mg/100 g (48.27%) after bio-supplement biscuit treatment. Total calcium milk content is higher than Sodiq and Abidin (2010) who reported milk goat calcium was 129 mg/100 g. Kuchtk et al. (2008) reported that stage of lactation had effect on the contents of all milk components, included milk calcium. Milk calcium content was affected by protein content in
Fig. 2: Milk production in each day

![Graph showing milk production over time](image)

Fig. 3: Milk calcium

![Bar chart comparing milk calcium before and after](image)

Table 2: Effect of biscuit bio-supplements on milk production at Bangun Karso farm

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Before treatment</th>
<th>After treatment</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>177±76.12</td>
<td>274±83.82</td>
<td>97±45.83</td>
</tr>
<tr>
<td>T1</td>
<td>179±61.88</td>
<td>316±78.89</td>
<td>137±42.52</td>
</tr>
</tbody>
</table>

T0: Without biscuit, T1: With biscuit 15%. Results are significant at (p<0.05)

Table 3: Effect of biscuit bio-supplement on milk calcium content at Bangun Karso farm

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Before treatment</th>
<th>After treatment</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>mg/100 g</td>
<td>%</td>
<td>mg/100 g</td>
</tr>
<tr>
<td>T0</td>
<td>0.03±0.02</td>
<td>30.51±21.38</td>
<td>0.05±0.07</td>
</tr>
<tr>
<td>T1</td>
<td>0.15±0.07</td>
<td>105.70±73.38</td>
<td>0.29±0.30</td>
</tr>
</tbody>
</table>

T0: Without biscuit, T1: With biscuit 15%. Superscript in the same column indicated significant differences (p<0.05)

bio-supplement biscuit due to protein role as calcium catcher. Protein-calcium form was easier to absorb by mucosa used diffusion mechanism from cytoplasm to basal membrane (Trilaksani et al., 2006). Calcium would be deposit as milk mineral in lactated animal system.

Calcium is one of important mineral for human body that needed in abundant number. Result analyses showed that bio-supplement biscuit had significant effect on milk calcium content (p<0.05). Effect of Biscuit Bio-Supplement on Milk Calcium Content at Bangun Karso Farm has been shown in Table 3.

Increase in milk calcium also affects the active compound in papaya leaves as biscuit bio-supplement component. Fiber consume have a role in calcium absorption (Waluyo, 2009) that reduce feed transit time in intestinal tract and accelerate absorption process. Moreover, calcium absorption affected by age, animal requirement and feed sources. Milk calcium has been represented in Fig. 3.
CONCLUSION
Bio-supplement biscuit increased milk production up to 43.35% and milk calcium about 48.27%.

ACKNOWLEDGMENT
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