EFFECT OF BAGASSE PORTION IN DIET ON BODY COMPOSITION OF GOAT

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ABSTRAK

Penelitian bertujuan untuk memprediksi komposisi tubuh kambing lokal yang diberi *total mixed ration* (TMR) berbasis ampas tebu. Lima belas ekor kambing jantan lokal (berumur 18 bulan dengan berat badan rata-rata 18 kg) digunakan dalam penelitian ini. Kambing dibagi secara acak menjadi 3 perlakuan, dan diberi TMR yang masing-masing mengandung 15, 25, dan 35% ampas tebu. Pakan perlakuan disusun isoenergi dan isoprotein. Setelah 12 minggu adaptasi terhadap pakan perlakuan dan lingkungan, masing-masing perlakuan pengaruh pakan terhadap kecernaan pakan, komposisi tubuh dan serum glukosa. Data diuji dengan menggunakan uji Anova. Hasil penelitian menunjukkan bahwa komposisi tubuh dan konsentrasi serum glukosa tidak berbeda nyata (P>0,05) antar perlakuan. Penggunaan ampas tebu sampai 25% dalam TMR dapat menurunkan konsumsi pakan dan pertambahan berat badan (P<0,05) antar perlakuan. Porsi ampas tebu sampai 35% dalam TMR tidak mempengaruhi komposisi tubuh kambing.

Kata Kunci: bagase, komposisi, Total Mixed Ratio, kambing

ABSTRACT

The study was aimed to predict body composition of local goats fed bagasse based total mixed ration (TMR). Fifteen male local goats (18 months old with average body weight of 18 kg) were used in this study. Goats were divided randomly into 3 groups, and were fed TMR's those contained 15, 25, and 35% of sugarcane bagasse, respectively. All experimental diets were designed to be isoenergy and isoprotein. After 12 weeks of adaptation to experimental diets and environment, each group was subjected to feed digestibility trial, body composition, and experiment of feeding effect on serum glucose. The data were analyzed using one way analyses of variance. The results showed that the body composition and serum glucose concentration were not significantly different (P>0.05) among treatments. The bagasse portion in the TMR upto 25% lowered daily feed consumption and body weight gain (P<0.05). It was concluded that the use of sugarcane bagasse up to 35% in the TMR did not affect body composition of goats.

Keywords: bagasse, body composition, TMR, goats

INTRODUCTION

Enhancement of goat meat production needs the support of sustainable feed availability. Goats have different feeding behavior, intake, diet selection, and rate of eating from other ruminants (Lu *et al*., 2005). Goats are browser animal, but shrub trees for browsing activity and shrub foliage availability are limited seriously during recent years. The total mixed ration (TMR) becomes an alternate effort to sustain feed availability. The sugarcane bagasse availability is dominant agroindustrial byproduct in Java island, especially in the dry season. Sugarcane bagasse could be the fiber source in a goat ration, but its use should be restricted or processed before the mixture due to the high content of fiber (ligno-hemicellulose and ligno-cellulose) in sugarcane bagasse (Ramli *et al*., 2005a; Ramli *et al*., 2005b; Prayuwidayati and Muhtarudin, 2006).

A high fiber ration may increase fat portion of ruminant products. West *et al.* (1999) reported that greater dietary fiber content increases milk fat percentage in lactating dairy cows. Acetate from ruminal degradation of dietary fiber is known as fat sources for ruminant product (Preston and Leng, 1987). Effective dietary fiber increases ruminal acetate to propionate ratio in goats (Zhao *et al.*, 2011). It is postulated that greater portion of sugarcane bagasse in TMR may increase fat portion of body goats.

Technique of urea dilution is commonly used for estimating body composition of ruminants (Velazco *et al.*, 1997; Nonaka *et al.*, 2006; Shingu *et al.*, 2007; Hanna, 2010). In this study, body composition of goats fed on different levels of sugarcane bagasse was determined using the urea dilution technique.

MATERIALS AND METHODS

Fifteen male Jawa Randu crossbred goat (18 months old with average body weight of 18 kg) were used in this study. Goats were devided randomly into three groups, and were fed TMR's those contained 15, 25, and 35% of sugarcane bagasse, respectively. Experimental diets were designed to be isoenergy and isoprotein (Table 1). Animals were housed individually in the metabolic cages, and water drinking was available throughout experimental period. Body weight of each goats was measured once a week throughout experimental period.

