Performance of Local Thin Tailed Sheep Fed Sweet Potato (*Ipomoea babatas L*) Biomass as A Substitute for Concentrate Feed

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ABSTRACT

This experiment aimed to analyze the potency of sweet potato biomass as a local feed resource for substituting concentrate feed in supporting the performance of local thin tailed sheep. The experimental design was completely randomized block design (3 x 3) using 9 sheep of 9-12 months old with average body weight of 14.34 ± 1.32 kg. They were placed in individual metabolic cage provided with buckets for feed and drinking water. Feeding level was 3.5% of their body weight on dry matter basis and given at 0630 and 1600. Drinking water was provided ad libitum. The treatments were T1 (70% Napier grass + 30% concentrate), T2 (50% Napier grass + 50% sweet potato veins), and T3 (70% sweet potato veins + 30% sweet potato tubers). Parameters measured were feed/nutrients intake, feed digestibility, body weight gain, and feed efficiency. Data were analyzed using analysis of variance and any significance different results were further tested using Duncan's multiple range test. The results showed that feed intake, feed digestibility, body weight gain and feed efficiency were significantly affected by the treatment ($P<0.05$). Daily gain and feed efficiency of sheep in T1 group (70% Napier grass + 30% concentrate) were not significantly different ($P<0.05$) from those in T3 (70% sweet potato veins + 30% sweet potato tubers). Sweet potato biomass, a local cheap feed, can be used as a substitute for expensive concentrate feed.

Keywords: Concentrate feed, Performance, Sheep, Sweet potato biomass

INTRODUCTION

Sheep farming business in Indonesia is currently dominated by smallholder farms with a relatively small scale of about 3 to8 heads of sheep per family. Lack of knowledge of good sheep farming practice of the farmers is the main factor affecting low productivity of sheep, especially in the case of feeding. The farmer only provides forage they can get without taking into account the nutritional needs of the sheep. This will be more severe especially during the dry season where availability and quality of forage are low. Commercial (concentrate) feed prices are too expensive for farmers. This results in low livestock performance. Therefore, it should be sought alternative feed that is cheap, easy to obtain but has good quality.

For sheep farmers in Bogor one alternative feed that can be used is the biomass of sweet potatoes. This plant is favored by farmers to be planted because it is easy to manage, relatively resistant to drought, besides it can grow on various types of soil. According to BPS (2014) sweet potato production in Indonesia was 2,382,025 tons, while in West Java 471,737 tons and in Bogor the production was 82,935 tons. Sweet potato tubers are usually sold to the

market with a fairly cheap price around Rp 1,000 to Rp 1,400. Sweet potato veins that are agricultural waste have been widely used by the farmers to feed the sheep. Sweet potato veins can be used as a protein source, it contains crude protein of 19.29% (Sutardi, 1979). Provision of sweet potato veins alone cannot meet the energy needs of sheep. This can be fulfilled by sweet potato tubers with a TDN content of 83.9%. The use of veins and tubers was expected can meet the needs of energy and protein of sheep, so it is expected will improve the performance of sheep in order to achieve production efficiency. However, the tubers are rarely used as sheep feed by the farmers.

This study aimed to evaluate the digestibility of feed and the performance of Thin-Tailed Sheep (Javanesse Thin-Tailed) fed with sweet potato biomass (*Ipomoea batatas*) in the form of veins and tubers.

MATERIALS AND METHODS

This experiment was conducted in field laboratory of Department of Nutrition and Feed Technology and chemical analysis was conducted at the laboratory of Research Center for Biological Resources and Biotechnology of Bogor Agricultural University. Nine sheep of 9 - 12 months old with average body weight of 14.34 ± 1.32 kg were allocated into completely randomized block design incorporating three treatments and three replicates. Sheep were reared for 16 weeks consisted of two weeks of adaptation period and 14 weeks of measuring period. They were placed in individual metabolic cage provided with buckets for feed and drinking water. Feeding level was 3.5% of their body weight on dry matter basis and given at 0630 and 1600. The nutrient content of experimental diets was shown in Table 1. Drinking water was provided *ad libitum*. The treatments were T1 (70% napier grass + 30% concentrate), T2 (50% napier grass + 50% sweet potato veins), and T3 (70% sweet potato veins + 30% sweet potato tubers). Variables measured were feed/nutrients intake, feed digestibility, body weight gain, and feed efficiency. Data were analyzed using analysis of variance and any significance different results were further tested using Duncan's multiple range test (Steel and Torrie, 1980).

