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Performance of Beetal Goats and Lohi Sheep Under Different Feeding Management Systems

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Abstract.- A study was conducted to compare the performance of goats and sheep when they (1) grazed Lucerne for eight hours per day (extensive), (2) grazed lucerne for four hours per day and been pen fed lucerne for an additional four hours (semi intensive), and (3) been pen fed lucerne for eight hours per day (intensive). Forty five female Beetal goats (20 kg body weight) and 45 female Lohi sheep (22 kg body weight) were divided into three groups within each species. Feed intake and weight gain of animals were monitored over a three month period. In goats and sheep, dry matter and neutral detergent fiber intakes were highest ($p<0.05$) under the extensive management system compared to semi intensive or intensive systems. However, in each of the three systems sheep consumed more ($p<0.05$) dry matter and neutral detergent fiber than goats. Although crude protein intake did not differed ($p>0.05$) among systems within species, sheep presented a significant higher (144.43 g/d) crude protein intake compared to goats (127.92 g/d) under intensive feeding. The extensive system resulted in the highest ($p<0.05$) average daily gain, and the intensive system in the lowest ($p<0.05$) for both goats and sheep, with growth higher ($p<0.05$) in sheep than goats in the respective systems. With the lowest feed efficiency (gain per feed intake) found with intensive pen feeding of animals, it can be concluded from this study that extensive grazing of animals on lucerne would result in the cheapest and most effective system to raise either goats or sheep.

Key words: Feeding systems, nutrient intake, weight gain, feed efficiency, cost of production, goats and sheep.

INTRODUCTION

Goats and sheep are multipurpose animals which providing hair, wool, meat and milk. The production of meat from goats and sheep play a vital role in the supply of animal protein for the people of our country. Goats production in many traditional village systems in tropical countries is often characterized by poor growth rates and high mortality (Devendra and Burns, 1983). The productivity of goats can be improved by improving the nutrition either concentrate feeding (Paravan and Ovalo, 1985; Pathasarathy, 1986) or provision of additional forage (Pathasarathy *et al.*, 1984).

It is generally known that raising young animals on high concentrate diets results in higher daily gains, dressing percentage and carcass quality than on a forage system (Johnson *et al*., 2005; Kosum *et al.*, 2003; Warmington and Kirton, 1990). It reduces age to slaughter, increases carcass quality and meat output, thereby improving access to animal protein and income to households in the traditional sector (Mtenga and Kitalyi, 1990). When only grazing on forages is provided, it may not be sufficient for optimum live weight gain and wool production (Mahajan *et al*., 1976; Kochapakdee *et al*., 1994). Under the prevailing low feeding regimen, the genetic potential of local breeds is under exploited.

The current study aimed to evaluate the performance of goats and sheep under different feeding management systems with lucerne, including (1) grazing only, (2) grazing supplemented with pen feeding, and (3) pen feeding only. This would result in the identification of the most effective and profitable system, which could in turn be used by practicing nutritionists to generate economic response recommendations.

MATERIALS AND METHODS

Experimental animals and management

Ninety female animals consisting of 45 Beetal goats (approximately 15 months of age and 19.9±0.47 kg average body weight) and 45 Lohi sheep (approximately 13 months of age and 22.1±0.69 kg body weight) were used. Fifteen animals from each species having three replicate

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with 5 animals each were allocated to one of three management systems: (1) access to lucerne pasture for eight hours per day (8:00 to 16:00; extensive); (2) access to lucerne pasture for four hours per day (8:00 to 12:00) together with pen feeding with Lucerne for four hours (semi intensive); and (3) pen feeding with lucerne for eight hours per day (intensive). The experiment was conducted as a two (species) x three (management system) factorial design. Animals were fed in groups each group having three replicates consisting 5 animals each.

Pasture (1.21 ha) was divided by means of electric fences into suitable paddocks for each group, with shelter and water supplies. All animals were housed at night in the same open-sided cement-roofed shed, and offered a concentrate diet at 240 g/animal/day. Chemical composition of lucerne and concentrate are presented in Table I. Freshwater was available *ad libitum* to animals at all times. All animals were treated for ecto- and endo-parasites before the start of experiment.

