Effects of Dietary Supplementation with Jackfruit Leaves and Soybean Meal on Nutrient Intake and Digestibility in Sheep

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ABSTRACT
This study aimed to evaluate the effect of dietary supplementation with soybean meal (which is known to have high nutritional value) and jackfruit leaves (which are abundant resources) on nutrient intake and digestibility in sheep. For that purpose, 12 female thin-tailed sheep (age = 1.5 years old; body weight = 18±2 kg) were divided into three treatment groups. The odot grass (*P purpureum cv. Mott*) basal diet was formulated as the control group. The other treatment groups were fed a basal diet supplemented with jackfruit leaves (T1) and soybean meal (SBM) (T2), respectively. The ration of the three treatments was iso energy. The experimental animals received the experimental diets for 6 weeks, of which the last 2 weeks were the total collection period. This study used a completely randomized design with three treatments and four replicates. The treatments consisted of 5000 g odot grass basal diet (control), 4000 g odot grass and 700 g jackfruit leaves (T1), and 4000 g odot grass and SBM 75 g (T2). The crude protein and total digestible nutrient (TDN) contents of each treatment were 7.68 and 58.08%, 8.81 and 58.20%, and 10.44 and 58.78%, respectively. The variables observed were nutrient intake and digestibility. The results showed that dry matter intake in the control group, T1, and T2 were 52.69±3.27, 53.88±1.00, and 54.40±3.77 g/kgBW/day, respectively, while the dry matter digestibility in those groups was 69.27±5.06, 72.22±4.61, and 74.76±0.96, respectively. There was no significant difference in nutrient intake and digestibility among treatments. Therefore, it can be concluded that the addition of soybean meal and jackfruit leaves had no significant effect on nutrient intake and digestibility (P>0.05).

Keywords: *Sheep, Jackfruit leaves, Soybean meal, Intake, Digestibility, Nutrient*

1. INTRODUCTION

Several efforts directed to achieve a balance between the supply and demand for macronutrients have implications on the requirement of macronutrients. Several accurate systems are available to define nutrient requirements of sheep and can be used in the formulation of rations. The nutrient requirements of sheep have been widely published [1] [2]. All of them provide daily needs for energy, protein, minerals, etc., for basic life in sheep.

Good-quality forage and pasture provide adequate protein for sheep. In high-producing sheep or sheep fed low-quality forage, it is important to determine dissolved N (consumed and degraded protein) needed by rumen microorganisms and fermented energy for optimizing fiber digestibility, production of microbial protein, post-rumen feed amino acid requirements, and production purposes [3].

Generally, the basal diet for ruminants in tropical regions includes agricultural waste, which contains high

levels of fiber, especially in the dry season. If this basal diet is given to the animals, it only meets the basic requirements of the animal. In this regard, there is an alternative to provide dietary supplements containing high protein levels. The supplements can be obtained from by-products of the agricultural industry and leaves [4] [5].

Artocarpus heterophyllus, commonly known as jackfruit, is extensively grown in Indonesia, both in the dry and rainy seasons. The leaf part of the jackfruit contains adequate nutritional values, such as protein ****, which can be beneficial as a protein source for ruminants.

Among many agricultural by-products, soybean meal is the most important protein source used in the animal feed industry. The supplementation of soybean meal (****) in the diet has a beneficial effect on the nitrogen balance of Kacang goat [5]. Soybean meal is the by-product of the extraction of soybean oil and has been used primarily as a source of protein for feeding both ruminant and non-ruminant animals. Soybean meal has high levels of protein (45%), but low contents of cell wall (15.8%) [6]. Thus, it has a high degradation level.

The objective of this study was to evaluate the effect of dietary supplementation with soybean meal and jackfruit leaves on nutrient intake and digestibility in sheep fed a high-fiber basal diet.

2 MATERIALS DAN METHOD

Twelve (12) female thin-tailed sheep (average body

weight = 18.1±1.56 kg; average age = 1.5 years old or poel 1) were used. The experimental animals were kept in individual pens equipped with feed troughs and water containers and grouped according to the treatment groups.

Feed ingredients contained odot grass (*P purpureum cv. Mott*), jackfruit leaves, and soybean meal (SBM). Odot grass was used as a basal diet, while the dietary supplements consisted of jackfruit leaves (CP = 15.14%) and SBM as a protein source (CP = 51.78%

2.1. Animal Grouping

The treatments consisted of 5000 g odot grass basal diet (control), 4000 g odot grass supplemented with 700 g jackfruit leaves (T1), and 4000 g odot grass supplemented with 75 g SBM (T2) (Table 2). Feed was given fresh

2.2. Adaptation and Collection

The experimental diets were given to the animals for 6 weeks and the adaptation period was carried out for 2 weeks. The animals were fed twice a day at 7:00–8:00 a.m. and 4:00–5:00 p.m. Feed samples, feed residues, and feces were collected during the last 14 days. Approximately 10% of the sample was sun dried and then dried again at 55ºC until constant weight. All samples were then composited for 14 days and used for proximate analysis.

Table 1. Chemical composition of the experimental feed ingredients

Item	DM (%)	Composition in 100% DM					
		OM	CP	CF	CFb	NFE	TDN
P purpureum cv. Mott	24.60	79.93	7.68	3.55	28.82	41.85	58.08
A heterophyllus	25.22	90.53	15.14	6.23	33.89	41.88	58.87
Soybean meal	87.60	92.14	51.78	1.61	2.63	43.98	86.72

Note: Chemical analysis of the feed ingredients samples was carried out at the Animal Feed Science Laboratory, Faculty of Animal Science, Universitas Gadjah Mada. DM: dry matter; OM: organic matter; CP: crude Protein; CF: crude fat; CFb: crude fiber; NFE: nitrogen-free extract; TDN: total digestible nutrients

Table 2. Chemical composition of the experimental diets (%)

Group	DM (%)	Nutrient in 100% DM					
		OM	CP	CF	CFb	NFE	TDN
Control	24.60	79.93	7.68	3.55	28.82	41.85	58.08
T1	24.84	84.08	8.81	3.96	29.59	41.85	58.20
T2	28.54	80.69	10.44	3.43	28.66	41.73	58.78

Note: Chemical analysis of the samples was carried out at the Animal Feed Science Laboratory, Faculty of Animal Science, UGM. T1: Treatment 1; T2: Treatment

2.3. Variables Observed

The variables observed included nutrient intake, nutrient digestibility, total digestible nutrients (TDN), and daily weight gain.

