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Physical Characteristic and Palatability of Biscuit Bio-supplement for Dairy Goat

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Abstract: The objective of this study was to apply the physical characteristic and palatability of biscuit bio-supplement for dairy goat. This research was conducted at Laboratory of Feed Industry, Faculty of Animal Science, Bogor Agricultural University, Indonesia and the palatability test was conducted on the dairy goat farm at Leuwiliang, Bogor, Indonesia on March-July 2012. Twenty heads of dairy goat were randomly assigned to five dietary treatments (four heads of goat/treatment). Experimental design used Completely Randomized Design (CRD). The treatments were biscuit bio-supplement composition i.e., R1 = biscuit bio-supplement of *Indigofera* sp., R2 = biscuit bio-supplement of *Sauropus androgynus* L. Merr leaf, R3 = biscuit bio-supplement of *Carica papaya* L. leaf, R4 = biscuit bio-supplement of *Sauropus androgynus* L. Merr leaf and *Indigofera* sp., R5 = biscuit bio-supplement of *Carica papaya* L. leaf and *Indigofera* sp. The variables measured were moisture, water activity, water absorption, density and palatability of dairy goat. The results of this research indicated that the treatments of biscuit bio-supplement gave significant effect ($p<0.05$) on water content, water absorption, density and palatability, but had not significant effect on water activity. Palatability of R1 was 76.38±7.92, R2 was 23.81±6.08, R3 was 40.25±3.54, R4 was 29.56±4.77 and R5 was 95.63±7.36 g/head. Biscuit bio-supplement of *Carica papaya* L. leaf and *Indigofera* sp., (R5) had the best value of palatability for dairy goat and had the best crude protein (36.65%), also had lowest water activity, highest density than the other biscuits.

Key words: Biscuit, bio-supplement, physical characteristic, palatability, dairy goat

INTRODUCTION

Dairy goat farming in Indonesia is an activity that has potential to be developed. The goat milk has better quality than cow milk and fetches a higher price. The problem often encountered in the dairy goat farm is low production. Usually, milk production less than 2 L/head/day. The use of forage for goats requires particular strategies in order to increase productivity (Ibrahim, 2003).

The major constraints of ruminant feed are as follows: low quality of forage; the level of palatability and digestibility is low. Therefore, it is necessary to develop suitable technologies to produce ruminant feed which is more durable, easier to handle, more convenient to distribute and available in all seasons.

Biscuit is a dry product that is relatively long-lasting under normal storage conditions and easy to handle (Whiteley, 1971). Technology has an important role in feeding livestock. 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.

This study aimed to compare the quality of the physical properties of feed bio-supplement biscuits, level of digestibility and palatability of the feed bio-supplement biscuits.

MATERIALS AND METHODS

The research was conducted at Laboratory of Feed Industry, Faculty of Animal Science, Bogor Agricultural University and the palatability test conducted on the dairy goat farm at Leuwiliang, Bogor, Indonesia, on March-July 2012. Twenty heads of thin tail dairy goats were used in this experiment. This research used female dairy goats 2 years old with the average body weight round were 36±2.30 kg. The animals were randomly

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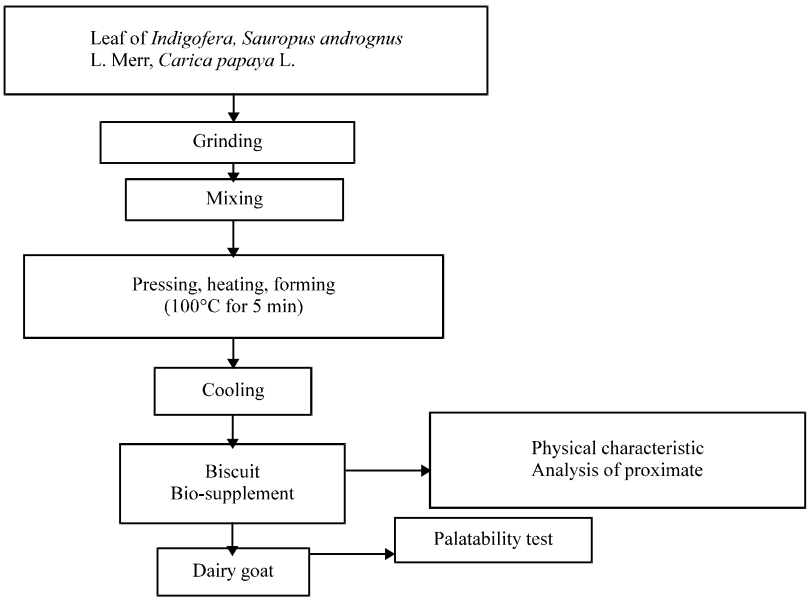

