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Effect of energy supplementation to berseem (*Trifolium alexandrinum*) hay based feed block on growth performance in Jalauni lambs

M. M. Das, K. K. Singh and P. K. Pathak
Indian Grassland and Fodder Research Institute, Jhansi-284003, India
Corresponding author e-mail: mmdas1964@rediffmail.com
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Abstract

Growing Jalauni lambs (n=18) of approximately similar age and body weight (14±0.65 kg) were divided in three groups of six animals each. Animals of T_1 (control) were fed blocks of berseem (Egyptian clover, *Trifolium alexandrinum*) hay alone whereas animals of T_2 and T_3 were fed 15% and 30% maize grain supplemented along with berseem hay based feed block for a period of 90 days. At the middle of the experimental feeding, a digestion cum metabolism trial was conducted for 7 days. Before the onset of metabolism trial, rumen liquor was collected through esophageal tube at 2 hours post feeding. DM and OM intake was significantly ($P<0.05$) increased in T_2 and T_3 than T_1. DCP intake was not affected among the groups whereas TDN intake was significantly ($P<0.05$) increased in maize grain supplemented groups. The digestibility coefficients of DM, OM and fiber were higher in T_2 and T_3, however, CP digestibility was comparable among the groups. Ruminal NH_3-N concentration was not affected significantly among the groups. TVFA concentration was higher in T_2 and T_3. The average daily gain was significantly ($P<0.05$) higher in T_2 and T_3. Similarly feed conversion efficiency was higher in maize grain supplemented groups than un-supplemented groups. It can be concluded that 15% maize grain supplementation to berseem hay based feed block seems to be sufficient to improve the nutrient utilization and growth performance of Jalauni lambs.

Key words: Berseem hay, Egyptian clover, Energy supplementation, Feed block, Growth performance, Nutrient utilization, Jalauni lamb, Small ruminants

Abbreviations: ADF: Acid detergent fibre, **CF**: Crude fibre, **CP**: Crude protein, **DCP**: **D**igestible crude protein, **DOMI**: Digestible organic matter intake, **DM**: Dry Matter, **DMI**: Dry matter intake, **EE**: Ether extract, **OM**: Organic matter, **NDF**: Neutral detergent fiber, **TA**- **T**otal ash, **TVFA**- Total volatile fatty acid,

Introduction

Legume hays contain higher concentration of protein and other nutrients. The protein content of berseem is about 20% and energy content is 4 kcal/g (Chauhan *et al*., 1992). Lambs consuming diets solely comprising of legume hays are often unable to meet desired levels of production due to lack of sufficient energy/protein combination (Saldana *et al*., 1989). Lambs with higher growth potential have higher nutritional needs especially with regard to protein and energy. For achieving high growth rate in lambs, a high-energy value feed along with protein in the diet is required. Therefore, in present experiment, the effect of feeding berseem hay based feed block supplemented with varying levels of energy (maize grain) on nutrient utilization and growth performance was studied in jalauni lambs.

Materials and Methods

Berseem or Egyptian clover (*Trifolium alexandrinum*) hay was prepared from the berseem harvested in January and February by sun drying. Berseem hay based feed block containing berseem hay alone (B1), supplemented with 15% maize grain (B2) and 30% maize grain (B3) was prepared in an automatic feed blocking machine at 2000 psi to assure proportionate intake of both the components at a time. A physical characteristic of the blocks was studied for bulk density and post compression expansion. Eighteen jalauni lambs weighing around 14±0.65 kg body weight were divided into three groups of six each. Control group (T_1) was fed blocks of B1 whereas group (T_2) and group (T_3) were fed blocks of B2 and B3 respectively for a period of 90 days. Rations were offered *ad libitum* and drinking water was provided twice a day.

Weekly body weight and daily feed intake of lambs were recorded. At the middle of the experimental feeding, a metabolism trial was conducted in completely randomized design involving seven-day collection period. During the metabolism trial, the lambs were housed in metabolism stall having provision for individual feeding and watering. Before the starting of trial, rumen liquor sample was collected through oesophageal tube after 2 hour post feeding.

