Effect of Feeding Systems on Feed Intake, Eating Behavior, Growth, Reproductive Performance and Parasitic Infestation of Black Bengal Goat

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ABSTRACT : The experiment was conducted to find out the effect of 4 feeding systems on growth, feed intake, eating behavior, lactation performance, gestation period, post-partum heat period, conception rate and parasitic infestation of Black Bengal goat. Twenty four does of approximately 1 year of age were randomly selected for 4 treatment (feeding systems) groups having 6 replications in each. Treatments were stall feeding (T_1), tethering (T_2), restricted grazing (T_3) and grazing (T_4). T_1 group was housed continuously and adequate amounts of natural grass were supplied for *ad libitum* feeding. T_2 group was tethered for grazing natural grass from 8 a.m. to 4 p.m. being moved at one hour intervals. Goats of T_3 group were allowed grazing from 8 a.m. to 1 p.m. T_4 group was grazed from 8 a. m. to 4 p.m. Concentrate supplement was given at the rate of 150 g per day per goat for all of the treatment groups. Duration of experiment was 219 days. Daily live weight gain was significantly ($p<0.05$) higher in case of stall fed goats than that of others. DM intake also significantly ($p<0.05$) differed among the treatment groups and was 3.40 3.95, 3.76 and 4.05 per cent of their live weight for stall feeding, tethering, restricted grazing and grazing groups, respectively. Rate of rumination was significantly ($p<0.05$) higher in case of tethering group of goats than that of others. Birth weight of kids, milk yield, lactation period and post-partum heat period were significantly higher in case of stall fed goats than others. Tethering group showed significantly ($p<0.05$) higher litter size than others. Infestation rate of *Fasciola* was significantly ($p<0.05$) higher in the grazing group. In conclusion, it may be stated that among these feeding groups overall performance of stall fed goats was more satisfactory, and that the tethering group showed better performance than the others. ***(Asian-Aust. J. Anim. Sci. 2002. Vol 15, No. 10 : 1453-1457)***

Key Words : Feeding System, Intake, Growth, Reproduction, Goat

INTRODUCTION

Asia accounts for 63 per cent of the total goat population of the world (FAO, 1999). Among the Asiatic countries Bangladesh has got the second highest population of goats which accounted for 33.5 million heads (FAO, 1999). The goat ranks second in terms of meat, milk and skin production representing about 28.0, 23.0 and 28.0 per cent among the total contribution of livestock, respectively, in Bangladesh (FAO, 1999). It is estimated that more than 90 per cent of the goat population in Bangladesh are Black Bengal goats (Hussain, 1998). Rural people are rearing more than 98 per cent of goats in different feeding systems. During adverse climatic condition farmers have to house their goats, providing stall feeding with tree leaves, natural grasses and kitchen wastes (Hussain, 1998). Thus it may recognized that in Bangladesh, like other tropical countries, goats are reared by using 4 types of feeding systems i.e. grazing, tethering, semi-intensive and stall-feeding. Gastrointestinal parasite infection is a common cause of goat mortality in Bangladesh (Rahman et al., 1975). Rahman et al. (1976) reported that in case of adult goats, 43.45 percent of total mortality was due to gastro-intestinal parasitism in Mymensingh region of Bangladesh. So, more attentions should be given to the effect of these 4 systems of feeding on the productivity and parasitic infestation of Black Bengal goats. The effects of feeding systems on the productive and reproductive performances of Black Bengal goats are not clear. Therefore, systematic study is needed to determine the effect of these 4 systems (stall-feeding, tethering, restricted grazing and grazing) on growth, feed intake, feeding behavior, disease prevalence, reproductive performance and carcass characteristics of Black Bengal goat.

Taking this in mind, the present experiment was carried out to study the feed intake, growth, feeding behavior, conception rate, gestation period, birth weight of kid, lactation period, milk yield and parasitic infestation of Black Bengal goat on different systems of feeding.