Table I.- Chemical composition of lucerne fodder and concentrate Ration.

Nutrient	Lucerne	Concentrate
Dry matter (%)	20.5	85.0
Crude protein (%)	18.9	16.0
Neutral detergent fibre (%)	46.0	39.0
Acid detergent fibre (%)	42.0	17.0
Gross energy (MJ/kg)	16.3	17.4

Measurements and analysis

Grazing intake was estimated by the animal weight gain method. Animals were weighed individually before access to the grazing paddocks. The animals were allowed to graze and weighed with two hour intervals during grazing hours. The difference between weights before and after grazing was considered as the amount of feed consumed by individual animals of each group (Hossain *et al*., 2003). To determine feed intake in pens, animals were offered a daily quantity at 30 % of body weight and refusals were weighted the next day. To determine weight gain, animals were weighed initially and then at fortnightly intervals. Feed efficiency was calculated as the amount of gain (kg) per kg feed intake. Measurements were conducted over a three month period.

Proximate analyses of feed samples were done according to the procedures of AOAC (2000) and the method of Van Soest *et al*. (1991) was used to determine neutral detergent fiber and acid detergent fiber contents. Gross energy (GE) values were determined with an adiabatic bomb calorimeter (IKA C2000, Janke and Kunkel, Staufen, Germany).

The GLM procedure of SAS version 9.1.3 (SAS Institute Inc., Cary, NC) was used to analyze data. Animal was used as the experimental unit. The differences among treatment means were evaluated through LSD tests (Steel *et al*., 1997), with $p<0.05$ considered as significant.

RESULTS AND DISCUSSION

Nutrient intake

Daily intakes of dry matter, crude protein, neutral detergent fiber, acid detergent fiber and gross energy are presented in Table (II). The highest ($p<0.05$) intakes of dry matter, neutral detergent fiber and acid detergent fiber occurred in both goats and sheep with the extensive system compared to the semi intensive and intensive systems. This high dry matter intake on the extensive system could probably be attributed to the unlimited availability of Lucerne during grazing. No differences ($p>0.05$) in intakes of crude protein and gross energy were obtained among systems in neither goats nor sheep.

In all systems intakes of dry matter, neutral detergent fiber and acid detergent fiber were higher ($p<0.05$) in sheep than goats. A possible explanation for this could be that selective behaviour is more profound in goats than sheep (Peacock, 1996; Abijaoude *et al*., 2000). Similarly, higher dry matter intakes by sheep compared to goats have been reported by Kabir *et al*. (2002), Salim *et al*. (2003) and Animut *et al*. (2006). A further possible reason for the differences in dry matter intakes between species could be attributed to the fact that goats are browsers, whereas sheep are known as exclusively grazers. Goats would spend more time on selection than sheep. However, the use of electric fences around grazing paddocks in the current study could have adversely influence the eating behavior of the goats in limiting their ability for movement and thus selection.

Table II.- Nutrient intakes (mean ± standard error, *n* = 15 animals per group) in goats and sheep under different feeding management systems.

Nutrient	Goats			Sheep		
	Extensive	Semi-intensive	Intensive	Extensive	Semi-intensive	Intensive
Dry matter (g/d)	733.32±2.15 [b]	661.44±7.37 [c]	658.43±9.99 [c]	794.26±6.19 [a]	746.43±10.79 [b]	753.51±9.72 [b]
Crude protein (g/d)	131.95±5.37 [ab]	127.87±4.80 [b]	127.92±4.33 [b]	142.71±5.06 [ab]	136.30±4.35 [ab]	144.43±5.35 [a]
Neutral detergent fibre (g/d)	323.01±4.26 [b]	247.43±4.75 [d]	255.10±4.40 [d]	350.75±5.61 [a]	295.39±3.86 [c]	303.04±5.95 [c]
Acid detergent fibre (g/d)	255.21±5.79 [b]	216.10±5.32 [d]	217.02±4.35 [d]	280.70±5.19 [a]	254.16±4.94 [b]	237.40±4.18 [c]
Gross energy (MJ/d)	11.76±2.39	11.76±2.39	10.96±2.01	12.72±0.59	12.72±0.59	12.39±2.97

[a,b,c,d]Values within a row with different superscripts were significantly different ($p<0.05$).