Fig. 1: Diagram process of biscuit bio-supplement production

Table 1: Nutrient composition of biscuit bio-supplement (% dry matter)

Biscuit	Ash	Crude protein	Crude fiber	Crude fat	NFE
R1	7.85	36.51	19.24	4.41	31.99
R2	10.69	35.27	21.75	5.80	26.51
R3	10.88	34.90	16.27	5.15	32.80
R4	7.78	36.37	20.87	3.91	31.06
R5	8.55	36.65	20.40	3.77	30.63

R1: Biscuit feed biosupplement *Indigofera* sp., R2: Biscuit feed biosupplement *Sauropus androgynus* L. Merr leaf R3: Biscuit feed biosupplement *Carica papaya* L. leaf; R4: Biscuit feed biosupplement *Sauropus androgynus* L. leaf and *Indigofera* sp., R5: Biscuit feed biosupplement *Carica papaya* L. leaf and *Indigofera* sp.

assigned to five dietary treatments (four heads of goat/treatment). Dry matter and crude protein content of feed can be seen in Table 1.

Diagram process of biscuit production: Figure 1 showed that a diagram process of biscuit bio-supplement production from raw material i.e., *Indigofera* sp., *Sauropus androgynus* L. Merr leaf and *Carica papaya* L. leaf 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.

Experimental design: The experimental design used in this research was Completely Randomized Design (CRD) with five treatments and four replications. The treatments were biscuit composition, i.e:

- R1 = Biscuit bio-supplement of *Indigofera* sp.,
- R2 = Biscuit bio-supplement of *Sauropus androgynus* L. Merr
- R3 = Biscuit bio-supplement of *Carica papaya* L.
- R4 = Biscuit bio-supplement of *Sauropus androgynus* L. Merr and *Indigofera* sp.,
- R5 = Biscuit bio-supplement of *Carica papaya* L. and *Indigofera* sp.,

Biscuits bio-supplement variables measured were water content (AOAC, 2005), water activity (AW meter's instruction), water absorption (Trisyulianti *et al*., 2003) and palatability test (Kaitho *et al*., 1997).

Palatability test was done by modification of the Kaitho's method (Kaitho *et al*., 1997). Adaptions periods was done for 5 days and palatability of test for 2 days. Feeding of biscuit bio-supplement was done at 6 a.m. 12 p.m. The Palatability level was detectable by counting the difference between total feed that has been given with the rest of the feed that consumed by dairy goat.

Mathematical model: Mathematical model of this design is:

$$Y_{ij} = \mu+\alpha_i+\varepsilon_{1j}$$

Where,

Y_{ij} = Observations treatment to-i and replications to-j
μ = The average value of the observations
α_I = Effect treatment to-i
εij = Effect error treatment to-i and replications to-j
I = Treatment given (1,2,3,4,5,6)
j = Replications of each treatment (1,2,3)

The data was analysed using Analysis of Variance (ANOVA). The differences among treatments were examined with Duncan test (Steel and Torrie, 1991).

