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

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Abstract. The objective of this study was to evaluate the physical characteristic and palatability of bio-supplement biscuit for dairy goat. This experimental research applied Completely Randomized Design, constituting 20 heads of dairy goat randomly assigned to five dietary treatments. The treatments were R1 = bio-supplement biscuit of *Indigofera sp*; R2 = bio-supplement biscuit of *Sauropus androgynus L. Merr* leaf; R3 = bio-supplement biscuit of *Carica papaya L* leaf; R4= bio-supplement biscuit of *Sauropus androgynus L. Merr* leaf and *Indigofera sp*; R5= bio-supplement biscuit of *Carica papaya L* leaf and *Indigofera sp*. The variables measured were moisture, water activity, water absorption, density, and palatability. The results indicated significant effect of bio-supplement biscuit treatment on water content, water absorption, density, and palatability, but no significant effect on water activity. Palatability of R1 was 76.38±7.92 g/head, R2 was 23.81±6.08 g/head, R3 was 40.25±3.54 g/head, R4 was 29.56±4.77 g/head, R5 was 95.63±7.36 g/head. Bio-supplement biscuit of *Carica papaya L* leaf and *Indigofera sp* had the highest values of dairy goat's palatability for dairy goat, crude protein (36.65%) and density, but the lowest in water activity.

Keywords: biscuit, bio-supplement, dairy goat, palatability, physical characteristic

Abstrak. Tujuan penelitian ini adalah untuk mengevaluasi sifat-sifat fisik dan palatabilitas biskuit bio suplemen untuk kambing perah. Penelitian menggunakan Rancangan Acak Lengkap, terdiri dari 20 ekor kambing perah yang secara random diberi ransum percobaan. Perlakuan terdiri dari R1 = bio-supplement biscuit dari *Indigofera sp*; R2 = bio-supplement biscuit dari *Sauropus androgynus L. Merr* leaf; R3 = bio-supplement biscuit dari daun *Carica papaya L*; R4= bio-supplement biscuit dari daun *Sauropus androgynus L. Merr* dan *Indigofera sp*; R5= bio-supplement biscuit dari daun *Carica papaya L* dan *Indigofera sp*. Variabel yang diamati meliputi kelembaban, aktivitas air, absorbsi air, kepadatan, dan palatabilitas pakan. Hasil peneltian menunjukkan efek nyata dari biscuit bio-suplemen terhadap kandungan air, daya serap air, kepadatan dan palatabilitas, tetapi tidak berpengaruh nyata terhadap aktivitas air. Palatabilitas dari R1 adalah 76,38±7,92 g/ekor, R2 23,81±6,08 g/ekor, R3 40,25±3,54 g/ekor, R4 29.56±4.77 g/ekor, R5 95,63±7,36 g/ekor. Bio-supplement biscuit dari daun *Carica papaya L* dan *Indigofera sp* mempunyai nilai palatabiltas, protein kasar (36,65%) dan kepadatan tertinggi, tetapi nilai aktivitas air paling rendah.

Kata kunci : biscuit, bio-supplement, kambing perah, palatabilitas, karakteristik fisik

Introduction

Dairy goat farming in Indonesia is a potential development since goat milk has better quality than cow milk and is worth higher price. The problem often encountered in the dairy goat farm is the low production of less than 2 L/head/day in which dairy goats production is largely determined by feed availability and quality. The use of forage for goats requires particular strategy to increase productivity (Ibrahim, 2003).

The major constraints of ruminant feed are hard-to-handle bulky and perishable forage, inconsistent distribution and process supply between dry and rainy seasons, and low level of palatability and digestibility. It therefore demands the development of suitable technology 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 durable under normal storage conditions and

easy to handle (Whiteley, 1971). Technology has an important role in feeding livestock. High durability makes biscuit a dry product for prolonged and handy storage during traveling because of the volume and weight after the drying process. Biscuits bio-supplement feed is made of fiber, especially fresh green forage in replace of ruminants to utilize the fiber when the quality and quantity of forage decrease.

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 the Laboratory of Feed Industry, Faculty of Animal Science, Bogor Agricultural University and the palatability test was at the dairy goat farm at Leuwiliang, Bogor from March to July 2012. Twenty heads of two-year-old female thin-tailed dairy goats with average body weight of 36±2.30 kg were administered and randomly assigned to five dietary treatments (four heads of goat/treatment). Dry matter and crude protein content of feed presents in Table 1.

