

The Effect of Alfalfa Meal Supplementation in Concentrate on Feed Digestibility of Ettawa Crossbred Goat

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ABSTRACT

This research was conducted to determine feed digestibility of Ettawa Crossbred (EC) goat fed concentrate supplemented with alfalfa meal. Eleven EC goats, age 1.5 to 2.5 years, initial body weight 32.2 to 50.5 kg and milking periode 2 to 3.5 months, fed with forages consisted of king grass, *Gliricidia maculata* and concentrate supplemented with alfalfa meal by 0%, 2.6%, and 5.1% (dry matter basis). The proportion of forages and concentrate was 50:50 (dry matter basis). The diet and water was introduced *ad libitum*. Collected data were consumption of dry matter (DM), organic matter (OM), crude protein (CP), crude fiber (CF), ether extract (EE), nitrogen free extract (NFE), and total digestible nutrients (TDN) as well as digestibility of DM, OM, CP, CF, EE, and NFE. The data were analyzed variance using one way design, the differences between mean continued by *Duncan's New Multiple Range Test* (DMRT). The result showed that the supplementation of alfalfa meal in concentrate up to 5.1% had no effect on feed consumption. However, the supplementation of alfalfa meal in concentrate up to 5.1% increased the digestibility of DM 9.3% (78.34% vs 71.65%), OM 8.8% (79.44% vs 72.96%), CF 24.8% (81.95% vs 65.64%), EE 28.5% (88.74% vs 69.03%) compared with control, but didn't affect digestibility of CP and NFE. It could be concluded that the supplementation of alfalfa meal up to 5.1% increased the nutrient digestibility, and it could met the nutrient requirement of EC goat.

Keywords: Alfalfa meal, Ettawa crossbred goat, Feed consumption, Nutrien digestibility

INTRODUCTION

The performance of ruminants fed forage diets depends largely on forage consumption and digestibility. Substitution of legumes for low quality forage has been shown to increase forage consumption compared with diets consisting only of low quality forage (Hunt *et al.*, 1985). 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 (Thorlacius, 1977).

Alfalfa (*Medicago sativa* L.) is a Fabaceae perennial herb and is an important legume used for forage worldwide. It was introduced and cultivated all over the world. Alfalfa is a high-yield and perennial legume which is regarded as the "King of Grass" in the world (Yu *et al.*, 2014), with rich nutritional value and rich in active substances, utilization of alfalfa resources has become a good prospective projects in the development of forage resources (Chen *et al.*, 2016). Chemical analysis indicated that alfalfa contains 88.5% DM, 92.7% OM, and 19.0% CP (DM basis), as observed by Hunt *et al.* (1985). Soofie *et al.* (1982) reported alfalfa contains 19.5% CP, 91.7% OM, 91% DM, 54.4% NDF, 35.4% ADF. Heavens (1978) *cit.* Soofie *et al.* (1982) found a positive associative effect when alfalfa was added as 33% of the diet to low quality timothy hay. Paterson *et al.* (1982) reported greater dry matter (DM)

digestibility and steer performance with a 50% alfalfa-50% corn cob diet compared with either the 100% alfalfa or 100% corn cob diets. Addition of legumes to grass hay or low quality forage diets also has the advantage of increasing dietary crude protein. Montgomery and Baumgardt (1965) *cit.* Thorlacius (1977) observed an increase in dry matter digestibility, 55.9-68.97%, as percent corn was increased in pelleted diets containing alfalfa meal and com. However, dry matter intake decreased as the corn increased, and digestible energy intake was similar for all diets. The objectives of this study were to determine the digestibility of diets consisting of alfalfa meal to lactating dairy goat.

MATERIAL AND METHOD

Diet Formulation. Three diets containing varying levels of alfalfa meal were formulated (Table 1). The king grass and *Gliricidia maculata* as forages were chopped and fed *ad libitum* twice daily. The diets were also fed twice daily, the proportion of forages and concentrate was 50:50 (dry matter basis).