Samples of feed offered, feed refusals and faeces were estimated for proximate principles (AOAC, 1995) and fiber components (Van Soest *et al*., 1991). Nitrogen content of urine samples was estimated by Kjeldhal method. Rumen liquor samples were analyzed for total N (Microkjeldhal), ammonia N (Conway, 1957), total VFA (Barnett and Reid, 1957). The data was subjected to analysis of variance for statistical significance among the treatment means (Snedecor and Cochran, 1969).

Results and Discussion

Nutritive value of blocks: The CP content of the berseem hay (Table 1) was within the reported range of Ahmed *et al*. (2007). The CP and CF content of B2 and B3 blocks were lower than B1 block that might be due to in corporation of crushed maize at 15% and 30% level in B2 and B3 blocks respectively.

Table 1. Ingredient and chemical composition of different feed blocks.

Component	B1	B2	B3
Ingredient Composition			
Berseem hay	100	85	70
Crushed maize grain	-	15	30
Chemical composition			
DM	95.76	98.04	96.74
OM	85.78	87.03	88.17
CP	22.93	21.61	20.60
EE	1.98	1.84	1.76
CF	27.32	23.17	19.87
TA	14.22	12.97	11.83

Nutrient intake and utilization: DM intake was significantly (P<0.0.5) increased with maize supplementation, however, no significant difference was observed among different levels of supplementation (Table 2). Similarly Lardy *et al.* (2004) also observed that DM intake increased with increasing level of barley supplementation in steers feed grass hay based diet however, further increase in supplementation does not improve the DMI. Matejovsky and Senson (1995) also noted similar responses in DM intake for lambs fed increasing levels of corn with high quality hays. In present study as the forage berseem was offered in the form of block, there was no scope for selection of forage and concentrate (maize grain) separately and the total intake as % of body weight was found higher in T_2 and T_3. Digestible OM intake (DOMI) increased as supplementary maize was increased as reported earlier by Lardy *et al.* (2004). The data indicated the largest change in DOMI in T_2 whereas increment was minimum in T_3.

The intake of DCP was comparable among the groups as reported early by Rao *et al.* (2003) in goats. The intake of DCP (g/d) was higher (39.02-64.28%) in all the groups than the requirement (ICAR, 1998). TDN intake however, significantly increased in maize grain supplementation groups. TDN intake was 28.88% lower in lambs fed unsupplemented block whereas it was sufficient to achieve a daily gain of 125g/d in T_2 and T_3. DM, OM and fiber digestion increased significantly (P<0.0.05) in response to higher level of maize supplementation in T_2 and T_3. Increases in DM and OM digestibility are likely a result of availability of more soluble carbohydrates in the supplement. Higher levels of NDF digestibility in lambs fed maize grain supplement diet are could be due to more microbial population as a result of readily available carbohydrates from maize. The CP digestibility was comparable among the groups, however, in T_3 decreased CP digestibility presumably reflecting the un-matched protein and energy ratio in the blocks.

No significant differences in ruminal pH were observed after 2h post feeding among the groups (Table 3), however, comparatively lower pH was observed in T_3 and T_2. The decline in pH probably occurred as a result of the rapid fermentation of soluble carbohydrate, resulting in a rapid increase in VFA and lactic acid concentration, decrease in the proportion of acetate and an increase in the proportion of propionate (Lee *et al*., 2003) Similarly Reynolds *et al.* (1993) also noted lower ruminal pH at 4h after feeding 30% corn supplements to steers. Ruminal ammonia concentration decreased linearly with increasing levels of maize grain supplementation as reported earlier (Pordomingo *et al*., 1991). Decreased ruminal ammonia concentration in T_2 and T_3 may be due to the availability of more OM for ruminal fermentation and more ammonia assimilation in microbial protein. Total VFA (mmol/dl) concentration was increased with maize supplementation in T_2 and T_3. Boyles *et al.* (1998) noted similar increase in TVFA production with increasing level of barley supplementation.

Growth performance

Average daily gain in lambs was higher in T_2 and T_3 than T_1 (Table 4). However, no difference in daily gain was observed in T_2 and T_3. Feed (kg) required per kg live weight gain in lamb was lower (6.9 and 6.83 kg) for supplemented than unsupplemented group (8.27 kg). Hossain *et al*. (2003) also found superior feed conversion ratio in sheep fed energy-supplemented diets. The results indicated that the efficiency of utilization of protein improved in lambs with supplemented dietary energy. All the animals were in positive N balance and the balance in T_2 and T_3 were significantly ($P<0.05$) higher than T_1 which might be due to higher intake of dietary N and lower excretion of N through urine. Similarly the retention of N as percentage of N intake and grams of N absorbed was higher in energy supplemented groups. This indicated that energy supplementation improved the utilization of absorbed N and reduced the excretion through urine.