After three months of adaptation to experimental diets and environment, each goats was subjected to one week period of feed digestibility test. All groups of treatment were also subjected to body composition measurement after one week of feed digestibility test. The experiment of urea dilution technique was conducted according to the procedure of Nonaka *et al.* (2006) and Hanna (2010). A solution of urea of 200 g per liter (0.65 mg per live body weight) was injected into the jugular vein through a cannula at a rate of 120 ml/min. Blood samples were taken into heparinized test tubes before injection and 12 min after the mid-time of the injection period. They were put immediately on ice and separated within 2 h, and the plasma was stored for analysis at -20°C. Urea space (US) was calculated by the following equation: US = D/(C_{12} – C_0), where US = urea space (liters); D = dose (grams of urea); and C_{12} – C_0) = the change in urea concentrations (gram per liter) in plasma between samples that were taken before and 12 min after urea injection.

Additional blood sampling was also conducted to study the incremental increase of blood glucose after feeding in each goats. This observation was conducted three days after commencement body composition measurement. Blood sampling were taken before and three hours after feeding.

Content of proximate components in feed and feces were analysed using procedure of AOAC (1995). NDF cotent in feed and feces were analysed according to procedure of Van Soest *et al.* (1991). The concentrations of urea in the injected solution and in the plasma were determined according method of Berthelot (AOAC, 1995). The glucose concentration in blood serum of goats before and after feeding was determined using with a glucose assay kit (GLUCOSE liquicolor, Human Gesellschaft fur Biochemica und Diagnostica mbH, Taunusstein-Germany).

Data were analyzed using one way analyses of variance. Duncan's multiple range test was performed to estimate the difference between treatments (Steel and Torrie, 1981) .

RESULTS AND DISCUSSION

Feed Digestibility and Conversion

Greater portion of bagasse in the diet may decrease feed intake, because rate of passage in the digestive tract become slower. (Ramli *et al.*, 2005a) stated that high content of fiber commponents in sugarcane bagasse are in the form of ligno-hemicellulose and ligno-cellulose those are unable to be attacked by enzymatic system of rumen microbes. This effects on amount of feed consumed by goats. Table 1 shows that consumption of dry matter, crude protein, TDN, and NDF were decreased ($P<0.05$) because of bagasse portion in the diet. However, the portion of bagasse did not effect on dry matter feed digestibility. Bagasse is a bulky feed that may limit dry matter consumption. The bulky feed cause increasing tense which in turn results in satiety sensation of goats (Toharmat *et al.*, 2006). In additon, the experimental diets were designed to isoenergy. In this experiment, the feed dry matter consumption were in the range from 2.5 to 3.2% of goats body weight. Kearl (1982) stated that feed dry matter consumption of goats are in the range from 2.7 to 3.5% of body weight.

Serum Blood Glucose

High portion of bagasse in the diet lowered blood glucose concentration of goats, because smaller supply of glucose precursor from gastrointestinal (Weekes, 1991). Ruminants normally rely on hepatic gluconeogenesis which utilizes propionate as the glucose precursor (Achmadi *et al.*, 2007). Dietary effective fiber

Table 1. Ingredients and Chemical Composition of Experimental Diets

	Diet		
	15	25	35.00%
	--------------------- % baggase ----------------------		
Ingredients (based on 100% DM)			
Sugarcane bagasse	15.00	25.00	35.00
Copra mill	13.00	13.50	13.50
Groundnuts shell	7.00	3.50	2.00
Molasses	7.00	7.00	7.00
Soybean mill	7.00	9.00	11.00
Rice bran	14.50	11.00	10.50
Coffee seed shell	12.00	7.00	2.00
Urea	0.50	0.50	0.50
Palm frond mill	10.00	10.00	5.50
Wheat pollard	14.00	13.50	13.00
Chemical composition[2]			
Crude protein	12.26	12.44	12.19
Crude fiber	6.17	5.99	5.30
Extract ether	29.11	29.18	28.78
Neutral detergent fiber	62.38	63.16	63.45
Total digestible nutrients	60.30	60.33	60.02