Table 1. Composition of diets to lactating dairy goat (DM basis)

Feed ingredients	Level of alfalfa meal (%)		
	0	2.6	5.1
<i>Wheat pollard</i>	52.0	50.6	49.4
Soybean hull	27.0	26.3	25.5
Rice bran	19.0	18.5	18.0
Salt	1.0	1.0	1.0
<i>Premix</i>	1.0	1.0	1.0
Alfalfa meal	0.0	2.6	5.1
Total	100	100	100

Goat Digestion Trial. Each diet was fed to eleven Ettawa Corssbred lactating goats (ECLG), weight 32 to 52 kg, in an experiment of randomized design. The goats were kept in metabolism cages and had free access to water. The experiment consisted of a 7 days adaptation period, and a 5 days measurement of voluntary intake and total fecal 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. Feces were collected daily and stored at 5°C until the end of the collection period. After each collection period, total feces were weighed, mixed by hand and subsampled. Subsamples of feed and feces were dried at 65°C for 2 days for chemical analysis.

Chemical Analysis. Dried subsamples of feed and feces were ground through a 1-mm screen and conducted for chemical analysis, including DM, OM, CP, CF, and EE, according AOAC (2005) procedures, and then NFE and TDN were calculated. Nutrient intake and digestibility value were calculated based on the result of chemical analysis of feed and feces.

Experimental Design and Statistical Analysis. Treatments were arranged in a one way design, with the main factors being level of alfalfa meal (0, 2.6, and 5.1%). Lactating dairy goats were kept separately conducted for each treatment with three replicates for control (0% of alfalfa meal) and four replicates for (2.6 and 5.1% of alfalfa meal). The data in the main study were analyzed as a one way arrangement. The differences of mean value were analyzed by Duncan's new multiple range test (Steel and Torrie, 1980).

RESULT AND DISCUSSION

Chemical Composition of Feed Ingredients

Chemical analysis indicated that alfalfa was higher than control diet in crude protein (Table 2). Addition of alfalfa meal to diets had the advantage of increasing dietary crude protein. An increase of dietary crude protein observed in increasing level of alfalfa meal was added, followed by an increase of total digestible nutrients. Another advantage, addition of alfalfa meal in diets decreased dietary crude fiber. Hunt *et al.* (1985) reported addition of legumes to grass hay or low quality forage diets also has the advantage of increasing dietary crude protein.

Table 2. Chemical composition of feed ingredients of diets to lactating dairy goat

Feed ingredients	Chemical composition (DM basis)						
	DM	OM	CF	CP	EE	EFN	TDN
King grass	17.21	86.32	33.13	13.88	5.09	37.21	61.62
<i>Gliricidia maculata</i>	24.35	89.31	22.62	25.68	3.00	29.61	87.13
Alfalfa meal	88.70	88.88	25.54	14.90	10.12	38.33	52.78
Diets (0% alfalfa meal)	88.08	86.79	27.15	10.00	4.32	45.32	53.93
Diets with 2.6% alfalfa meal)	87.97	91.40	22.72	11.08	5.58	52.02	61.57
Diets with 5.1% alfalfa meal)	88.19	90.99	23.12	13.07	5.72	49.09	59.91

Nutrient Intake of Lactating Dairy Goat

Effects of addition of alfalfa meal on nutrient intake of lactating dairy goats are presented in Table 3. Addition of alfalfa meal didn't affect nutrient intake of lactating dairy goats. Eventhough addition of alfalfa increased dietary crude protein and total digestible nutrient (Table 2), but it could not effect nutrient intake. Throughout the three levels of alfalfa meal, differences between animals intake was not significant, possibly because when intake is expressed per unit of metabolic body size (kg BW^{0.75}), the effective importance of size of sheep is negligible (Soofie *et al.*, 1982). Soto-Navarro *et al.* (2014) reported, as the forage quality decreased, the difference in DMI was smaller. A diet that included 5.1% alfalfa meal appeared to meet the maintenance requirements of the animal.

In contrast, several study indicated that increasing level of alfalfa increased feed intake.

