

Nutrient Intake and Digestibility in Merino Sheep Fed Peanut Straw

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Abstract

This study aimed to compare nutrient intake and digestibility between male and female Merino fed peanut straw as sole feed. Four male and five female Merino sheep ages 10 to 12 month with average weight of 40 kg were used in this study. All animals were confined in individual metabolism cages and nylon nets were fitted below the cages for faecal collection. This experiment was done with 14 d adaptation period and 7 d collection period. Representative sample of feed, refusal feed, and faeces were analysed proximate including dry matter (DM), organic matter (OM), crude protein (CP), crude fibre (CF), ether extract (EE), and extract-free nitrogen (EFN). Data collected were used to calculate nutrient intake and digestibility. All nutrient intake in male Merino was higher ($P < 0.05$) than female one, whereas digestibility of DM, CP, and CF in male Merino sheep were higher ($P < 0.05$) than female sheep. It could be concluded male Merino sheep consumed feed more than female, but they had similar value of digestibility.

1. Introduction

Merino is Indonesian local sheep breed which has high potencies to be developed, they commonly reared for fattening because their good performances. The main problem arise in animal fattening is feed supply which is less than the requirement. Therefore, this study on feed stuffs that can meet the nutrient requirement, nutrient contents and its quality is needed. One of the potential feedstuff for sheep was agriculture by products such as peanut straw which is easy to find during harvesting time. Usually farmers use agriculture by products such as rice straw, maize straw, and peanut straw as sole diet for ruminant. Ruminant require protein in the diet to nitrogen supply for rumen microbial activity and animal tissue metabolism. Microbial requirement are met at 6-8% crude protein in the diet while animal requirement range from 7-20% in the diet depending upon species, sex, and physiological status [1].

The performance of ruminants fed forage diets depends largely on feed consumption and its digestibility. It is well known that feed intake and its digestibility is main factor affecting nutrient utilization [2]. Substitution of legumes for low quality forage has been shown to increase forage consumption compared with diets consisting only of low quality forage [3]. A major problem in diet formulation is predicting the effect of changes in composition of diet on intake. For diets containing long forage, intake is positively correlated with digestibility [4]. Digestion of plant material is a time-dependent process. An increase of feed intake accelerate the passage of digesta through the tract, resulting reduce digestive efficiency [5,6].

Based on the review, it is necessary to evaluate a single feed from peanuts straw to supply protein requirement of Merino, either male or female, using nutrient intake and digestibility experiment.



2. Materials and Methods

2.1. Animals and Feeding Treatment

In this experiment, peanut straw as sole diet was obtained from the Yogyakarta province. Peanut straw was served without the empty root neither the hard woody straw, only the edible portion which was used as the feedstuff. The chopped straw was offered in fresh condition, they collected after harvesting and stored in protected shed. Four male and five female Merino sheep, age 10-12 months and average body weight 40-50 kg were used in this experiment. The animals were confined in the individual metabolism cages, and nylon nets were fitted bellow the cages for faecal collection to get good separation of the urine and faeces.

2.2. Animal Digestion Trial

The animals were kept in individual metabolism cages and had free access to water. The experiment consisted of a 14 days adaptation period, and a 7 days measurement of voluntary intake and total faecal collection. The amount of feed offered was adjusted so that feed refusals were in excess of 10% of the amount offered during the preliminary and voluntary intake period. Feed refusals were removed and weighed once daily. During each collection period, samples of feed were collected and subsampled. Faeces were collected daily and stored at 5°C until the end of the collection period. After each collection period, total faeces were weighed, mixed by hand and subsampled. Subsamples of feed and faeces were dried at 65°C for 2 days for chemical analysis.

2.3. Chemical Analysis

During the collection period, 200 g of daily feed offered samples were collected, refusal feed were also collected daily, early in the morning before feeding time and then were weighed. Individually, 10% of the refusal feed samples were taken. Representative samples of feed, refusal feed and faeces were subjected to proximate analysis. After drying at 55°C, dried subsamples of feed and refusal feed were ground through a 1-mm screen and conducted for chemical analysis, including dry matter (DM), organic matter (OM), crude protein (CP), crude fibre (CF), and ether extract (EE), according to AOAC procedures [7], and then nitrogen-free extract (NFE) was calculated. Meanwhile, faeces were analysed in fresh condition. Nutrient intake and digestibility value were calculated based on the result of chemical analysis of feed and faeces.

