

Nitrogen Balance of Thin Tailed Sheep with the Addition of Soybean Meal and *Artocarpus heterophyllus* in *Pennisetum purpureum* cv. Mott as Basal Feed

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ABSTRACT

The purpose of this study was to evaluate consumption of nitrogen, excretion of nitrogen, digested nitrogen, and nitrogen balance in thin-tailed sheep with the addition of soybean meal (SBM) and *Artocarpus heterophyllus* leaves in the basal feed of *Pennisetum purpureum* cv. Mott. Total of twelve female thin-tailed sheep, age 12-16 months, with a 20 kg average weight were applied in this study. The animal's adaptation period to the environment was carried out for 14 days and continued with a total collection period of 14 days. Animals were kept individual cages equipped with feces and urine containers under the cage. Separate samples of sheep feces and urine were taken were analyzed. The contents of dry matter and nitrogen were determined for feed samples, feed residue, feces and urine in this study. Then, nitrogen intake, faecal nitrogen, digested nitrogen, urine nitrogen, and nitrogen balance were measured. The nitrogen intake, nitrogen excretion, digested nitrogen and nitrogen balance presented significant differences ($P < 0,05$). In conclusion, the difference in feeding a large portion of *A. heterophyllus* leaves indicated a positive nitrogen balance value, which increased the female thin-tailed sheep's protein requirements.

Keywords: soybean meal, *Artocarpus heterophyllus*, thin-tailed sheep, nitrogen balance

1. INTRODUCTION

Sheep farming in Indonesia has bright prospects in the future as various levels of society, religion, and belief may accept and consume lamb-like beef and chicken. However, in the technical cultivation of sheep, they frequently face challenges such as poor feed quality, particularly in terms of protein sources. This protein feed contains nitrogen, which is required for rumen microbial activity and the digestion of animal tissues. As a result, several attempts have been made to gain maximum protein advantages by modifying the rumen ecology in various ways. As a result, protein source with high quality is protected (by-passed) from ruminal fermentation continued to post rumen digestion, where it can be applied by ruminants. [1,2,3]. Applying tannins to the feed diet is one technique to protect protein. Tannins can establish complex interaction with protein, preventing microorganisms in

the rumen from degrading them. [4, 5]. High quantities of tannins have been found in the leaves of *Artocarpus heterophyllus*, which can be employed as protective agent for protein in the rumen, increasing post rumen protein digestibility [6,7,8].

The introduction of organic compound, such as tannin to the feed has been discovered to increase nitrogen digestion after rumen fermentation. As results, it has a high nitrogen balance impact [9]. Nitrogen balance indicates how protein requirements are met for basic needs, growth, and then production, as well as determining quality of feed protein or value of biological [10]. When the nitrogen released is less than the nitrogen absorbed, nitrogen retention increases [11]. On the principle of nitrogen balance, the problem of feed formulation is determining the minimum content of protein in the feed that enables maximum retention for livestock growth. As a result, nitrogen

balance can be utilized to figure out how much protein an animal needs for survival and productivity [12]. Based on the previous finding, it is necessary to assess the utilization on digested and excreted nitrogen, as well as the addition of *A. heterophyllus* leaf as a source of tannin in the ration as a protein protection agent in thin tailed sheep feed.

2. MATERIAL AND METHODS

2.1. Material

The leaves of *A heterophyllus* used in this study were collected from Sleman, Yogyakarta, Indonesia. The fresh leaves of *A heterophyllus* were mixed into the ration with soybean meal (SBM) addition at T.2 and T.3.

Table 1. Diet treatment (gram DM/day)

Feedstuff	g DM		
	T.1	T.2	T.3
<i>P. purpureum cv. Mott</i>	1,274.50	1,019.60	1,019.60
<i>A. heterophyllus</i>	0.00	107.28	187.74
Soybean meal (SBM)	0.00	67.05	67.05
Crude Protein (%)	8.38	13.40	13.94
Condensed tannin (%)	0.00	1.58	2.97

2.2. Methods

2.2.1. General

This experiment consisted of an adaptation period of 14 days and a total collection period of 14 days. Twelve female thin tailed sheep were used in this experiment, between the ages of 12 and 16 months with

Individual cage were used in this study to maintain all animal. The cage was equipped with a faecal and urine container under the cage. During the period of adaptation and total collection, animal was fed in the morning at 07.00 am and in the afternoon at 04.00 pm. The samples collected were samples of feed administered, refusal feed, feces, and urine. Feed samples, feed refusal and feces were weighed and taken as much as 20% of the total excreted per day. The collected urine was measured and composted for 10%, then added with H₂SO₄ until the pH changed below 3. Samples of urine and feces were stored at 5°C until the end of the collection period. After the collection period, total feces and refusal feed were weighed, mixed by hand, and taken sub-sampled for analysis of chemicals.