Hunt *et al.* (1985), also observed a linear increase in *ad libitum* DM intake was found for diets with increasing levels of alfalfa. No differences in NDF intake were observed for any of the dietary treatments. Moseley (1974) and Soofi *et al.* (1982) have reported a linear increase in DM consumption with the addition of a legume to high forage diets. Greater consumption was highly correlated with a shorter ruminal retention time of diets containing legumes. A greater voluntary intake of legumes may also be related to the lower NDF content of leguminous forages (Hunt *et al.* 1985). Van Soest (1965) suggested that intake is limited by the cell wall content of the diet when present in concentrations greater than 60%. Soofi *et al.* (1982) found that dietary fiber content was among the primary factors limiting intake by sheep fed soybean stover-alfalfa diets.

Table 3. Nutrient intake of lactating dairy goat fed diet consisting of alfalfa meal

Nutrient intake	Level of alfalfa meal (%)		
	0	2.6	5.1
In g/head/day ^{ns}			
DM	1502.45 ± 42.05	1467.19 ± 62.95	1469.16 ± 73.78
OM	1303.19 ± 37.53	1275.13 ± 53.78	1274.85 ± 64.74
CP	169.88 ± 13.14	166.84 ± 11.15	166.29 ± 10.87
CF	355.82 ± 3.28	339.17 ± 23.02	339.66 ± 21.49
EE	79.73 ± 2.99	82.83 ± 7.62	79.61 ± 5.06
EFN	647.48 ± 10.04	624.69 ± 18.20	635.50 ± 14.50
TDN	1252.90 ± 28.95	1213.50 ± 47.96	1221.10 ± 47.76
In g/(d·kg BW ^{0.75}) ^{ns}			
DM	80.34 ± 5.43	88.10 ± 6.71	89.36 ± 13.37
OM	69.68 ± 4.78	76.57 ± 5.80	77.53 ± 11.49
CP	9.09 ± 0.95	10.02 ± 1.00	10.08 ± 1.27
CF	19.02 ± 0.94	20.37 ± 2.06	20.62 ± 2.84
EE	4.26 ± 0.31	4.97 ± 0.54	4.72 ± 0.50
EFN	34.61 ± 1.88	37.49 ± 2.14	38.59 ± 5.89
TDN	66.98 ± 3.99	72.86 ± 5.35	74.21 ± 10.34

^{ns} not significant

Nutrient Digestibility

The addition of alfalfa meal indicated to increase nutrient digestibility of DM, OM, and CF (P<0.05), and EE (P<0.01) to lactating dairy goats, as presented at Table 4, eventhough the treatments did not affect nutrient intake as shown at Table 3. A linear increase in the digestibility of DM, OM, EE, as well as CF was observed with increasing level of alfalfa meal. The 5.1% alfalfa in diets had a substantially greater of potentially digestible DM, OM, EE, and CF compared with the 0% alfalfa in diets. However, no differences in digestibility of CP and EFN were observed for any of the dietary treatments.

Table 4. Nutrient digestibility of lactating dairy goat fed diet consisting of alfalfa meal (%)

Nutrient digestibility	Level of alfalfa meal (%)		
	0	2.6	5.1
DMD	71.65 ^a ± 1.00	75.78 ^{ab} ± 2.92	78.34 ^b ± 3.12
OMD	72.96 ^a ± 0.89	76.86 ^{ab} ± 2.82	79.44 ^b ± 2.91
CPD ^{ns}	86.46 ± 7.91	85.45 ± 7.56	89.13 ± 5.36
EED	65.64 ^c ± 0.72	66.50 ^c ± 2.84	81.95 ^d ± 9.08
CFD	69.03 ^a ± 2.86	81.94 ^{ab} ± 15.35	88.74 ^b ± 2.60
EFND ^{ns}	71.92 ± 2.90	76.99 ± 6.48	72.60 ± 8.83

^{ns} not significant

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

^{c,d} significant (P<0.01)

Those result in linear with study from Montgomery and Baumgardt (1965) *cit.* Thorlaciuss (1977) observed an increase in dry matter digestibility, 55.9-68.97%, as percent corn was increased in pelleted diets containing alfalfa meal and corn. Paterson *et al.* (1982) reported greater dry matter (DM) digestibility and steer performance with a 50% alfalfa-50% corn cob diet compared with either the 100% alfalfa or 100% corn cob diets. Hunt *et al.* (1985)

