

Effect of different levels of concentrate supplementation on the performance of Black Bengal goat

MR Ferdous¹, MJ Khan*¹, MA Rashid², M Kamruzzaman¹

¹Department of Animal nutrition, Bangladesh Agricultural University, Mymensingh; ²Department of General Animal Science and Animal nutrition, Patuakhali Science and Technology University, Dumki, Patuakhali

Abstract

Fifteen castrated male goats (12.97±1.46 Kg) aged between 12 and 13 months were used to study the effect of different levels of concentrate supplementation on growth performance and nutrient digestibility in Black Bengal goat under stall feeding. The feeding trial was continued for a period of 75 days where goats were supplied at the rate of 158g DM/kgW^{0.75} /day. The animals were assigned into five dietary treatments: A (Only dal grass as sole feed), B (15% DM from concentrate + 85% DM from dal grass), C (20% DM from concentrate +80% DM from dal grass), D (25% DM from concentrate + 75% DM from dal grass), E (30% DM from concentrate + 70% DM from dal grass). Digestibility of all nutrients was gradually higher (P<0.01) from A to E. Total live weight gain of goats of group A was statistically lowest (P<0.01) than those of other groups. There was also significant difference (P<0.01) among the treatment groups E, D, C and B. Live weight was gradually increase due to gradual increase of concentrate from B to E. Nitrogen balance, carcass yield and net profit of treatment group E was highest (P<0.01) then D, C and B than A. Green grass do not fulfill the appetite and nutrient requirements as a sole feed. Concentrate supplementation is undoubtedly essential to fulfill the nutrient requirements and concentrate can be supplemented upto 30% of required DM to obtain the best result.

Key words: Black Bengal goat, concentrate supplementation, digestibility, performance

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Introduction

There are 15.20 million goats in Bangladesh (BBS 2008), of which 98% is distributed in the rural and 2% in the urban areas. Small, marginal and landless farmers contributed 75.8% and medium and large farmers contributed 24.2% of goat farming in the rural area (Huque 2008). So, goat plays a dominant role in small ruminant production systems and as a means of livelihood in the rural landless farmers. Goats and sheep have been treated as being the neglected species of livestock in Bangladesh, although, they alone represent 58.8% of the total livestock population (FAO 1999). Goat ranks second in terms of meat, milk and skin production representing about 38, 25 and 28% among the total contribution of livestock that yield 129 metric tons of meat per year (FAO 1997).

In Bangladesh, about 80% people are living below poverty level, 90% people are suffering from malnutrition and becoming the victims of various deficiency diseases. Presently, per capita intake of animal protein is less than 21g against the recommended level of 120g (Ministry of Fisheries and Livestock 2007). Therefore, goat production could also be an effective means of

increasing high quality meat to mitigate the shortage of protein.

Goat plays an important role in generating employment, source of income and capital. Being small in size, they do not require any large management skills and can easily be handled and managed by women and children (Acharya 1992). They are traditionally raised by "poverty-stricken" village people in a secondary system of grazing on harvested fallow land, along the road and canal sides without any supplementation. For the poor farmers who are unable to maintain large ruminants, goat justifies its designation as "the poor man's cow".

Some findings reflected that only grazing might not be sufficient for weight gain of goats (Kochapakdee et al. 1994; Mahjan et al. 1976). If scavenging goats can be supplemented with minimum amount of concentrate, the level of production may be increased at the minimum cost. With the growing human population and increasing demand for cereal food, the lands used for natural grazing of goats are reducing day by day. So, farmers are now trying to adapt and rear goat under intensive management system. Therefore, appropriate feeding technique

*Corresponding Author: mjkhan_bau04@yahoo.com

is needed for goat to be reared under intensive condition. To achieve the goal, the productivity of goat may be increased through nutritional manipulation either by concentrate feeding (Pathasarathy, 1986) or supplying good quality forages (Muri and Jordan 1991). Energy and protein concentrations of the diet play a significant role on growth of goats (NRC, 1981). Louca and Hancock (1977) reported that growth rate of kids increased with increasing protein content of the diet. However, reports on the nutrient requirements are scanty and very little information is available particularly on the contribution of dietary protein to the performance of Black Bengal goats under Bangladesh condition.

Therefore, the present experiment was undertaken to investigate the effects of different levels of concentrates on nutrient intake, digestibility, growth and carcass yield in Black Bengal goats under intensive system of rearing.