MATERIALS AND METHODS

The experiment was conducted at the Sheep, Goat and Horse farm under the Department of Animal Science, Bangladesh Agricultural University, Mymensingh, Bangladesh from June, 1999 to April, 2000. The experiment was conducted with twenty four Black Bengal goats (does). Their age was nearly 1 year. After an adjustment period of 1 month, 24 goats were randomly assigned for four treatment

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groups having 6 replications for each. Treatments were stall feeding (T_1), tethering (T_2), restricted grazing (T_3) and grazing (T_4). Goats of T_1 (stall feeding) group were kept fully in intensive conditions. They were given natural grass *ad-libitum*. Half of the total amount of grass was offered at 9 a. m and the remaining half was given at 2 pm. In group T_2, the goats were tethered from 8 am to 4 pm at the place of grazing and were moved at one hour intervals. A peg and a rope 20 feet in length was used for tethering. The goats of T_3 (restricted grazing) treatment group were allowed grazing from 8 am. to 1 pm. For these animals, concentrate feed mixture was given at 2.0 pm and natural grass at 4.0 pm. The goats of T_4 (grazing) were allowed grazing from 8 am to 4 pm. Natural grass was collected from grazing land. It was a mixture of Carpet grass (*Axonopus compresus*), Ulu grass (*Imperata cylindrica*), Durba grass (*Cynopodon dactylon*) and Mutha grass (*Cyperus rotundus*). Concentrate mixture was prepared by adding the same amount of wheat bran and matikalai (*Phaseolus mungo*) bran. Concentrate supplement was given at a rate of 150 g per day per animal in the first month and this amount was increased at the rate of 5 gram after every month. This increased amount of concentrate was added to adjust to their requirement for increased live weight. Supplement allocation was adjusted fortnightly based on live weight gain. Calfostonic was supplied at the rate of 5 g per animal per day as a vitamin-mineral premix. One per cent common salt was also added. Experimental animals were weighed individually before access to grazing land (at 8 am) and weighed again at 12 am after returning back from grazing land. The animals were again weighed after completing the grazing at 4 pm. The difference between two weight records was considered as the amount of herbage consumed by individual animals.

Three goats of each treatment group were observed at 5 minute intervals from 6 am to 8 am and again from 4 pm to 10 pm for examining the eating and rumination behavior. The observation had been carried out by a team of 4 researchers. The parameters observed were eating concentrate (EC), eating grass (EG), rumination (R), lying idling (LI), standing idling (SI), drinking (D), and asleep (A).

Goats were weighed individually at fortnightly intervals. Weighing was performed at 7.30 am before offering any feed, and special care was taken to get accurate weights.

The estrus symptoms of goats were identified by visual observation and goats in estrus were serviced by a Black Bengal buck towards the end of each estrus period. Proper care was taken for pregnant goats and weight gain was recorded. Date of service, gestation period, litter size and birth weight of kids were also recorded. On every third day of the suckling period, kids were separated from their dams for 24 h and does were milked in the morning and evening for estimation of milk yield. Average milk yield (g/day) was calculated and recorded for each doe of all the groups. Lactation period was determined from the date of kidding to the date of weaning.

Fecal samples were collected fortnightly directly from the rectum of each goat in the morning before supplying feed. Collected fecal samples were brought to the laboratory to count the eggs of different gastro-intestinal parasites by using Stall's method. From each fecal sample 3.0 g of feces were taken and well mixed with a few drops of water in a beaker using a flat bottomed glass rod. Saline water was added to make the total volume of 45 ml and stirred well using a glass stirrer. With the help of a graduated pipette 0.15 ml of fecal suspension was transferred to a glass slide and covered with a 20×40 mm cover glass. Traces of ova were counted under low power objectives of a microscope. Number of ova were counted and multiplied by factor 100 to determine the number of ova per gram of feces. The eggs were identified by studying their morphology, shape and size as suggested by Soullsby (1968).