Diagram Process of Biscuit Production

Figure 1 shows a diagram process of biscuit feed bio-supplement production from raw material i.e. *indigofera, Sauropus androgynus L. Merr* leaf and *Carica papaya L* leaf processed by grinding, mixing, pressing and heating with temperature 100^0C for 5 minutes 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 with five treatments and four replications. The treatments were biscuit composition i.e: R1 = bio-supplement biscuit of *Indigofera sp*; R2 = bio-supplement biscuit of *Sauropus androgynus L. Merr* leaf; R3 = bio-supplement biscuit *of Carica papaya L* leaf; R4= bio-supplement biscuit of *Sauropus androgynus L. Merr* leaf and *Indigofera sp*; R5= bio-supplement biscuit of *Carica papaya L* leaf and *Indigofera sp*. The data were analyzed using Analysis of Variance. The differences among treatments were examined with Duncan test (Steel and Torrie, 1993).

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

Palatability test was performed by modification of the Kaitho's method (Kaitho at al., 1997). Adaptions periods lasted for 5 days and palatability test for 2 days. Bio-supplement biscuit was fed at 6 am-12 pm. The palatability level was detectable by counting the difference between the dairy goat's total feed given and the residue.

Table 1. Nutrient composition of bio-supplement biscuit (% 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

Laboratory Analysis of Feed Science and Technology (2012)

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

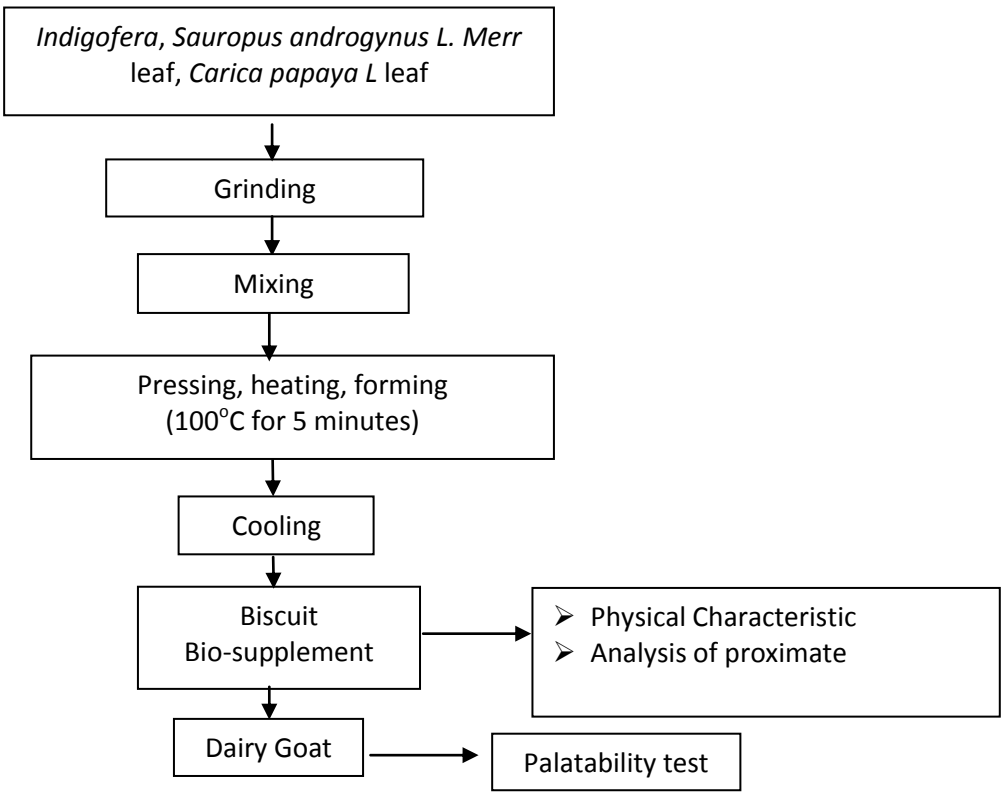

Figure 1. Diagram Process of Bio-supplement biscuit Production

Results and Discussion

Bio-supplement biscuit is generally the fragrant and brownish green coarse particle of 4.16-4.80 mm palatable for dairy goat. The general condition of bio-supplement biscuit is presented in Table 2. The brown color is due to browning reactions in nonenzimatic as reaction between the reducing sugars or Maillard reaction (Adawyah, 2007; Winarno, 1992).

Physical Characteristics of Bio-supplement biscuit

Water content

Wafer content is one important factor in determining the quality of the material. The results of analysis of variance showed significant difference on water content ($P<0.05$). Physical characteristic of water content values derived in this study ranged between 7.83-11.55% (Table 3). The results was in accordance with Syarief and Halid (1993) that the activity of microorganisms and enzymes can be suppressed at 12-14% of water content, preventing mold and rot. Water content of bio-supplement biscuit was lower than that of vegetable waste wafer, namely 9.42-13.39% (Retnani et al., 2010).