2.4. Experimental Design and Statistical Analysis

Treatments were arranged in t-test design, with the main factor being the sex of sheep, male and female. The data in the main study was analysed as t-test arrangement, the differences of mean value were analysed by Duncan's new multiple range test [8].

3. Results and Discussion

3.1. Chemical composition of peanut straw and nutrient intake of sheep

Nutrient contents of peanut straw was dry matter (DM) 20.14%, organic matter (OM) 84.25%, crude protein (CP) 14.55%, ether extract (EE) 1.55%, crude fibre (CF) 17.67%, and nitrogen free extract (NFE) 50.16%. Based on those data, the amount of feedstuff offered and the amount of refusal feed, as well as nutrient intake could be calculated, and the result of the study was presented in Table 1. It

showed that there were significant differences in the nutrient intake of male compared with female Merino. All nutrient intake in male Merino sheep was higher ($P < 0.05$) than female sheep.

Dry matter intake of male and female Merino sheep was 2.84% and 2.09% of their live weight, respectively. The DM intake of sheep was enough for maintenance need as mentioned it should be 2.0% of animal body weight [9]. Protein intake in Merino sheep also met their requirement, as known that protein intake for sheep was 63 g/day in weight 40 kg [9]. Dry matter and protein intake for maintenance in sheep was 2% of body weight and 95% in weight 50 kg, respectively [10]. The sex of animals influence the nutrient intake, the male sheep has higher nutrient intake than those female. Male sheep body weight was heavier than those female, thus, they need more nutrient for met their requirement.

Table 1. Nutrient Intake in Merino Fed by Peanut Straw as Single Diet

Nutrient intake	The sex of Merino	
	Male	Female
In g/day		
Dry matter	1,089.27 $\pm$ 65.88 ^a	713.86 $\pm$ 110.07 ^b
Organic matter	912.34 $\pm$ 54.39 ^a	597.28 $\pm$ 93.50 ^b
Crude protein	132.85 $\pm$ 7.53 ^a	87.74 $\pm$ 12.92 ^b
Ether extract	17.82 $\pm$ 1.01 ^a	11.69 $\pm$ 1.68 ^b
Crude fibre	170.87 $\pm$ 11.87 ^a	109.21 $\pm$ 15.93 ^b
EFN	442.35 $\pm$ 24.96 ^a	290.93 $\pm$ 48.97 ^b
In g/(d·kg BW ^{0.75})		
Dry matter	70.64 $\pm$ 1.75 ^a	50.46 $\pm$ 6.43 ^b
Organic matter	12.93 $\pm$ 1.06 ^a	11.82 $\pm$ 0.96 ^b
Crude protein	10.29 $\pm$ 0.26 ^a	7.41 $\pm$ 0.87 ^b
Ether extract	1.73 $\pm$ 0.14 ^a	1.58 $\pm$ 0.13 ^b
Crude fibre	98.58 $\pm$ 2.21 ^a	69.32 $\pm$ 8.73 ^b
EFN	4.49 $\pm$ 0.33 ^a	4.19 $\pm$ 0.40 ^b

^{a,b} significant ($P < 0.05$)

3.2. Nutrient Digestibility

All nutrient intake in male Merino was higher ($P < 0.05$) than female one, as presented in Table 1. In contrast, several nutrient digestibility in female sheep was higher than male. The digestibility of DM, CP, and CF in male Merino sheep was lower ($P < 0.05$) than those female (Table 2). However, no differences in digestibility of OM, EE, and EFN were observed for female compared with their digestibility in male sheep, as well as nutrient digestibility based metabolic body weight.