increases ruminal acetate to propionate ratio in goats (Zhao *et al*., 2011). Table 1 shows that the serum glucose concentrations of goats before and after feeding was not affected by the portion of bagasse in the diet, although the rate of glucose body utilization was not determined in the present study. It is well known that insulin plays important role in the glucose utilization the body. The action of insulin to increase the rate of glucose disposal via suppression of hepatic glucose output and stimulation of hepatic glucose uptake seems to be a minor route of glucose disposal in goats, since the suppression of hepatic glucose production by insulin has been reported to be relatively less sensitive in ruminants compared with that in monogastric (Achmadi, 2012).

Prediction of Body Composition

Higher fiber consumption may result in more fat propotion of ruminant carcass. It is well known that acetate from ruminal feed fiber degradation as a precursor of peripheral fat in ruminants (Preston and Leng, 1987). As mentioned above, higher dietary fiber increases ruminal acetat to propionate ratio in goats (Zhao *et al*., 2011). West *et al*. (1999) reported that greater dietary fiber content increases milk fat percentage in lactating dairy cows. However, body fat percentage of goats was not affected by bagasse portion in the diet (Table 2). Glycerol is also a precursor for body fat synthesis beside of acetate, and glucose may be converted to glycerol (Vernon and Houseknecht, 2000). The portion of bagasse did not affect serum glucose concentration (Table 2). The similar energy content in the diets may contribute to a discrepancy of this experimental result.

The similar protein content in the diets may also contribute to a discrepancy of body protein, because dietary bagasse did not affect body

Table 2. Experimental Results in Goats Fed Sugarcane-based Diets[1]

Parameters	Diet		
	15	25	35
	----------------------------- % baggase -----------------------		
Feed consumption[2]			
Dry matter, g/d	722.06±138.97[a]	591.72±77.43[b]	531.98±86.97[b]
Crude protein, g/d	88.52±17.04[a]	73.61±9.63[b]	64.85±10.60[b]
Total digestible nutrient, g/d	435.40±83.80[a]	356.98±46.71[b]	319.29±52.20[b]
Neutral detergent fiber, g/d	450.41±86.69[a]	373.73±48.91[b]	337.54±55.18[b]
Feed digestibility[2]			
Dry matter digestibility, %	65.42± 3.88	60.29±4.17	58.05±3.40
Body weight gain[3], g/d	104.23±17.78[a]	87.40±21.61[ab]	70.80±8.96[b]
Feed conversion[3]	7.00± 1.38	6.96± 1.13	7.50±0.93
Concentration of serum glucose			
Before feeding, mg/dl	50.02± 7.05	49.98± 9.27	44.86±10.74
Three hours after feeding, mg/dl	56.92± 6.88	55.32± 8.42	51.32±13.57
Prediction of body composition			
Body water, %	58.09± 0.16	58.21± 0.19	58.25± 0.20
Body protein, %	11.32± 0.38	11.21± 0.28	11.07± 0.33
Body fat, %	21.33±0 .22	21.16± 0.25	21.10± 0.26

[1]Values are means of five goat±SD.
[2]Average values of 7 days observations in each goat (mean±SD; n = 5).
[3]Average values of 90 days observations in each goat (mean±SD; n = 5).
[a,b]Means within a row with different superscripts letter are significantly different: $p<0.05$.

protein percentage of goats (Table 2). Indeed, protein portion of ruminant carcass may be lowered by the higher fiber consumption. Body protein portion is linearly correlated with the rate of ruminal microbe protein synthesis. Pina *et al*. (2009) reported that the growth eficiency of rumen microbes mostly rely on protein supply from feed, when two different feeds are qualitatively similar. Increasing levels of daily protein consumption may resulted in enhancement of ruminal microbes nitrogen production significantly (Geroge *et al*., 2006).

Decreasing body water content will increase content of fat body. Pond *et al*. (2005) stated that body water content is inversely correlated to the content of body fat. However, the content of body water was not affected by the bagasse portion in diets (Table 2).

CONCLUSION

The portion of sugarcane bagasse in the TMR upto 35% did not affect body composition, but it lowered feed consumtion and body weight gain in goats.

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