All the experimental data were analyzed using "MSTAT" statistical program to compute analysis of variance (ANOVA) for CRD. Duncan's New Multiple Range Test (DMRT) was done to identify significant differences among the treatment means.

RESULTS AND DISCUSSION

Feed intake

Effects of different systems of feeding on the feed intake of Black Bengal goats are shown in the Table 2. There was a significant ($p<0.05$) variation of roughage intake with values of 0.74, 0.83, 0.67 and 0.77 kg for stall-fed, tethered, restricted grazing and grazing goats per day, respectively. Average dry matter intake per goat per day was 334.36, 356.60, 318 and 341.88 g for stall-fed, tethered, restricted grazing and grazing goats, respectively. DM intake significantly ($p<0.05$) differed among the treatment groups. Lowest dry matter intake was recorded for stall fed goats. This may be due to variation of feeding systems. Grazing goats require extra energy for roaming. On the other hand, stall fed goats require less energy for maintenance as they live in the house all the day long.

Table 1. Chemical composition of feed ingredients used in the experimental diet

Feed ingredients	DM	% DM basis			
		CP	CF	EE	Ash
Matikalai	89	21	7.0	3.0	4.1
Wheat bran	84	13.0	12.0	3.0	6.0
Natural grass	24	9	40.0	1.5	8.2

Table 2. Effect of different systems of feeding on the feed intake of Black Bengal goats

Parameters	Treatments				LSD value and level of significance
	Stall feeding	Tethering	Restricted grazing	Grazing	
Average green roughage intake (kg/d)	0.74^{a}±0.07	0.83^{ab}±0.07	0.675^{b}±0.03	0.77^{b}±0.11	23.75*
Average concentrate intake (g/d)	172.5	172.5	172.5	172.5	
DM intake (g/d)	334.36^{ab}±7.92	356.6^{a}±7.92	318.84^{b}±9.70	342.88^{ab}±9.7	23.75*
DM intake (g/kgW/d)	34.47	39.62	37.51	40.34	
DM intake (g/kgw$^{0.75}$/d)	60.90	68.58	65.07	69.98	
Per cent of DM on live weight	3.4	3.95	3.76	4.05	

Mean with uncommon superscripts at the same row are significantly different ($p<0.05$).

Similarly, Galina et al. (1993) reported higher DM intake of pastured Alpine goats than that of housed goats.

Eating behavior

The eating behavior in different systems of feeding was studied and the results are presented in Table 3. Both in the morning and in the evening, rumination time by goats of tethering groups was significantly longer than that in the stall-feeding, restricted grazing and grazing groups which did not differ significantly. Rumination times were longer in the evening; a similar result was obtained by Domingue et al. (1991a). The longer rumination time of the tethered group is probably because of their higher forage intake with higher amount of stem than the other groups, and their lesser opportunity for feed selection. Tethered goats also usually ate less concentrate feed n both morning than evening than did the other groups. Concentrate intake by the restricted grazing goats was higher that that of any other group in the evening and this was probably due to insufficient roughage intake.

Growth performance

Average live weight gain during the experimental period is shown in the Table 4. Significant difference ($p<0.05$) was observed in live weight gain among the treatment groups. Live weight gain of stall-fed goats was significantly higher than that of others. Average daily live weight gains of stall feeding, tethering, restricted grazing and grazing goats were 15.98, 10.57, 9.13 and 7.98 g/d, respectively. The live weight gain per day is significantly ($p<0.05$) higher for stall-fed than tethered, restricted grazing and grazing goats. A similar result was obtained by Saini et al. (1986) who conducted an experiment using 10 weaned Barbari goats to study the effect of management system on growth performance. With these intensive, semi-intensive and extensive systems final body weight was 15.80, 14.25 and 13.03 kg with significantly different daily weight gains of 61, 45 and 30 g, respectively. However, the present study showed comparatively lower growth rate which is probably due to genetic potentiality, sex and age of animal and climatic conditions. The Black Bengal is a dwarf type goat. Normally its birth weight, weaning weight and weight at first heat is lower than other breeds. Genetically, they are very poor growers. Secondly, the goats were female, and their age was approximately 1 year. It is well established that the growth performance of females is lower than that of males. Adverse weather such as rain, fog, acute sunshine etc. during the experiment caused fluctuation of feed intake due to irregularities in grazing schedule. In the winter season, the availability and digestibility of natural grass was poor and ultimately the goats could not achieve optimum growth rate.