RESULTS AND DISCUSSION

Biscuit bio-supplement generally had brownish green colour with fragrant aroma so that is liked by dairy goat and had coarse of particle size (4.16-4.80 mm). The general condition of biscuit bio-supplement can be seen of Table 2. The brown color due to browning reactions in non enzimatis reaction between the reducing sugars or maillard reaction occurs (Adawyah, 2007; Winarno, 1992).

Table 2: General condition of biscuit bio-supplement

Treatment	Colour	Aroma	Particle size and texture
R1	Brownish green	Fragrant	4.23/Coarse
R2	Brownish green	Fragrant	4.80/Coarse
R3	Brownish green	Fragrant	4.33/Coarse
R4	Brownish green	Fragrant	4.16/Coarse
R5	Brownish green	Fragrant	4.33/Coarse

R1: Biscuit feed biosupplement *Indigofera* sp., R2: Biscuit feed biosupplement *Sauropus androgynus* L. Merr leaf, R3: Biscuit feed biosupplement *Carica papaya* L. leaf, R4: Biscuit feed biosupplement *Sauropus androgynus* L. leaf and *Indigofera* sp., R5: Biscuit feed biosupplement *Carica papaya* L. leaf and *Indigofera* sp.

Table 3: Physical characteristics of biscuit bio-supplement

Biscuit	Water content	Water activity	Density	Water absorption
R1	7.83±0.71^{b}	0.89±0.01	0.66±0.06^{b}	60.73±1.86^{c}
R2	10.40±2.08^{a}	0.85±0.06	0.64±0.03^{b}	67.85±4.83^{ab}
R3	11.55±0.47^{a}	0.90±0.01	0.72±0.03^{ab}	68.93±2.23^{a}
R4	8.24±1.03^{b}	0.89±0.02	0.65±0.06^{b}	60.45±2.66^{c}
R5	8.62±0.50^{b}	0.78±0.14	0.78±0.05^{a}	63.80±0.98^{bc}

Values with different letter's are significantly different at $p<0.05$ using Duncan test

Physical characteristics of biscuit biosupplement

Water content: Wafer content of is one important factor in determining the quality of the material. The results of analysis of variance showed that on water content was significant differences ($p<0.05$). Physical characteristic of water content values derived in this study range between 7.83-11.55% (Table 3). The results is in accordance with Syarief and Halid (1993) the activity of microorganisms and enzymes can be suppressed at 12-14% of water content, so the material is not easy to mold and rot. Water content of biscuit bio-supplement was lower than water content of vegetable waste wafer. Water content of vegetable waste wafer around 9.42-13.39% (Retnani *et al*., 2010).

Water activity: The measurement of water activity is needed to determine the minimum limits of microorganisms that can grow to be supported by water content. The value of water activity is known by reading the amount of free water contained in the biscuit of field grass and corn crop waste in the Aw-meter instrument. The results of analysis of variance showed that the water activity was not significant differences ($p>0.05$). Physical characteristic of water activity values derived in this study range between 0.78-0.90 (Table 3). It means that microbes can grow in biscuit of field grass and corn crop waste during this study. According to Syarief and Halid (1993), microbes can only grow in the range of water activity of 0.70 is considered good enough and hold it for storage. Water activity determines the safety of products consumed since Aw is an intrinsic factor or factors originating from within its own biscuit products thereby affecting the growth of microbes (Herawati, 2008).

Density: Density is a measure of compactness of particles in sheets. Density highly dependent on the density of the raw materials used and the amount of pressure given during process. The results of analysis of variance showed that density was significant differences ($p<0.05$). Physical characteristic of density values derived in this study range between 0.64-0.78% (Table 3). Biscuit bio-supplement of *Carica papaya* L. leaf and *Indigofera* sp. (R5) had high density compared with the other biscuits, so performance of R5 biscuit more hard texture and thicker. Biscuit bio-supplement had low density thinner, softer texture and more cavities. Density was affected by raw material and pressure given during the process. This makes them easier to handle during transportation and more durable in storage (Trisyulianti *et al*., 2003).