Materials and Methods

The study was conducted at the Animal Nutrition Field Laboratory, Bangladesh Agricultural University, Mymensingh for a period of 75 days between February and May 2009. Ambient temperature during the experimental period varied from 21.52 to 32.55°C with an average relative humidity of 80.72% (Weather Yard, 2009, BAU station) was recorded.

Experimental Animals and Management

Fifteen (15) castrated male Black Bengal goats aged between 12 and 13 months weighing on an average of 12.97±1.46 kg were used for the experiment. The animals were allowed 10 days to adapt with the experimental conditions and experimental feed prior to the commencement of the study. All the goats were ear tagged; feces were examined for parasitic infestation and dewormed with an antihelminthic drug (Livamizol, 250 mg). Following adaptation, goats were housed in individual pens subjected to natural ventilation and sun light. All animals were reared under same management condition. All goats were housed in a tin shed having iron-slatted floor raised above the ground level to keep them comfortable. Separate feeders were used for roughage and concentrate for each goat. Experimental animals were examined routinely to identify any health problems. Feeder and waterer were cleaned every morning before supplying the feeds.

Experimental Diets

The goats were assigned at random to five treatment groups (A-E) with three goats in each group. The animals of the dietary group A received only Dal grass (*Hymenachne amplexicaulis*) and the goats of group B to E received concentrate mixture 15, 20, 25 and 30% of required dry matter respectively and rest from Dal grass. Each diet was supplied to the respective group @ 158g DM per kgW^{0.75}. Dal grass was fed as roughage and concentrate feed comprised of maize (50%), wheat bran (19%), mustard oil cake (20%), soybean meal (5%), bone meal (5%) and salt (1%). The concentrate mixture contained 89.2% DM, 15.6% CP and 12.6 MJ ME/kg DM. Dal grass was collected in every morning and evening followed by cleaning, chopping and supplied to the animals. The concentrate mixture and green grass were offered individually in plastic pans and wooden basket respectively. The roughage and concentrate portions of the diets were fed separately. About 50% of the diet (roughage and concentrate) were provided at 7.30 am and the remaining at 4.00 pm. Fresh drinking water was made available *ad libitum* to all goats at all times.

Measurement of live weight gain

The initial live weight of each goat was taken at the beginning of the experiment for two consecutive days before offering feed at morning and the mean weight of individual animals were recorded as initial weight. Thereafter, animals were weighed individually in every 7 days interval throughout the experimental period. Final live weight of each animal was taken as an average weight of two consecutive days after completion of 75 days trial.

Digestibility Measurement

A conventional digestibility trial was conducted at the end of the growth trial for 7 days to assess the utilization of dietary nutrient by the goats. Feed refusals and feces voided by each goat during 24 hours were collected and weighed. All possible precautions were taken such as goat was kept in individual metabolic crates and feces was collected carefully from the net of metabolic crates to avoid mixing with urine.

Carcass Yield

The animals were weighed individually and slaughtered. The slaughtered goats were allowed

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to bleed properly usually for 10 minutes. The carcass was hoisted from its hock at a convenient height. The head was then removed at its atlanto-occipital articulation followed by flaying and evisceration. Feet below the carpals (knee bones) in the forelegs and tarsals in the hind legs were also removed. After finishing the above process the carcass weight were taken individually. Then dressing percentage was calculated from the carcass weight divided by the live weight then multiplying by 100.

Chemical analysis

Respective samples of feed, feces and leftover were subjected to chemical analysis for the determination of dry matter (DM), organic matter (OM), crude protein (CP), crude fibre (CF), ether extract (EE) and nitrogen free extract (NFE) following the methods of AOAC (2004).

Statistical analysis of the data

The data were analyzed using the "MSTATC" statistical program to compute analysis of variance (ANOVA) in a completely randomized design (CRD) and the mean values with standard error deviation (SED) were recorded. Duncan's Multiple Range Test (DMRT) was also done to compare the treatment means for different parameters.

Results and Discussion

Digestibility

The DM, CP, CF, EE, NFE and OM digestibility (%) for B, C, D and E diets were significantly higher ($P < 0.01$) than diet of A (Table 1). There was also significant variation ($P < 0.01$) among B, C, D and E gradually due to gradual increase of concentrate. This result of CP digestibility agreed with the result of Omar (2002) in which he stated that CP digestibility of 20% sesame oil cake (83.0) was significantly ($P < 0.05$) higher than 10% sesame oil cake (79.7) feed. Soto-Navarro et al. (2005) reported no significant variation in nitrogen digestibility from different levels of SBM supplementation. Higher level of protein from SBM helped increase digestibility of protein.

