The Effect of Ruminally Undegradable Protein Using Formaldehyde on the Nitrogen Balance and Productivity of Kacang Goat

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ABSTRACT

Kacang goat is one of indigenous breed in Indonesia that has low in productivity. Many researchs have been tried to increase the productivity. Soybean meal (SBM) was palatable for Kacang goat; however the protein of SBM was highly degraded in the rumen. Formaldehyde has been used to increase rumen undegradable protein in ruminant to increase the productivity. The purpose of this study was to increase the productivity of Kacang goat using SBM protected with 1% of formaldehyde. Fifteen heads of yearling Kacang buck, 17.53±1.19 kg were arranged with a completely randomized design in 3 different treatments: SBM: untreated SBM (control); SBM50: 50% untreated SBM + 50% formaldehyde-protected SBM; SBM100: 100% formaldehyde-protected SBM. The rations consisted of 30% *Pennisetum purpureum*, 30% *gliricidia* leaves, 19.2% cassava waste product, 13.8% wheat bran, 7% SBM, 1% mineral mix and were formulated containing 14-15% of crude protein (CP). The average daily gain (ADG) was calculated using linear regression of 10 weekly ody weights. Data were analyzed by analysis of variance using the SPSS statistics software version 19. The ADG of SBM control group (90.54±16.22 g) was similar to those of SBM100 (63.71±12.92 g), but it was higher ($P<0.01$) than those of SBM50 (36.22±24.79 g). However, the ADG of SBM50 was the same as those of SBM100. These trends were similar to the DMI, N intake, digestible N, and retention N. The N intake of untreated SBM was higher (18.47±3.30 g) compared to those of SBM50 (12.65±1.60 g), but the N intake of SBM50 was similar to those of SBM100. It can be concluded that the N retention and production of Kacang goats fed untreated SBM was better than those of goat fed treated SBM. These conditions were mainly reflected by the differences in DMI.

Keywords: ADG, Digested N, Fecal N, Kacang goat, Retained N.

INTRODUCTION

Kacang goat is one of indigenous breed in Indonesia that has low in productivity. Many researchers have been tried to increase the productivity. Soybean meal (SBM) was better to improve the productivity of Kacang goat than fish meal (Adiwinarti *et al.*, 2016); however the protein of SBM was highly degraded in the rumen. Darlis *et al.* (2000) reported that degradability of Nitrogen from soybean meal in the goats rumen fed rice straw and SBM was 68% and the crude protein digestibility was 71.1%. Formaldehyde has been used to increase rumen undegradable protein (RUP) in ruminant as reported by Widyobroto *et al.* (2010) and RUP has increased the productivity (Pamp *et al.*, 2004). The purpose of this study was to increase the productivity of Kacang goat using SBM protected with 1% of formaldehyde.

MATERIALS AND METHODS

Fifteen heads of yearling Kacang buck, 17.53±1.19 kg were arranged with a completely randomized design in 3 different treatments: SBM: untreated SBM (control); SBM50: 50% untreated SBM + 50% formaldehyde-protected SBM; SBM100: 100% formaldehyde-protected SBM. The rations were consisted of *Pennisetum purpureum*, *gliricidia* leaves, cassava waste product, wheat bran, SBM (untreated SBM and formaldehyde-protected SBM) (Table 1), 1% mineral mix and were formulated containing 14-15% of crude protein (CP). Soybean meal were protected by 1% of formaldehyde (using formalin that contained 37% of formaldehyde) and were calculated based on dry matter SBM. Feed composition and the composite ration analysis (AOAC, 2000) were presented in Table 1. Total daily feces and urine were collected, weighed and sampled during 14 days at the 8th week of the experiment. The fecal sample was collected using the procedure of Darlis *et al.* (2000) and urine was sampled based on Elamin *et al.* (2012). Parameters observed included nitrogen (N) intake, fecal and urinary N, digestible N, retained N, and retained N conversion ratio. The average daily gain (ADG) was calculated using linear regression of 10 weekly body weights. Data were analyzed by analysis of variance using the SPSS statistics software version 19.

Table 1. Feed composition and the nutrients content of composite ration

Nutrients	T0	T1	T2
Feed composition (%):			
Pennisetum purpureum	30.00	30.00	30.00
Gliricidia leaves	30.00	30.00	30.00
Cassava waste product	19.20	19.20	19.20
Wheat bran	13.80	13.80	13.80
Soybean meal	7.00	3.50	-
Formaldehyde-protected SBM (RUP)	-	3.50	7.00
Nutrients content (%):			
Dry matter (%)	91.50	90.90	91.40
Based on 100% dry matter content (%):			
Ash	10.10	9.60	9.30
Ether extract	2.60	2.80	2.60
Crude fiber	29.20	31.70	29.60
Crude protein	15.60	14.10	14.30
Nitrogen free extract	42.60	41.80	44.20
TDN	58.00	55.80	60.10