Even though male sheep consumed feed more than female, but they also excreted nutrient more than female. Nutrient digestibility was influenced by rumen microbe activities. It could be different among the sex of animals, because digestion process in rumen was affected by microbial enzyme activities, which is absolutely species specific. Nutrient intake in animal could also affected coefficient of digestibility of nutrient. It seems probable that the primary cause of lower digestibility at higher intakes was a faster rate of passage of feed through the digestive tract. Animals having an increase feed intake spent more time eating and ruminating and consequently less time resting. The

increase of feed intake reduce retention time of digesta, it means increase rate of passage of digesta through the gastrointestinal tract in cattle and sheep [2]. Digestion of plant material is a time-dependent process. An increase of feed intake accelerate the passage of digesta through the tract, resulting reduce digestive efficiency [5].

Table 2. Nutrient digestibility in Merino fed by peanut straw as single diet

Nutrient intake	The sex of Merino	
	Male	Female
In %		
Dry matter	60,57 ± 3,06 ^a	69,98 ± 4,56 ^b
Organic matter ^{ns}	66,05 ± 2,54 ^a	74,47 ± 4,56 ^b
Crude protein	68,05 ± 1,79 ^a	73,27 ± 3,87 ^b
Ether extract ^{ns}	73,53 ± 5,17 ^{ns}	75,62 ± 14,63 ^{ns}
Crude fibre	40,58 ± 7,09 ^{ns}	55,82 ± 14,62 ^{ns}
EFN ^{ns}	83,78 ± 2,39 ^a	88,28 ± 1,72 ^b
In g/(d·kg BW ^{0.75})		
Dry matter	39.93 ± 5.42 ^{ns}	35.27 ± 4.65 ^{ns}
Organic matter	8.00 ± 0.47 ^{ns}	8.78 ± 0.59 ^{ns}
Crude protein	6.67 ± 0.73 ^a	5.43 ± 0.73 ^b
Ether extract	1.30 ± 0.14 ^{ns}	1.19 ± 0.22 ^{ns}
Crude fibre	34.20 ± 6.75 ^{ns}	38.33 ± 3.69 ^{ns}
EFN	3.59 ± 0.20 ^{ns}	3.20 ± 0.33 ^{ns}

^{a,b} significant (P<0.05)

^{ns} not significant

4. Conclusion

It could be concluded male Merino sheep consumed feed more than female, but they had similar value of digestibility.

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References

- [1] Huston J E and Pinchak W E Range animal nutrition Grazing Management. An ecological perspective, ed R K Heitschmidt and J W Stuth chapter 2 <http://cnrit.tamu.edu/rlem/textbook/htm>
- [2] Colucci P E, Chase L E and Van Soest P J 1982 Feed Intake, Apparent Diet Digestibility, and Rate of Particulate Passage in Dairy Cattle J. Dairy Sci. **65**. 1445

- [3] Hunt C W, Paterson J A, and Williams J E 1985 Intake and Digestibility of Alfalfa-Tall Fescue Combination Diets Fed to Lambs *J. Anim. Sci.* **60**. 1 301
- [4] Thorlacius S O 1977 Prediction of Digestible Energy Intake by Sheep of Diets Containing Ground Roughage and Grain *Can. J. Anim. Sci.* **57**. 279
- [5] Clauss M, Streich W J, Schwarm A, Ortmann S and Hummel J 2007 The relationship of food intake and ingesta passage predicts feeding ecology in two different megaherbivore groups *Oikos* **116**. 209
- [6] Dias R S, Patino H O, López S, Prates E, Swanson K C and France J 2011 Relationships Between Chewing Behavior, Digestibility, and Digesta Passage Kinetics in Steers Fed Oat Hay at Restricted and Ad Libitum Intakes *J. Anim. Sci.* **89**. 1873
- [7] AOAC 2005 Official Method of Analysis of the Association of Official Analytical Chemists 18th ed, Maryland: AOAC International, ed William Harwitz (United States of America)
- [8] Steel R D G and Torrie J H 1980 Principles and Procedures of Statistics 2nd ed (New York: McGraw-Hill Book Company)
- [9] NRC 1981 Nutrient requirements of goats: angora, dairy, and meat goats in temperate and tropical countries Nutrient Requirements of Domestic Animal (Washington D C: National Academy Press)
- [10] Cheeke P R 2005 Applied Animal Nutrition Feeds and Feeding 3rd ed (USA: Pearson Prentice Hall)