

Profile of Rumen Fermentation and Blood Urea Nitrogen Concentration of Kacang Goat Fed Total Mixed Ration Vs. Roughage

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Abstract

Kacang goat is usually reared traditionally fed natural grass and having inferior performance. Many researches had been done to improve the performance. Total mixed ration (TMR) containing soybean meal (SBM) and fish meal (FM) could increase the performance of Kacang goat, but the profile of rumen fermentation has not been published. Therefore, this study investigated the profile of rumen fermentation and blood urea Nitrogen concentration (BUN) in Kacang goat fed natural grass (roughage) and TMR. Twelve yearling Kacang buck, 15.2-19.6 kg were arranged in completely randomized design. The treatments were NG (natural grass), FM (TMR containing FM), and SBM (TMR containing SBM). The TMR were formulated containing 15% crude protein and 56-58% TDN. Data were analyzed by one way ANOVA. Rumen pH 6 hours after feeding of NG (7.4) was higher ($P<0.01$) than that of FM (6.2) and SBM (6.4). This lowering pH of TMR was caused by increasing volatile fatty acids (VFA). The VFA total of FM (129.7 mmol/l) and SBM (153.1 mmol/l) were higher than that of NG (86.4 mmol/l). At 3 and 6 hours after feeding, ammonia in the rumen of SBM was higher than that of NG and FM, indicating higher degraded protein. The BUN at 3 hours after feeding of SBM was higher than that of NG. It can be concluded that protein in SBM was degraded higher than others and the lower pH in rumen of TMR goats was caused by higher VFA produced by TMR goats compared to NG goats.

1. Introduction

Kacang goat is usually reared traditionally fed natural grass and having inferior performance. Many researches had been done to improve the performance. Total mixed ration (TMR) containing soybean meal (SBM) and fish meal (FM) could increase the performance of Kacang goat [1,2], but the profile of rumen fermentation has not been published yet. Therefore, this study investigated the profile of rumen fermentation and blood urea Nitrogen (BUN) concentration in Kacang goat fed natural grass (roughage) and TMR (TMR containing FM and SBM).



2. Materials and Methods

The procedures of animal experiment were based on the guidelines of the Faculty's Livestock Ethics Committee. Twelve yearling Kacang buck, 15.2-19.6 kg were arranged in completely randomized design. The goats were penned individually provided by water *ad libitum* and different feeding treatments. The treatments were NG (natural grass), FM (TMR containing FM), and SBM (TMR containing SBM). The TMR were formulated containing 15% crude protein and 56-58% TDN consisted of *Pennisetum purpureum*, gliricidia leaves, cassava waste product, wheat bran, SBM or FM, and mineral mix (Table 1). Volatile fatty acids (acetic, propionic, and butyric acids) were assayed from rumen fluid collected at 0, 3, and 6 h after feeding and determined by gas chromatography (Shimadzu GC-8). Rumen ammonia was analyzed by Conway procedure [3]. Blood urea Nitrogen concentration was determined at 0, 3, and 6 h after feeding using Spectro MicroLab. Data were analyzed by one way ANOVA using SPSS statistics software version 19.

Table 1. Feed composition and nutrients contents (CP and TDN) of the ration [1,2].

Parameters	NG	FM	SBM
	----- % -----		
Feed composition:			
Natural grass	100	-	-
<i>Pennisetum purpureum</i>	-	30.00	30.00
Gliricidia leaves	-	30.00	30
Cassava waste product	-	20.10	19.20
Wheat bran	-	13.75	13.80
Fish meal	-	6.15	-
Soybean meal	-	-	7.00
Ration nutrient content:			
Crude fiber (CF)	34.62	29.68	29.18
Crude protein (CP)	10.92	15.26	15.59
Total digestible nutrients (TDN)	63.23	56.21	57.95

3. Results and Discussion

Rumen pH, volatile fatty acids, rumen ammonia and blood urea nitrogen (BUN) concentration was affected by the ration (Table 2 and 3). Rumen pH 6 hours after feeding of NG (7.4) was higher ($P<0.01$) than that of FM (6.2) and SBM (6.4). This lowering pH in TMR goats was caused by increasing volatile fatty acids (VFA) in the rumen (Table 2). The VFA total at 6 h after feeding in FM goats (129.7 mmol/l) and SBM goats (153.1 mmol/l) were higher than that in NG goats (86.4 mmol/l). Higher ruminal VFA concentration in TMR groups (FM and SBM) because the ration contained less fiber (Table 1.) and digested easier than in roughage group (NG). Concentration of VFA tended to

increase from 3 to 6 h after feeding as Widiawati *et al.* [4] reported. Widiawati *et al.* [4] stated that using *in vitro* method, the VFA concentration peaked at 6 h of incubation for gliricidia.