Water absorption: Water absorption is the ability of materials to absorb water from the air to bond with material's particle (Jayusmar *et al*., 2002). The water absorption is a variable that indicates the amount of water surrounding the ability of attractive feed to bind to the material particles or pores between particles suspended in the material (Trisyulianti *et al*., 2001). The results of analysis of variance showed that water absorption was significant differences ($p<0.05$). Physical characteristic of water absorption values derived in this study range between 60.45-68.93% (Table 3). The highest water absorption was found in biscuit bio-supplement of *Carica papaya* L. leaf (R3). The lowest water absorption was found in bio-supplement of *Sauropus androgynus* L. Merr leaf and *Indigofera* sp. (R4). It means that biscuit bio-supplement of *Carica papaya* L. leaf can absorb water more than the other biscuits. Hopefully, this biscuit can be digested in rumen easily.

Palatability: Palatability describe feed characteristics by organoleptic such as appearance, smell, taste (sour, salty,

Table 4: Palatability of biscuit bio-supplement

	Palatability test	
Biscuit	Feed (g head^{-1})	Dry matter (g head^{-1})
R1	85.24±8.83^{c}	76.38±7.92^{c}
R2	25.27±6.61^{a}	23.81±6.08^{a}
R3	44.05±3.96^{b}	40.25±3.54^{b}
R4	31.32±5.33^{a}	29.56±4.77^{a}
R5	102.91±8.12^{d}	95.63±7.36^{d}

Values with different letter's are significantly different at $p<0.05$ using Duncan test

sweet, bitter), texture and temperature, giving rise to stimuli and the attractiveness of animal to consume (Yusmadi and Ridla, 2008). Goat has a nature to select feed than other animal, i.e., cow and sheep. Biscuit biosupplement of *Carica papaya* L. leaf and *indigofera* sp. (R5) more palatable to dairy goat. *Carica papaya* L. leaf has bitter taste, so it can increase desire eat and *indigofera* sp., has good smell, so dairy goat like to eat. *Sauropus androgynus* L. Merr leaf has texture more coarse than other biscuits (Table 2).

The results of this research indicated that the treatments of biscuit bio-supplement made gave significant effect ($p<0.05$) on palatability. Palatability of R1 was 76.38±7.92, R2 was 23.81±6.08, R3 was 40.25±3.54, R4 was 29.56±4.77 and R5 was 95.63±7.36 g/head/day. Biscuit bio-supplement of *Carica papaya* L. leaf and *Indigofera* sp., had the best value of palatability for dairy goat (Table 4). Palatability of *Carica papaya* L. leaf and *Indigofera* sp., was higher compared with palatability of field grass biscuit in the other research was 74,68 g/head/day (Retnani *et al*., 2009). Feed has the important role in production and reproduction of dairy goat (Walkden-Brown *et al*., 1994). This means that the higher palatability will be able to produce high milk production. Qualitative test showed that *Sauropus androgynus* L. Merr, *Carica papaya* L. leaf and *Indigofera* sp., content saponin, alkaloids, tannin, phenolic, flavonoids, triterfenoid, steroid and glycosides. Widjastuti (2009) said that leaf of *Carica papaya* L. is medicinal plant because contain alkaloid compounds and proteolytic enzymes, i.e., papain, khimopapain and lysozyme, which are useful in the process of digestion, especially digestion of gut. According to Kiha *et al*. (2012), kimopapain enzyme, papain and lipase can help break down the bond complex, thereby increasing digestibility and nutrient utilization efficiency ration. According to Tietze (2002), a proteolytic enzyme papain has the ability to break down protein and convert its portion into arginine, because arginine in its original form can influence the production of human growth hormone produced in the pituitary gland.

CONCLUSION

It was concluded that biscuit bio-supplement of *Carica papaya* L. leaf and *indigofera* sp., had content highest amount of crude protein and also has the lowest water activity, contains the highest level of palatability for dairy goats, among other biscuits.

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