Samples of feed, feed residues, and feces were dried at 55°C for 2 days. Then, subsamples of feed, refusal feed, and feces for chemical analysis were screened through a 1 mm screen. Meanwhile, fresh urine was examined. The study included an analysis of dry matter and nitrogen content based on the Kjeldahl method according to the AOAC procedures [13]. Nitrogen analysis consisted of nitrogen intake, fecal nitrogen excretion, digested nitrogen, urine nitrogen excretion, and nitrogen balance. The Kjeldahl method covered destruction using H₂SO₄, distillation, and titration. The value of digested nitrogen and nitrogen excreted in urine and feces was calculated based on the results of the chemical analysis resulting in nitrogen balance.

2.2.2. Statistical Analysis

Analysis of unidirectional pattern variance was used to examine the treatment data, with the main factor being differences in levels of tannin administration. If the results of the analysis of variance have a significant effect, the statistical analysis was continued with the Duncan's New Multiple Range Test [14].

Table 2. Nitrogen intake, excretion, and digested nitrogen of thin-tailed sheep with the addition of soybean meal and *A. heterophyllus* in *P. purpureum cv. Mott* as basal feed

Parameter	Treatment		
	T.1	T.2	T.3
(g/head/day)			
Nitrogen intake	13.52±1.05 ^a	15.83±1.71 ^{ab}	17.34±1.51 ^b
Fecal nitrogen	1.81±0.21 ^a	2.46±0.34 ^b	2.80±0.27 ^b
Digestible nitrogen	10.56±0.93 ^a	13.97±1.65 ^{ab}	16.34±2.64 ^b
Urine nitrogen	2.24±0.98 ^a	3.29±0.24 ^{ab}	4.19±0.74 ^b
(g/BW ^{0.75} /day)			
Nitrogen intake	1.36±0.10 ^a	1.89±0.05 ^b	2.13±0.23 ^c
Fecal nitrogen	0.18±0.01 ^a	0.30±0.01 ^b	0.31±0.02 ^b
Digestible nitrogen	1.41±0.15 ^a	1.70±0.13 ^b	1.82±0.12 ^b
Urine nitrogen	0.23±0.01 ^a	0.26±0.03 ^b	0.29±0.08 ^b

^{a,ab,b} Different superscript at the same column shows significantly different (P<0,05)

average body weight (BW) approximately at 20 kg.

Table 3. Thin tailed sheep nitrogen balance with the addition of soybean meal and *A. heterophyllus* in *P. purpureum* cv. *Mott* as basal feed

Parameter	Treatment		
	T.1	T.2	T.3
Nitrogen balance (g/head/day)	9.48±1.76 ^a	11.08±0.10 ^{ab}	11.85±0.96 ^b
Nitrogen balance (g/BW ^{0.75} /day)	0.95±0.11 ^a	1.33±0.07 ^b	1.56±0.22 ^b

^{a,ab,b} Different superscript at the same column shows significantly different (P<0,05)

3. RESULT AND DISCUSSION

In this experiment, the feed ingredients for the rations were *Pennisetum purpureum* cv. *Mott* as basal feed, *A. heterophyllus* leaves, and SBM were given in a total mixed ratio. *P. purpureum* cv. *Mott* and leaves of *A. heterophyllus* were chopped using a chopper with a length of approximately 3-5 cm, then mixed with SBM at T.2 and T.3. Table 2 presents the amount of nitrogen intake, nitrogen excretion, and thin-tailed sheep digested nitrogen in different ration treatments. It indicated a significant difference in nitrogen intake, nitrogen excretion, and digested nitrogen. Tannins are generally used to reduce the protein degradation level in the rumen [15]. Tannins from leaf extracts of *Leucaena leucepala* and *Calliandra calothyrsus* can inhibit the *in vitro* degradation of protein-rich feed ingredients in the rumen [16,17]. Based on the reference, it explains that *in vitro* experiments, tannins are effective in protecting protein and deamination by rumen fluid enzymes and can increase the availability of post-rumen feed protein [18]. Tests using condensed tannins (CT) of leguminous plants in feed protein sources have been able to increase protein protection in the rumen [19,20,21]. It was suspected that the CT contained in the leaves of *A. heterophyllus* could protect protein in SBM in the rumen by increasing the flow of essential amino acids into the small intestine and increasing the absorption of amino acids into the blood [19,22].

The nitrogen balance is shown in Table 3. Based on observation, application of treatment had a significant effect (P<0,05). The results of a positive nitrogen balance point out that the nutritional requirement of animal have been obtained. By this condition, it allowed to increase productivity, especially daily gain of body weight because of the addition of tendons [23]. A higher protein-energy balance (P/E) on the ration could result in the greater amount of digested nitrogen (DN) and N-retention (NR) [24,25]. In general, nitrogen retention can be affected by the availability of N in the diet, the ability of rumen microbes to convert N into protein, and the ability of the animal to utilize protein, both from rumen microbes and feed protein [26].

4. CONCLUSION

The composition of tannins in the leaves of *A. heterophyllus* as a constituent of the ration together with SBM showed a positive nitrogen balance value. It

indicated that providing rations during the study can fulfill the thin-tailed sheep's needs of protein.

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