Ajayi and Ogunleke [5] reported rumen pH of West African Dwarf goats fed concentrate containing corncob 0-45% around 5.8-6.1 that is lower than this research. Abubakr *et al.* [6] stated rumen pH in goats fed dietary palm oil by-products about 6.1-6.4, while Darlis *et al.* [7] reported that rumen pH of goats fed rice straw supplemented with SBM was 6.5.

Total of VFA in this study was higher than those in Ariyani *et al.* [8] and Jelantik *et al.* [9], while similar to Darlis *et al.* [7]. Other researchers reported that VFA total was about 58.4-69.1 mM in Jawarandu goats fed diet containing sugarcane bagasse [8], 44.1-61.1 mM in Kacang goats fed ration containing fish meal [9], and 117.5-119.1 mM in goats fed rice straw supplemented with SBM or SBM and sago meal [7].

Table 2. Rumen pH, volatile fatty acids total, and rumen ammonia of Kacang goats fed roughage (NG) and TMR (FM and SBM).

Parameters	NG	FM	SBM
Rumen pH:			
0 hour	7.3	6.5	6.4
3 hours after feeding	7.2	6.3	6.3
6 hours after feeding	7.4 ^A	6.2 ^B	6.4 ^B
Volatile fatty acids (VFA) total (mM/L):			
0 hour	85.5	114.0	135.4
3 hours after feeding	79.2	118.6	141.6
6 hours after feeding	86.4 ^{Aa}	129.7 ^b	153.1 ^{Bb}
Rumen ammonia (mg/100mL):			
0 hour	20.8 ^a	24.6 ^{ab}	39.1 ^b
3 hours after feeding	22.0 ^a	23.8 ^a	38.3 ^b
6 hours after feeding	23.3 ^a	24.2 ^a	35.1 ^b

^{A, B} Means with different superscripts within a row are highly significantly different ($P < 0.01$)

^{a, b} Means with different superscripts within a row are significantly different ($P < 0.05$).

At 3 and 6 hours after feeding, ammonia in the rumen of SBM was higher than that of NG and FM, indicating higher degraded protein. This condition was supported by the BUN concentration at 3 hours after feeding of SBM that was higher than that of NG. In this study, high ammonia concentration in the rumen and BUN concentration of SBM goat was caused by high dry matter intake (DMI) and crude protein intake. The DMI of SBM goats (707.5 g) was higher than that of NG goats (502.2 g) and FM goat (597.86) [1], while crude protein intake of SBM, FM, and NG goats was 115.8 g, 94.7 g, and 52.6 g, respectively [2]. High nitrogen intake had increased rumen degradable nitrogen, therefore increasing ruminal ammonia concentration and BUN concentration. Abubakr *et al.* [6] reported that ammonia concentration in the goats' rumen was influenced by the diet. Ariyani *et al.* [8] stated that ruminal ammonia concentration was affected by dry matter intake and total degraded nitrogen in the rumen. Akhsan *et al.* [10] reported that the increase of protein in the ration from 8.69% to 17.00% have increased protein intake and digested protein in the rumen.

Table 3. Blood urea Nitrogen concentration of Kacang goats fed roughage (NG) and TMR (FM and SBM).

Parameters	NG	FM	SBM
Blood urea Nitrogen (BUN) (mg/dL):			
0 hour	34.4	40.4	48.1
3 hours after feeding	41.4 ^a	45.0 ^{ab}	56.6 ^b
6 hours after feeding	40.7	43.3	54.1

^{a, b} Means with different superscripts within a row are significantly different (P<0.05).

There is a tendency that BUN concentration increased at 3 h after feeding, then decrease at 6 h after feeding (Table 3). Usually, the concentration of urea tended to increase 2 h after feeding because of dietary protein degradation in the rumen [11]. Borja *et al.* [11] reported BUN concentration of 3/4 Boer goats fed 0-45% licury cake (*Syagrus coronate* (Martius) Beccari) about 20.9-25.7 mg/dL that was lower than BUN concentration in this study (34.4-56.6 mg/dL).

4. Conclusion

It can be concluded that protein in SBM was degraded higher than others. It was indicated by high ammonia concentration in the rumen and BUN concentration. The lower pH in rumen of TMR goats (FM and SBM) was caused by higher VFA produced by TMR goats compared to NG (roughage) goats.

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