It can be concluded that maize grain supplementation increases digestibility of DM, OM and fiber. Similarly the average daily gain (g/d) was significantly ($P<0.05$) higher in T_2 and T_3 than T_1. DCP intake was not influenced significantly in treated groups however energy supplementation significantly ($P<0.05$) improved the TDN intake. Therefore 15 % maize grain supplementation to berseem hay based diet seems to be sufficient to improve nutrient utilization and growth performance of Jalauni lambs.

Table 2. Nutrient intake and utilization in lambs fed different levels of energy supplemented berseem hay based feed block

Parameter	T_1	T_2	T_3
BW (kg)	19.81± 2.23	21.12± 0.91	21.32± 0.99
DMI (kg/d)	0.64^a± 0.05	0.81^b± 0.05	0.85^b± 0.04
DMI% BW	3.26^a± 0.22	3.85^b± 0.12	4.02^b± 0.20
DOMI (g/d)	288^a±19.56	415^b± 24.19	440^b± 22.10
DCPI (g/d)	97.32± 6.34	115.44± 8.76	109.49± 6.31
TDNI (g/d)	319.71^a±20.79	440.62^b±25.23	476.22^b±22.75
Nutrient digestibility (%)			
DM	51.17^a ± 1.27	57.47^b ± 0.81	56.80^b ± 1.21
OM	52.30^a ± 1.27	58.22^b ± 0.83	58.11^b ± 1.48
CP	64.45 ± 1.61	66.25 ± 1.52	63.78 ± 0.81
NDF	48.30^a ± 3.49	57.62^b ± 1.88	59.88^b ± 1.52
ADF	40.74^a ± 3.38	49.21^b ± 1.60	51.38^b ± 1.95
EE	51.62 ± 1.26	52.55 ± 1.10	52.38 ± 1.19
N balance (g/d)			
N intake	24.48 ± 2.28	27.85 ± 1.88	27.46 ± 1.52
Fecal N	8.72 ± 1.03	9.39 ± 0.68	9.94 ± 0.58
Urine N	5.88 ± 0.54	3.10 ± 0.39	2.94 ± 0.28
Balance	9.67^a ± 0.48	15.37^b ± 1.25	14.58^b ± 0.92
Retention			
N intake (%)	40.21^a± 1.43	55.18^b± 2.52	53.08^b± 1.54
N absorbed (%)	62.74^a± 1.02	83.12^b± 2.07	83.16^b± 1.47
Nutritive value (%)			
DCP	15.18	14.15	12.79
TDN	49.83^a	54.19^b	55.83^b

Means bearing different superscripts in a row differ significantly ($P<0.05$)

Table 3. Rumen metabolites in lambs fed berseem hay based feed block

Parameter	T_1	T_2	T_3
pH	6.41±0.06	6.25±0.05	6.20±0.02
TVFA (mmol/dl)	110^a±0.57	125^b±1.60	128^b±3.17
NH_3-N (mg/dl)	35.47±1.23	32.60±1.13	31.73±0.46
Total N (mg/dl)	87.73^{c}2.12	84.0^{ab}2.62	81.2^{a}2.27

Means bearing different superscripts in a row differ significantly ($P<0.05$)

Table 4. Growth performance of lambs fed berseem hay based feed block

Parameter	T_1	T_2	T_3
Initial B W (kg)	13.98±0.80	14.48±0.60	14.76±0.73
Final B W (kg)	21.35±0.95	25.43±1.10	25.81±1.27
Live weight gain (kg)	7.36±0.61	10.95±0.68	11.05±3.67
Average daily gain (g/d)	84.85^a±7.36	121.67^b±7.51	122.78^b±9.32
DMI (kg)	59.73^a±2.62	74.70^b±2.48	74.24^b±2.63
DMI/kg gain (kg)	8.26^b±0.53	6.91^a±0.36	6.84^a±0.33

Means bearing different superscripts in a row differ significantly ($P<0.05$)

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