Table 1. Nutrient content of experimental diets

Nutrients	Treatments		
	T1	T2	T3
Dry matter (%)	42.02	18.03	18.44
Crude protein (%)	11.88	13.20	13.66
Ether extract (%)	5.76	6.35	5.57
Crude fibre (%)	22.00	21.28	11.84
Nitrogen free extract (%)	50.24	46.71	58.91
Ash (%)	13.12	12.72	10.36
TDN (%)	58.21	62.29	74.16

T1: 70% Napier grass + 30% concentrate, T2: 50% Napier grass + 50% sweet potato veins,T3: 70% sweet potato veins + 30% sweat potato tuber. TDN: total digestible nutrient

RESULTS AND DISCUSSION

Nutrient Intake

Intakes of nutrients were shown in Table 2. The treatment had a significant effect on the consumption of dry and organic matter (P<0.05). Treatment of T1 and T2 had dry and organic matter consumption which was not significantly different, whereas treatment (T3) had the lowest dry and organic matter consumption. The main reason that the animal to consume the feed is to meet the energy needs for his body. Therefore, low dry matter consumption of T3 may be caused by the higher its energy content than those of other treatments.

Table 2. Nutrient intakes (g/kg BW/day) of sheep during experiment

Nutrients	T1	T2	T3
Dry matter	33.44 ± 0.30^{b}	33.08 ± 0.13^{b}	29.72 ± 0.22^{a}
Organic matter	29.04 ± 0.26^{b}	28.87 ± 0.16^{b}	26.64 ± 0.19^{a}
Crude protein	2.98 ± 0.02^{a}	4.25 ± 0.01^{c}	4.01 ± 0.03^{b}
Crude fibre	7.26 ± 0.06^{c}	7.15 ± 0.03^{b}	3.51 ± 0.02^{a}
Ether extract	1.93 ± 0.01^{b}	2.07 ± 0.00^{c}	1.65 ± 0.01^{a}
Nitrogen free extract	18.85 ± 0.15^{c}	15.39 ± 0.06^{a}	17.42 ± 0.12^{b}
TDN	19.53 ± 0.17^{a}	20.45 ± 0.07^{b}	22.04 ± 0.16^{c}

T1: 70% Napier grass + 30% concentrate, T2: 50% Napier grass + 50% sweet potato veins, T3: 70% sweet potato veins + 30% sweat potato tuber
Different superscripts in the same row show significant differences (P <0.05)

The treatment significantly (P<0.05) affected crude protein (CP) consumption. Sheep fed sweet potato veins (T2 and T3) have higher protein intake than that of sheep fed without sweet potato veins feed (T1). This because sweet potatoes veins contain high protein (18.42%). In this study, crude protein consumption of sheep ranges from 2.98 to 4.25 g/kg BW/day indicated the protein requirement of sheep had been fulfilled. According to Kearl (1982) the minimum protein requirement for sheep weighing 10 to 20 kg with weight gain of 0 to 100 g/day ranged from 2.6 to 3.6 g/kg BW/day.

The treatments had significant effect (P<0.05) on the consumption of crude fiber. Sheep fed T1 feed (70% napier grass + 30% concentrate) had higher (P<0.05) crude fiber consumption compared with T2 treatment. Elephant grasses have a high crude fiber content (26.9%), so the more elephant grass in the ration causes the higher consumption of crude fiber. Group T3 feed (70% sweet potato veins + 30% sweet potato tuber) had the lowest crude fiber consumption value. This is because the crude fiber content of T3 feed was also the lowest. Treatment had significant (P<0.05) effect on ether extract (EE) consumption. The pattern of EE consumption was in line with the EE content of the ration. Sheep fed T2 diet, which had the highest dietary EE content, also had the highest EE consumption followed by T1 and T3 groups, respectively.

Treatment had significant effect (P<0.05) on the consumption of free extract nitrogen (NFE). NFE consumption of sheep given T1 is highest (P<0.05) followed by T3 and T2. This is because T1 and T3 treatments use high carbohydrate source feeds that are concentrates and sweet potato tubers. The treatment also had significant effect (P<0.05) on energy consumption (TDN). In accordance with the TDN content of each diet, T1-fed sheep consumed a lower TDN compared to sheep fed T2 and T3, each of which was given veins of and biomass of sweet potato, respectively.

Dry matter digestibility (DMD) and organic matter digestibility (OMD)

The treatment significantly affected (P <0.05) percentage of dry matter and organic matter digestibility. The digestibility of dry matter and organic matter of feed is presented in Table 3.

Table 3. Feed digestibility and efficiency and daily gain of sheep

Variables	T1	T2	T3
DMD (%)	72.04 ± 3.42[a]	69.29 ± 1.33 [a]	79.91 ± 1.87[b]
OMD (%)	70.76 ± 3.58 [a]	68.58 ± 1.36 [a]	80.07 ± 1.86[b]
Daily gain (g/day)	69.14 ± 6.19 [b]	40.25 ± 16.71[a]	70.57 ± 17.08[b]
Feed efficiency	0.11 ± 0.01[ab]	0.08 ± 0.02[a]	0.14 ± 0.03[b]

T1: 70% Napier grass + 30% concentrate, T2: 50% Napier grass + 50% sweet potato veins, T3: 70% sweet potato veins + 30% sweat potato tuber. DMD: Dry matter digestibility, OMD: Organic matter digestibility
Different superscripts in the same row show significant differences (P<0.05)