Growth performance

The effects of concentrate supplementation on growth performance are shown in Table 2 and

Figure 1. The total live weight gain of goats belonged that group E was statistically higher ($P < 0.01$) than group A and B. Though group B showed higher live weight gain than group A but there was no significant difference among B, C and D as well as C, D and E. Previous studies (Shahjalal et al. 1992) indicated that sources of nitrogen supplementation had effect on weight gain of Angora goats. The average live weight gain per day in kids received the high protein diet (16% CP) was higher (62.4 vs. 45.4 g/d) than those fed the low protein diet (10% CP) up to weaning (Kabir et al. 2002). The higher level of concentrate supplement increased daily live weight gain of kids (Bhuiyan et al. 1996).

However, there are also evidences that growth rate increased linearly as the level of protein increased in the diet (Bishwas, 1997; Lu and Potchoiba 1990). Feed conversion efficiency (LWG/DMI) in group E was higher ($P < 0.01$) than other groups. There was no significant difference among B, C and D and B and A but C and D differed from A. In contrast, DM intake, weight gain and feed efficiency (ADG/DMI) were mostly similar among goats receiving different levels of CP in the diet (Prieto et al. 2000). Bishwas (1997) also showed that high protein diet did not significantly improve conversion efficiency of DM and ME. Protein conversion efficiency (PCE) of group B, C, D and E was statistically higher ($P < 0.05$) than group A. Energetic efficiency was highest ($P < 0.05$) in group E then D followed by C and B than A. The difference of different parameters (Total LWG, FCE, PCF and energetic efficiency) among different treatment groups (A, B, C, D and E) might be due to supplementation of different level of concentrate particularly CP and ME.

Nitrogen Balance

All the animals used in the present experiment showed positive nitrogen balance. It can be observed from Table 2 that N balance of goats fed diet B, C, D and E showed significantly higher ($P < 0.01$) values than diet A. Though there was no significant difference among E, D and C or D, C and B but E showed highest N balance. These results indicate that an increase in concentrate supplementation showed significantly higher N balance.

Table 1. Apparent digestibility of different diets (g/100g)

Item	Dietary treatments					SED	Sig.
	A	B	C	D	E		
DM	50.49 ^e	54.61 ^d	58.48 ^c	64.26 ^b	66.55 ^a	1.61	**
CP	47.50 ^e	56.84 ^d	60.67 ^c	63.69 ^b	66.80 ^a	4.01	**
CF	50.23 ^e	52.71 ^d	57.22 ^c	66.97 ^b	69.46 ^a	2.11	**
EE	49.17 ^e	54.06 ^d	59.23 ^c	61.82 ^b	65.31 ^a	1.60	**
NFE	49.63 ^e	55.55 ^d	59.77 ^c	65.09 ^b	67.44 ^a	1.79	**
OM	50.99 ^e	60.97 ^d	63.44 ^c	66.16 ^b	70.96 ^a	1.83	**

Figures with different superscript in the same column differ significantly; **, significant at 1% level of probability; SED, standard errors of deviation

Table 2. Growth performance of Black Bengal goats fed different levels of concentrate supplement

Parameters	Dietary treatments					SED	Sig.
	A	B	C	D	E		
Initial live wt	12.99	13.05	12.87	12.94	12.99	0.39	NS
Final live wt (kg)	14.06	15.58	15.80	16.14	16.90	0.50	NS
Total live wt. gain (kg)	1.07 ^c	2.53 ^b	2.93 ^{ab}	3.20 ^{ab}	3.93 ^a	0.31	**
FCE (IWG/DMI)	0.04 ^c	0.07 ^{bc}	0.08 ^b	0.08 ^b	0.09 ^a	0.00	**
PCE (CPI/LWG)	2.18 ^a	1.51 ^{cb}	1.33 ^{bc}	1.30 ^b	1.16 ^b	0.13	*
Energetic efficiency (MEI/LWG)	0.22 ^a	0.15 ^b	0.12 ^c	0.12 ^c	0.11 ^d	0.01	*
N balance (g/d)	3.14 ^c	5.98 ^b	6.48 ^{ab}	6.80 ^{ab}	7.82 ^a	0.491	**