Water activity

The measurement of water activity is needed to determine the minimum limits of the growing microorganisms 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 residue in the Aw-meter instrument. The analysis of variance results showed no significant difference on the water activity ($P>0.05$). Physical characteristic of water activity values derived in this study ranged between 0.78-0.90 (Table 3) proving that microbes can grow in biscuit of field grass and corn residue. According to Syarief dan Halid (1993), microbes can only grow in the range of 0.7 water activity as the proper storage. Water

Table 2. General condition of bio-supplement biscuit

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 chacarteristic of bio-supplement biscuit

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±0.98b^{c}

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*

activity determines the safety of products consumed since Aw is an intrinsic factor or factors originating from its own biscuit products, thereby affecting the growth of microbes (Herawati, 2008).

Density

Density is a measure of compactness of particles in sheets, highly dependent on the density of the raw materials used and the amount of pressure given during the manufacturing process sheets to determine or measure the weight of the sample for every one unit of sample volume (Suryani, 1986). The results of analysis of variance showed significant different (P<0.05) on density. Physical characteristic of density values obtained ranged between 0.64-0.78% (Table 3). Bio-supplement biscuit of *Carica papaya L* leaf and *Indigofera sp* (R5) had higher density than the other biscuits, leading to harder and thicker performance of R5 biscuit. Bio-supplement biscuit had low density and more cavities, was thinner and softer. Density was affected by raw material and pressure given during the process, attaining an easier transport handling and prolonged 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). 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 significantly different (P<0.05). Physical characteristic of water absorption values derived in this study ranged between 60.45-68.93% (Table 3). The highest water absorption was found in bio-supplement biscuit of *Carica papaya L* leaf (R3) while the lowest was in bio-supplement of *Sauropus androgynus L. Merr* leaf and *Indigofera sp* (R4). It proved that bio-supplement biscuit of Carica papaya L leaf had higher permeability than the other biscuits, and thereby was easily digested in rumen.

Table 4. Palatability of Bio-supplement biscuit

Biscuit	Palatability Test (g/head)	
	As Feed	As Dry Matter
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]

[a, b, c, d] Values bearing different superscript on the same column differ significantly (P<0.01)

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* biscuit feed biosupplement papaya leaf and *Indigofera sp*. Note: the biscuit were offered to the goats for 2 minutes

Palatability

Palatability described feed characteristics by organoleptic such as appearance, smell, taste (sour, salty, sweet, bitter), texture and temperature, enhancing the stimuli and the attractiveness of animal to consume (Yusmadi et al., 2008). Goat has a nature to select feed compared to other animal, i.e. cow and sheep. Biscuit biosupplement of *Carica papaya L* leaf and *indigofera sp* (R5) is more palatable to dairy goat. *Carica papaya L* leaf's bitter taste increases appetite, and *indigofera sp's* good smell is preferable by dairy goat to eat. *Sauropus androgynus L. Merr* leaf is coarser than other biscuits (Table 4).

The results of this research indicated that the treatments of bio-supplement biscuit gave significant effect (P<0.05) on palatability. Palatability of R1 (bio-supplement biscuit of *Indigofera sp*) was 76.38±7.92 g/head/day, R2 (bio-supplement biscuit of *Sauropus androgynus L. Merr* leaf) was 23.81±6.08 g/head/day, R3 (bio-supplement biscuit of *Carica papaya L* leaf) was 40.25±3.54 g/head/day, R4 (bio-supplement biscuit of *Sauropus androgynus L. Merr* leaf and *Indigofera sp*) was 29.56±4.77 g/head/day, R5 (bio-supplement biscuit of *Carica papaya L* leaf and *Indigofera sp*) was 95.63±7.36 g/head/day. Bio-supplement biscuit of papaya leaf and *Indigofera sp* had the best value of palatability for dairy goat. Palatability of *Carica papaya L* leaf and *Indigofera sp* was higher than that of field grass biscuit in the other research namely 74.68 g/head/day (Retnani et al., 2009). Feed holds important role in production and reproduction of dairy goat (Walkden-Brown et al., 1994). Accordingly, that the higher the palatability, the higher the milk production.

Conclusion

Bio-supplement biscuit of *Carica papaya L* leaf and *indigofera sp* has the highest level of palatability for dairy goats, the highest amount of crude protein and the lowest water activity among other biscuits. *Carica papaya L* leaf and *indigoferra sp* can be processed to produce biscuit as a bio-supplement for dairy goat.

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