Table 3. Effect of different systems of feeding on feeding behavior of Black Bengal goats

Parameters	Treatments								LSD value and level of significance	
	Stall feeding		Tethering		Restricted grazing		Grazing			
	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening
Rumination	4.67^{b}±2.08	6.33^{b}±3.06	17.33^{a}±0.58	21.00^{a}±8.72	6.33^{b}±4.93	4.66^{b}±1.53	10.33^{b}±3.06	6.67^{b}±2.52	5.83*	5.83*
Asleep	1±1	4.67±4.51	1±1	7.0±4.36	1±1	9.0±2.65	1±1	6.0±4.00	NS	NS
Eating concentrate	0.667^{a}±0.58	0.667^{b}±1.15	0.333^{a}±0.58	0	0.67^{a}±1.15	1.33^{b}±2.31	0	0.33^{b}±0.58	1.33*	2.49*
Standing behavior	8.667^{bc}±2.31	9.000^{b}±3.61	3.33^{c}±1.53	18.67^{b}±9.29	15.67^{a}±4.93	23.0^{ab}±6.56	12.0^{ab}±3.46	37.67^{a}±10.41	6.24*	6.25*
Resting behavior	8.667^{a}±3.51	40.667^{a}±4.04	2.0^{b}±2.0	17.67^{ab}±17.21	0^{b}	26.33^{b}±5.03	0.67^{b}±1.15	14.0^{b}±7.21	3.96*	3.96*

Mean with uncommon superscripts at the same row are significantly different ($p<0.05$).

[#] Values indicate the number of observation taken at 5 minutes interval.

Table 4. Effect of different systems of feeding on the live weight gain of Black Bengal goats

Parameters	Treatments				LSD value and level of significance
	Stall feeding	Tethering	Restricted grazing	Grazing	
Duration (d)	219	219	219	219	
Average initial live wt. (kg)	7.950±1.25	7.867±1.58	7.3±1.19	7.65±1.22	NS
Average final live wt. (kg)	11.45^{a}±1.34	10.18^{ab}±1.20	9.62^{b}±0.69	9.37^{b}±1.06	1.369*
Average live wt. gain (kg)	3.500^{a}±1.29	2.317^{b}±0.84	2.0^{b}±0.75	1.750^{b}±0.33	1.140*
Average daily live wt. gain per day (g/d)	15.978^{a}±5.88	10.572^{b}±3.85	9.127^{b}±3.44	7.982^{b}±1.52	5.204*

[ab] Mean values in the same row with different superscripts differ significantly ($p<0.05$).

Reproductive performance

Effect of feeding systems i.e., stall feeding, tethering, restricted grazing and grazing on birth weight of kid, gestation period, milk yield, lactation performance, litter size and conception rate are shown in the Table 5. Milk yield of stall-fed groups was significantly ($p<0.05$) higher than others. Lactation period differs significantly ($p<0.05$) than that of others. System of feeding had significant ($p<0.05$) effect on litter size. The value for tethering was significantly higher than others. System of feeding had no effect on conception rate or gestation period. Goats of tethering group ranked the second lowest period of post-partum heat. The higher daily intake of feed and higher production of milk per unit of body weight are functions of a higher metabolic rate related to body size (Devendra and McLeory, 1982). Similarly, in this experiment, higher milk yield in stall-fed goats was probably due to better body condition and higher feed efficiency. Other groups of goats, reared by tethering, restricted grazing and grazing, suffered from different types of parasitic infestation and other diseases. Due to loss of energy for roaming, less amount of nutrients remained for milk production. Thus their reproductive performance was poor.