Figures with different superscript in the same column differ significantly; * and **, significant at 5% and 1% level of probability, respectively; NS, not significant; SED, standard errors of deviation

Carcass characteristics

The dressing percentages of concentrate supplemented groups (B, C, D and E) were higher than group A, fed only dal grass. The dressing percentage was gradually increased due to gradual increase of concentrate supplementation (Table 3). The dressing percentage of present study was higher than the value for Black Bengal goat and cross bred (41.48% to 43.73%) observed by Abedin et al. (2005), Moniruzzaman et al. (2002) and Das et al. (2005). However, a lower dressing percent and age of Black Bengal goats (38.61%) was also reported by Singh et al. (1986) in Indian Black Bengal goat. Chowdhury and Faruque (2004b) reported dressing percent of Black Bengal goat between 181 and 365 days of age was 46.4%. Devendra and Owen (1983) and Verma et al. (2004) reported the value 48.10% -52.15% for Indian pure Black Bengal breed. These two values agreed with the present findings. The variation in dressing percentage of Black Bengal goats observed by different investigators might be due to the variation in age, body condition and nutritional status of the slaughtered animals.

Economics study of the experiment

The feed cost of rearing animals was calculated based on the market price of feed ingredients

during the trail period. The Price of dal grass was taken as Tk 0.5 per kg. It reveals from Table 4 that the total feed cost per animal of group E was statistically higher ($p < 0.01$) than B, C, D and A. But the cost for B, C and D was statistically similar and differed from A.

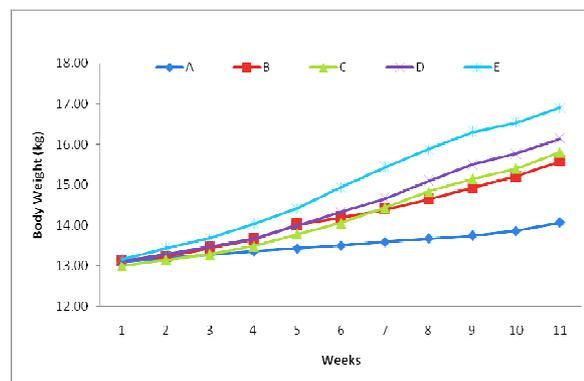


Figure 1. Cumulative body weight of different groups of goats

Total rearing cost also similar to feed cost except group B. Total cost of B was lower than group C and D. Total meat yield was highest ($P < 0.01$) in group E than other groups. Net profit was highest ($P < 0.01$) in group E (+134.25) than that of group B and A. There was no statistical difference among group C, D and E or group B, C and D. Group A showed negative balance (-115.25).

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Table 3. Cost analysis of different treatment groups per goat by 75 days

Parameters	Dietary treatment					SED	Sig. level
	A	B	C	D	E		
Total feed cost	83.25 ^c	235.5 ^b	291.75 ^b	337.25 ^b	414.75 ^a		**
*Other costs	200	200	200	200	200	0.00	-
Total cost of rearing	283.25 ^d	435.25 ^c	491.25 ^b	537.25 ^b	614.75 ^a	33.82	**
weight gain (kg)	1.07 ^c	2.53 ^b	2.93 ^{ab}	3.20 ^{ab}	3.93 ^a	0.31	**
Dressing %	45.22 ^c	51.45 ^b	52.05 ^{ab}	53.65 ^{ab}	54.73 ^a	0.99	**
Total meat yield	0.484 ^c	1.30 ^b	1.53 ^{ab}	1.72 ^{ab}	2.15 ^a	0.18	**
Price of meat (@ 350Tk/kg)	168.0 ^c	455 ^b	535.16 ^{ab}	600.83 ^{ab}	749 ^a	62.89	**
Profit/loss (Tk/animal)	-115.25 ^c	+19.75 ^b	+43.91 ^{ab}	+63.58 ^{ab}	+134.25 ^a	27.24	**

*Other cost, Labour cost, plastic bottle etc.; Means with different superscripts in the same column differed significantly; SED, standard error deviation; **, $p < 0.01$; +, profit; -, loss

Conclusion

Feeding of goats through supplying of green grass do not fulfill the appetite and nutrient requirements. Concentrate supplementation is undoubtedly essential to fulfill the nutrient requirements. Supplementation of concentrate mixture with 15.60% crude protein at the rate of 30% of total required dry matter per 100 kg body weight is suggested for optimizing growth performance of Black Bengal goat under stall-feeding system in Bangladesh.

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