Table III.- Growth rate, feed efficiency and cost of gain in goats and sheep (mean ± standard error, *n* = 15 animals per group) under different feeding management systems.

Measurement	Goats			Sheep		
	Extensive	Semi-intensive	Intensive	Extensive	Semi-intensive	Intensive
Average daily gain (g)	82.59±4.04 [b]	66.29±3.46 [c]	49.62±4.04 [d]	98.14±4.61 [a]	83.33±5.77 [b]	62.59±4.04 [dc]
Feed efficiency	0.11±0.00 [ab]	0.10±0.00 [b]	0.07±0.00 [c]	0.12±0.00 [a]	0.11±0.00 [ab]	0.08±0.00 [c]
Cost (Rs/kg gain)	137.40±5.19 [e]	184.77±4.61 [c]	241.61±3.46 [a]	119.54±2.30 [f]	151.18±6.35 [d]	201.05±3.46 [b]

[a,b,c,d] Values within a row with different superscripts were significantly different ($p<0.05$).

Crude protein intake was higher ($p<0.05$) in sheep than goats in the intensive system, but not with extensive or semi intensive feeding (Table II). According to Fedele *et al*. (2002) goats have a selective behaviour, specific for protein content of the diet. This could explain why goats were able to consume similar protein content than sheep during grazing in the current study, despite a lower dry matter intake in goats. However, with lucerne supplied in a cut form (intensive system), it could be that selection was restricted in goats, which would result in a higher crude protein intake in sheep due to a higher dry matter intake.

Weight gain and feed efficiency

With both species, maximum and minimum ($p<0.05$) weight gains were obtained in the extensive and intensive systems, respectively Table III. The high gains in the extensive system might be attributed to a higher intake of nutrients compared to the semi intensive and intensive systems. However, in contrast to our results, Munir *et al*. (2008) reported better performance of Balochi sheep in an intensive than in an extensive feeding system. This contradiction could probably related to differences in breeds, grazing conditions and nutritional values of diets between studies. Sheep gained more ($p<0.05$) weight than goats with extensive and semi intensive feeding, but gains were only numerically higher in sheep in the extensive system. Higher weight gains in sheep could be attributed to higher nutrient intakes by sheep than goats, and agree with results presented by Van Niekerk and Casey (1988). A better ($p<0.05$) feed efficiency for both sheep and goats was achieved during extensive and semi intensive feeding than intensive feeding (Table III). However, within feeding systems feed efficiency did not differ ($p>0.05$) between goats and sheep. This disagreed to Lu and Potchoiba (1990) and El-Khidir *et al*. (1998), who reported lower feed efficiencies in goats than sheep.

For both species feed cost for gain was the highest ($p<0.05$) on the intensive system, and lowest ($p<0.05$) on the extensive system (Table III). This is in contrast to Legesse *et al*. (2005), who found a higher profit margin with goats in a semi intensive than extensive and intensive feeding systems. Differences in experimental animals and feed might have caused this discrepancy between studies. Legesse *et al*. (2005) used male animals and fed Rhodes-grass hay, whereas all animals were females and lucerne were fed in our study. In all three feeding systems feed costs were higher ($p<0.05$) for goats than sheep. Hadad and Obeidat (2007)

reported higher cost of production per kg gain in lambs than kids (all males) when fed total mixed rations for a period of sixty days.

CONCLUSIONS

It can be concluded from this study that grazing for eight hours per day resulted in the highest weight gain, best feed efficiency and lowest feed cost when compared to grazing for four hours and pen feeding of lucerne for four hours, or pen feeding of lucerne for eight hours. Sheep presented higher weight gains than goats. Despite similar feed efficiencies, sheep could be raised at a lower feed cost than goats.

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