Observed the 100% alfalfa substrate had a substantially faster rate of potentially digestible DM disappearance compared with the 0% alfalfa substrate. The linear response in rate of DM disappearance may be explained by the increase in cell solubles present in the substrate as alfalfa was added. Smith *et al.* (1972) reported a faster rate but a lower extent of digestion for legumes compared with grass forages. The faster rate of digestion was associated with the greater content of cell solubles in the legumes. DM digestibility increased as the percentage of alfalfa in the blend increased (Soofie *et al.*, 1982).

Milk Production

Milk production from dairy goats fed diets containing alfalfa presented at Figure 1. The observaton showed that alfalfa could limited a decrease of milk production. Dairy goats fed without alfalfa in diets tended to decrease milk production rapidly, compared with goats fed alfalfa.

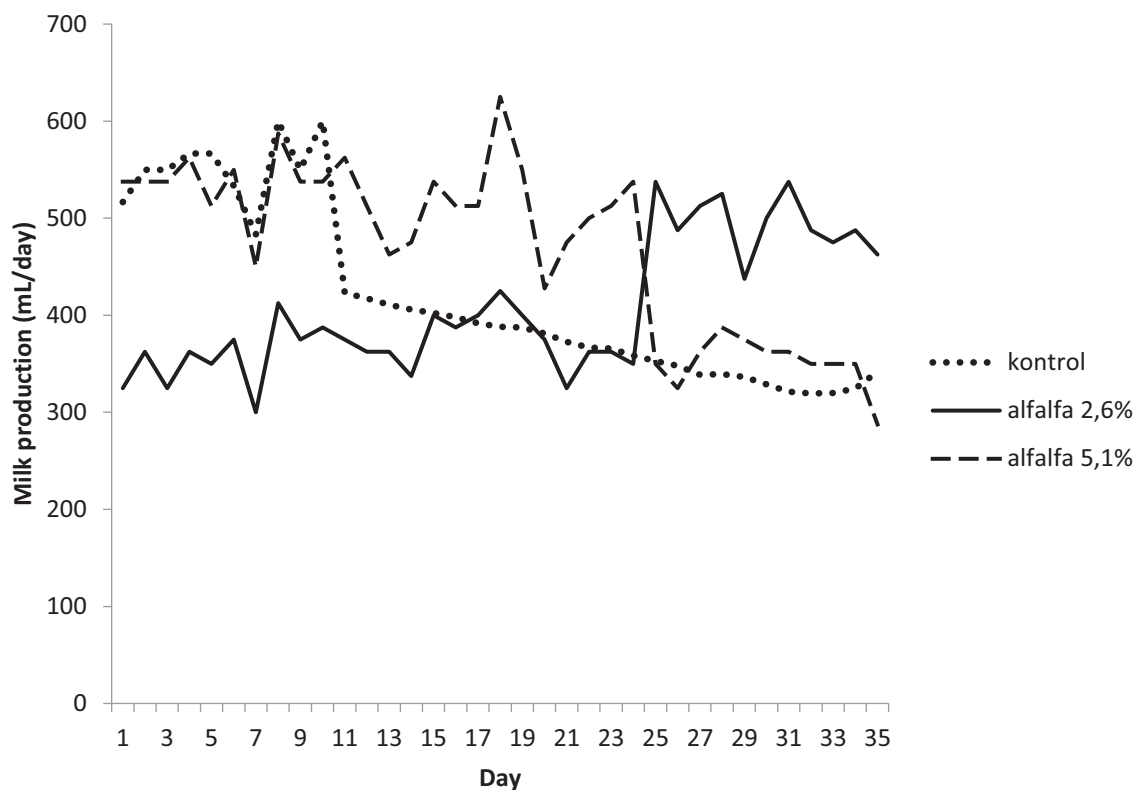


Figure 1. Milk production from dairy goat fed diets containing alfalfa

CONCLUSION

The supplementation of alfalfa meal up to 5.1% increased the nutrient digestibility, and it could met the nutrient requirement of EC goat.

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