2.4. Sample Analysis

Feed samples, feed residues, and feces were analyzed for dry matter content using the evaporation method or the thermogravimetric method, of which the samples were heated at a temperature of 105ºC until constant weight. Crude fat, crude fiber, and crude protein were analyzed using the Soxhlet, acid and alkaline boiling, and Kjeldahl methods, respectively. Generally, the sample analysis was in accordance with the AOAC guidelines.

2.5. Data Analysis

Data were analyzed using one-way analysis of variance (ANOVA) in SPSS 16.0 software. Differences between treatment means were further analyzed using Duncan's multiple range test (DMRT).

3. RESULT AND DISCUSSION

Feed intake is an essential factor as it is used by the animal for growth and production. Nutrient intake can be influenced by several factors, including animal itself, feed, and environmental conditions. The body size of the animal also affects nutrient intake [8]. Kusumaningrum [9] reported that the level of nutrient intake is influenced by external factors, including housing or cages, palatability, feed form, and nutrient content of the diet. Moreover, internal factors, such as physiological status, body weight, and livestock production also affect nutrient intake. The results of this study showed that the intakes of dry matter, crude protein, crude fat, NFE, and TDN among treatments were significantly different (P<0.05) (Table 3)

3.1. Nutrient Digestibility

Digestion is a process that converts complex nutrients in a feed into forms that can be absorbed by the animal (Kellems and Church, 2010). The digestibility of feed ingredients can be determined using *in vivo* method, which directly involves the animal (Van Soest, 1994)

Table 3. Average nutrient intake of the experimental animals (g/kg BW/day)

Nutrient gram/kg BW	Group		
	Control	T1	T2
Dry matter^{ns}	52.69 ± 3.27	53.88 ± 1.00	54.40 ± 3.77
Dry matter^{ns} (g/kg BW$^{0.75}$)	107.43 ± 6.90	109.51 ± 18.68	108.57 ± 7.26
Crude protein	4.31 ± 0.13^{a}	5.10 ± 0.67^{a}	6.09 ± 0.44^{b}
Crude fat	2.32 ± 0.03^{ab}	2.53 ± 0.22^{b}	2.07 ± 0.20^{a}
NFE^{ns}	31.02 ± 4.10	31.10 ± 5.95	31.36 ± 2.09
TDN^{ns}	32.62 ± 2.33	33.27 ± 5.61	33.62 ± 2.38

Note : Chemical analysis of the samples was carried out at the Animal Feed Science Laboratory, Faculty of Animal Science, Universitas Gadjah Mada. BW: Body weight; BW0.75: Metabolic body weight

^{a,b,c} : Different superscripts in the same row showed significant differences (P<0.05)

^{ns} : not significant

Table 4. Nutrient digestibility of thin-tailed sheep (%)

Nutrient (%)	Group		
	Control	T1	T2
DM	69.27±5.06^{a}	72.22±4.61^{ab}	74.76±0.96^{ab}
CP^{ns}	72.17±5.51	62.96±9.38	67.61±5.78
CF	88.11±1.61^{b}	81.51±4.34^{ab}	79.86±3.48^{a}
NFE	66.62±7.64^{a}	73.22±3.98^{ab}	75.27±1.96^{ab}

Note: Chemical analysis of samples was carried out at the Animal Feed Science Laboratory, Faculty of Animal Science, Universitas Gadjah Mada

^{a,b,c} : Different superscripts in the same row showed significant differences (P<0.05); ^{ns} : not significant

The *in vivo* is a conventional method that has been widely used to evaluate the digestibility of feed ingredients (Daryatmo, 2010). Kustantinah et al. (2012) reported that *in vivo* is the best method for measurement of the feed digestibility as it displays the value of palatability, intake, and digestibility of the feed (Tamtomo, 2016)

Digestion is a process that converts complex nutrients in a feed into forms that can be absorbed by the animal. Nutrient digestibility observed in this study included dry matter (DM), crude protein (CP), crude fat (CF), and nitrogen-free extract (NFE) (Table 4)

3.2. Daily Weight Gain

Daily weight gain was calculated based on the difference between the initial body weight and the final body weight divided by the length of the experimental period (days). Daily weight gain of the experimental animals during the experiment is presented in Figure 1.

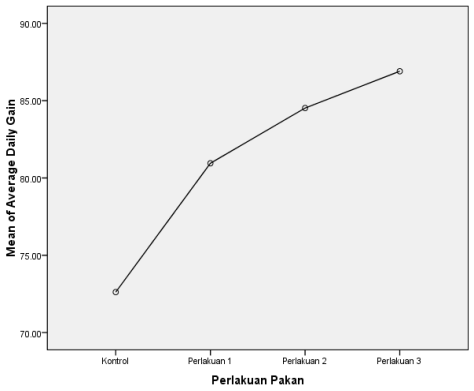

Figure 1. The graph of average daily gain (ADG)

4. CONCLUSION

It can be concluded that dietary supplementation with jackfruit leaves and soybean meal had no significant effect on nutrient intake and digestibility as compared to the control diet.

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