Highest average birth weight of kids was obtained from the stall fed group. Birth weights of stall fed and tethered group of goats were similar to those obtained by Hussain (1993) who reported 0.92 to 1.17 kg. In case of restricted grazing and grazing groups, lower birth weight of kid might be due to lower body weight, ill health, and parasitic infestation of doe and also due to exposure of fluctuating and adverse environmental conditions. Variation in case of post-partum heat period probably was also for the same reasons.

Parasitic infestation

Effect of different systems of feeding on the rate of parasitic infestation is shown on the Table 6. Number of eggs of *Fasciola* were significantly higher in case of grazing goats than that of others. The average value of stall fed goats for *Strongylus* was significantly ($p<0.01$) lower than that of restricted grazing and grazing groups.

IMPLICATIONS

The experiment showed that the growth performance was higher with stall fed goats than tethering, restricted grazing and grazing groups. A better result was also obtained for milk yield from stall fed goats. Survivability and growth performance of the kids may be improved by rearing does in stall feeding condition to increase milk production. In comparison to others, this system is more expensive due to extra housing facility and more labor for collection and feeding roughage, and for intensive care. This system is very important in case of land scarcity. The information obtained from this experiment may be helpful for the researchers and policy makers for the development of better stock of Black Bengal goat. The rate and time spent for rumination was higher in case of tethering group

Table 5. Effect of different systems of feeding on reproductive performance of Black Bengal goats

Parameters	Treatments				LSD value and level of significance
	Stall feeding	Tethering	Restricted grazing	Grazing	
Birth weight of kid (kg)	1.44^{a}±0.21	1.10^{b}±0.14	0.913^{c}±0.13	0.90^{c}±0.08	0.1878**
Gestation period (d)	145±2.77	145±2.77	144±1.71	143±0.58	NS
Milk yield (ml)/lactation	460^{a}±96.18	255^{b}±57.01	212^{b}±25.00	225^{b}±28.87	77.17**
Litter size	1.00^{b}±0.00	1.5^{a}±0.55	1.0^{b}±0.00	1.0^{b}±0.00	0.3752*
Conception rate	1	1	1	1	NS
Lactation period (d)	56^{a}±5.6	37^{b}±4.85	33.75^{b}±2.5	32.5^{b}±6.45	8.785**
Post-partum heat period (d)	68^{c}±2.94	73^{b}±2.95	81.5^{a}±3.11	85.25^{a}±2.96	4.884**

Mean with uncommon superscripts at the same row are significantly different ($p<0.05$).

Table 6. Effect of different systems of feeding on parasitic infestation of Black Bengal goats

	Treatments				LSD value and level of significance
	Stall feeding	Tethering	Restricted grazing	Grazing	
Fasciola	3.33^{b}±5.16	4.17^{b}±6.65	7.50^{b}±8.22	23.33^{a}±15.06	15.69**
Paramphistomum	7.5^{ab}±9.87	0^{b}	0^{b}	13.33^{a}±10.33	8.60*
Trichuris	1.0^{b}±2.45	13.33^{ab}±16.33	11.67^{ab}±9.83	22.50^{a}±8.8	12.73*
Coccidia	11.0±17.04	0	0.83±2.04	0.33±0.82	NS
Strongylus	1.67^{b}±4.08	6.67^{ab}±10.33	23.33^{a}±19.66	23.33^{a}±15.06	16.34*

Mean with uncommon superscripts at the same row are significantly different ($p<0.05$).

of goats than others. It indicates that tethered goats take more coarse roughage than others. This result may be helpful for formulating rations and for recommending appropriate feeding practices for goats. Tethered groups of goats showed better performance than that of restricted grazing and grazing groups. The rate of parasitic infestation is also comparatively lower in case of tethering group. Tethered goats cannot damage standing crops, which is the most important advantage of this system. So tethering system of feeding may be more suitable in crop-livestock farming conditions.

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