The digestibility of dry matter and organic matter in this research were 69.29 - 79.91% and 68.58 - 80.07%, respectively. Dry matter and organic matter digestibility on T3 treatment (70% of sweet potato veins and 30% sweet potato tuber) were higher than other treatments. This is due to the low crude fiber content in the T3 feed treatment compared to other treatments. Cell walls in forage plants containing lignin will inhibit the action of rumen microbes in degrading crude fiber. T1 treatment had dry matter digestibility value and organic material which is not different from that of T2 treatment. Rianto *et al*. (2006) reported lower values of DMD and OMD in male thin tailed sheep than the results of this study, ie., 58.02 - 68.28% and 60.81 - 71.13%, respectively. While higher digestibility of feed was reported by Aprianto (2013) with 60% of elephant grass and 40% concentrate feed that is DMD was 80.51% and OMD was 81.94%. The digestibility value is not fixed for every food or every livestock, but it is influenced by several factors, such as the chemical composition of feed material and the physical form of feed (McDonald *et al*., 2002). High dry matter and organic matter digestibility can increase nutrient absorption, so that more nutrients can be used to meet the nutritional needs of livestock for maintenance and production (Arora, 1986).

Daily gain and feed efficiency. The daily weight gain of sheep during the study was presented in Table 3. The treatment had significant effect (P <0.05) on daily weight gain of sheep. In general, feeds that have high nutrient content, high levels of digestibility and good palatability can increase more quickly the weight gain of sheep during rearing period.

Sheep fed T3 diet had the highest daily gain (71 g/head/day) which was not significantly different from that of the sheep fed T1 diet (69 g/head/day). While the lowest daily gain was in T2 diet treatment (40 g/head/day). Sheep fed T3 treatment (70% of sweet potatoes veins and 30% of tubers) had the highest daily gain due to the adequacy of crude protein content in sweet potato veins along with the high energy in the tubers, and also its highest OM and DM digestibility. The lowest weight gain in the T2 treatment compared to other treatments was probably due in part to the lower dry matter and organic matter digestibility in T2 treatment compared with other treatments. So that only a few nutrients can be absorbed and utilized by the body for weight gain.

The treatments had significant effect (P<0.05) on the efficiency of feed utilization. The higher the value of feed efficiency indicates better feed use in increasing the growth of animal. The feed efficiency values in this study were 0.14, 0.11, and 0.08 for the treatments of T3, T1, and T2, respectively. Sheep fed diet T3 treatment despite having low feed intake, but because the feed has the highest energy content with the lowest crude fiber and high

digestibility of organic and dry matter so that nutrients were absorbed in large quantities for the highest weight gain. Pond *et al*. (1995) stated that the more efficient feed used for weight gain showed better feed quality and lower feed conversion.

CONCLUSIONS

Giving the combination of 70% veins and 30% sweet potato tubers (T3) is able to provide nutritional adequacy and support good sheep performance, and can be used as an alternative feed for concentrate substitutes.

REFERENCES

Aprianto, T. 2013. Karakteristik Fermentasi Rumen Dan Performa Domba Teradaptasi yang Diberi Pakan Silase Daun Singkong (*Manihot esculenta sp.*) dengan Taraf Berbeda. Skripsi. Institut Pertanian Bogor. Bogor.

Arora, S. P. 1986. Pencernaan Mikroba Rumen. UGM press.Yogyakarta.

Badan Pusat Statistik. 2014. Statistik Indonesia 2014. Jakarta. Diunduh 7 September 2014. http://www.bps.go.id/.

Kearl, L. C. 1982. Nutrient Requirements of Ruminants in Developing Countries. All Graduate Theses and Dissertations. Paper 4183. Utah State University.

McDonald, P., R. A. Edwards, J. F. D. Greenhalgh, and C. A. Morgan. 2002. Animal Nutrition. 6th ed.Ashford Colour Pr. Gosport.

Pond, W. G., D. C. Church, and K. R. Pond. 1995. Basic Animal Nutrition and Feeding. 4th ed. John Wiley and Sons. New York.

Rianto, E., E. Haryono, and C. M. S. Lestari. 2006. Produktivitas domba ekor tipis jantan yang diberi *pollard* dengan aras berbeda. Proceeding Seminar Nasional Teknologi Peternakan dan Veteriner. pp. 431-439.

Sutardi, T. 1979. Ketahanan protein bahan makanan terhadap degradasi oleh mikroba rumen dan manfaatnya bagi peningkatan produktivitas ternak. *Proceeding* Seminar dan Penunjang Peternakan. Bogor. Lembaga Penelitian dan Pengembangan Pertanian.

Steel, R. G. D. and J. H. Torrie. 1980. Principles and procedures of Statistics: A Biometric Approach. McGraw-Hill Book Co., New York.