RESULTS AND DISCUSSION

Nitrogen balance

Nitrogen balance of Kacang goat fed formaldehyde-protected SBM is presented in Table 2. Digestible N (%) of SBM control goats were higher ($P<0.05$) than those of SBM50 goats, even the digestible N (g), digestible N (g/kg $BB^{0.75}$), and N retention of SBM control were highly significantly different ($P<0.01$) from those of SBM50. Digestible N and N retention of SBM control goats were higher than those of SBM50 goats because N intake of SBM control goats was also higher ($P<0.05$) than those of SBM50 goats (Table 2). The high N intake in the control group was caused by the high intake of crude protein (CP) and dry matter intake (DMI). Crude protein intake and DMI of untreated SBM (109.35 g and 701.27 g) were higher ($P<0.01$) than those of SBM50 (76.37 g and 541.07 g). In addition the CP

content of untreated SBM was a little bit higher than those of formaldehyde-protected SBM (Table 1). Akhsan *et al.* (2015) stated that CP content influenced the nitrogen intake, digestible N, and retained N. The higher protein content from 8.7% to 17.0%, the bigger portions of protein intake, digested protein, and retained N (Akhsan *et al.,* 2015).

However, digestible N and N retention of SBM50 goats were similar to those of SBM100 goats because the DMI, CP intake, and N intake of SBM50 goats were not different from those of SBM100 goats. In fact, digestible N and N retention of untreated SBM group were not different from SBM100 group, because the DMI, CP intake, and N intake of untreated SBM were not different from SBM100. Retained N conversion ratio was not significantly different (P>0.05) between the treatments (Table 2). This indicated that the more was N retained, the higher was the average daily gain produced. High N retained was caused by high N intake and digested N.

Table 2. Nitrogen balance of goat fed formaldehyde-protected SBM

Parameters	Treatments			P value
	SBM control	SBM50	SBM100	
Nitrogen intake (g)	18.47^{a}	12.65^{b}	14.78^{ab}	0.013
Nitrogen intake (g/kg $BB^{0.75}$)	1.74	1.32	1.47	0.061
Nitrogen loss from:				
Fecal N (g)	5.78	4.97	5.22	0.324
Urinary N (g)	3.16	3.83	2.79	0.387
Digestible N (g)	12.69^{A}	7.68^{B}	9.56^{AB}	0.006
Digestible N (g/kg $BB^{0.75}$)	1.49^{A}	0.90^{B}	1.12^{AB}	0.006
Digestible N (%)	68.40^{a}	60.51^{b}	64.91^{ab}	0.034
N retention (g)	9.52^{A}	3.85^{B}	6.78^{AB}	0.002
N retention (g/kg $BB^{0.75}$)	1.12^{A}	0.45^{B}	0.79^{AB}	0.002
N retention (%)	50.63^{A}	30.87^{Bb}	46.61^{Aa}	0.002
Average daily gain (g)	90.54^{A}	36.22^{B}	63.71^{AB}	0.003
Retained N conversion ratio	0.11	0.17	0.11	0.409

Note: SBM control: untreated SBM; SBM50: 50% untreated SBM + 50% formaldehyde-protected SBM; SBM100: 100% formaldehyde-protected SBM.
^{a,b}Means with different superscripts within a row are significantly different (P<0.05).
^{A,B}Means with different superscripts within a row are highly significantly different (P<0.01).

Retained N in this study (3.85 to 9.52 g) was higher than those reported by Elamin *et al.* (2012) in Sudan goat (2.7 to 3.7 g) and Singh and Kundu (2013) in local Indian goat (0.3 to 5.1 g). However, the N retention in this experiment was lower than those in Akhsan *et al.* (2015) research that was 5.20 to 15.20 g.

The average daily gain (ADG)

The ADG of untreated SBM group (90.54±16.22 g) was similar to those of SBM100 group (63.71±12.92 g), but it was higher (P<0.01) than those of SBM50 group (36.22±24.79 g). However, the ADG of SBM50 group was not significantly different (P>0.05) from those of SBM100 group. High ADG of the goats was caused by high DMI, CP intake, N intake, digested N, and retained N. This study showed that Kacang goats fed ration containing mixed of 50% of formaldehyde-protected SBM and 50% of untreated SBM had lower productivity (ADG) than control goats because of lower DMI. In fact, the ADG of goats fed ration containing 100% of formaldehyde-protected SBM was not significantly different (P>0.05)

from those of control goats. This indicated that SBM-RUP mixed ration (T1) was not good enough to increase DMI, retained N, and productivity of Kacang goat compared to 100% RUP ration (T2) and untreated SBM ration (T0).

The ADG of Kacang goat fed RUP (T1 and T2) was lower than those of crossbred Boer fed *Pennisetum purpureum* and commercial pellet or *Pennisetum purpureum* and soy waste (71.40 to 80.20 g) reported by Rahman *et al.* (2014). However, the ADG of Kacang goat fed 100% RUP (T2) was relatively the same as those of Kacang goat reported by Restitrisnani *et al.* (2013) and higher than those of Kacang goat reported by Gafar *et al.* (2013). Restitrisnani *et al.* (2013) reported that Kacang goat fed ration containing SBM and 11.67 to 18.33% CP had 61.86 to 69.41 g of ADG. Gafar *et al.* (2013) stated that ADG of Kacang goat fed palm oil decanter cake was 37.80 to 50.00 g.

CONCLUSIONS

It can be concluded that 100% RUP ration (T2) and untreated SBM ration (T0) were better to increase nitrogen retention and the productivity of Kacang goat than 50% RUP ration (T1).

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