



Impact of straw-based complete pellet feed on goat production at the community level in selected areas of Bangladesh

Md. Ashraful Islam¹, Razia Khatun^{1*}, Masud Rana², Sabina Yasmin¹, Syidul Islam¹, Sharmin Sultana¹, Sadek Ahmed³ and Nasrin Sultana⁴

¹Farming System Research Division, Bangladesh Livestock Research Institute, Savar, Dhaka-1341

²Incharge, Bangladesh Livestock Research Institute regional Station, Jashore Sadar, Sadar

³Goat production Research Division, Bangladesh Livestock Research Institute, Savar, Dhaka-1341

⁴Bangladesh Livestock Research Institute, Savar, Dhaka-1341

ARTICLE INFO

Article history

Received: 05 December 2023

Accepted: 27 December 2023

Keywords

Straw-based Pellet Feed, Goat Production, Community Level, Bangladesh

Corresponding Author

Razia Khatun

Email: rkbaby96@yahoo.com

ABSTRACT

Goat farming is a profitable business for the women and rural farmers of Bangladesh. Due to the increasing population and decreasing land size, it was difficult to rear goats in a semi-intensive farming system. Now, farmers are rearing goats in a closed system with stall feeding. Straw-based complete pellet feed may offer a cost-effective solution with balanced nutrition, enhancing the production performance of goats in Bangladesh. A straw-based complete pellet feeding trial was done in black bengal and cross-breed goats in Jashore Sadar and Shorifbag, Dhamrai areas. Young goats of about 4-10 months of age were selected and divided into treatment and control groups in each location. Then straw-based pellet feed was supplied to the treatment group and data were recorded on different parameters and analyzed in SPSS Software. In this study, the average daily gain of cross-breed goats in the Jashore treatment group was 85.33gm which is higher than the control group (44.25gm). Whereas in the Shorifbag area, the average daily gains of black bengal goats were 80.19 ± 17.91 gm in the treatment group and 27.43 ± 4.30 gm in the control group. The average body weight change of cross-breed goats was 8.53 ± 2.18 kg in the treatment group and 4.42 ± 0.57 kg in the control group. In black bengal goats average body weight change was 5.77 ± 1.29 kg in the treatment group whereas 1.97 ± 0.31 kg in the control group. In black bengal goats the FCR value was 6.36 compared to cross-breed goat 7.11. BCR in complete pellet-feeding black bengal goats was 2.47 and in cross-breed goats 2.21. Whereas in the control group, BCR were 1.15 and 1.31 for black bengal and cross-breed goats respectively. This result suggests that complete pellet feeding would be more economical in community-level goat production under stall-fed conditions, and farmers will be more benefited using complete pellet feed compared to conventional grass and concentrate feed.

Introduction

Goats have been associated with humans since the beginning of agriculture and the domestication of animals, a very important animal providing different products and services to man throughout the world, especially in developing countries (Bhardwaj *et al.*, 2018). Goat is a valuable and promising livestock species used mainly for meat production around the world (Barkley *et al.*, 2012). Goats represent the second most important species of ruminant livestock and are highly popular among the smallholder farmers in Bangladesh. In Bangladesh, about 26.9 million goat herds are distributed over the country (DLS, 2023), which are commonly reared in a semi-intensive system, and have also created women empowerment opportunity, contributing country's economic growth as well poverty alleviation in rural and urban areas. At present there is little scope for free grazing of goats and sheep resulting in low productivity and poor reproduction of animals. In rural areas of our

country, feeding of small ruminants mainly depends on the agricultural crop residues and by-products, low-quality hay, tree leaves, and natural grasses (Hassan and Talukder, 2011). Furthermore, seasonal variations play a potential role in the nutrient content of common grasses, as grasses have higher dry matter (DM) content during the dry season than rainy season (Rashid *et al.* 2016). However, these available feed sources are characterized by high roughage content with low protein, energy, mineral, and vitamin contents, which cannot adequately meet the maintenance requirements of goats (Huque, 2012). Goats are selective feeders and their food intake can be reduced under confinement; therefore, careful attention should be observed when determining ad-libitum intake (Goetsch *et al.*, 2010). As a result, goat performance is poor due to low digestibility coupled with lack of feed intake (Sultana *et al.*, 2017). According to Rashid *et al.* (2016), faster growth rates have been found in stall feeding goats than feedlot goats, as it allows finishing at specific target weights. Therefore, it is

necessary to determine an alternative feeding approach for rearing goats under intensive or stall-fed conditions to increase the profitability of goat farmers in our country. Feeding system based on complete pellet feed could be a promising approach for better utilization of poor quality crop-residues and agro industrial by-products. This would help developing stall-feeding methods for commercial goat production and this would encourage the feed manufacturing entrepreneurs for commercial production of complete pellet feed. This system of feeding also ensures the supply of balanced nutrients reduces feeding cost and maximizes production by converting poor quality and non-edible by-products into palatable and highly nutritious animal feeds. Therefore, a validation trial of rice-straw based complete pellet feed technology was conducted at farmers level to observe the performances of goat.

Materials and Methods

Site and farmer’s Selection

The experiment was conducted at Shorifbag Dhamrai and at Modhugram Jashore Sadar upazila under the Dhaka and Jashore district of Bangladesh. A total of 10 farmers were selected, having at least four goats that were 4-10 months of age. One farmer’s goat from each upazila was taken for the control group.

Animal preparation

An on-farm field trial was conducted, total animal were prevented from some selected disease. For this region, all the selected animals were tagged and deworming doses were given according to their demand. Vitamin was given in injectable form and then PPR vaccine was also given in individual goats.

Animal management

Black bengal goat at Dhamrai and cross (Jamunapari x BBG) goat breed at Jashore sadar was taken in this study. The goats were reared under the traditional semi-intensive system and fed with complete pellet feed and sheltered at night. Housing facilities were improved by providing slat to the farmer. Management service was improved by supplying adequate materials and technological facilities.

Farmer’s knowlege

A participatory meeting and brief discussion were held with farmers, technical persons, and DLS personnel. During the session, participants were briefed about the study design, the benefits of pellet feeds, and methods for providing them to the goats.

Baseline Survey

A base line survey was carried out in different parts of the selected areas with a structured questionnaire and interviewing of 5 goat farmers in each location. Data were collected through face to face interviewing of every family. This baseline survey was conducted about their goat rearing and feeding and management system and also the socioeconomic status of selected farmers.

Experimental Trial

Collection and processing of feedstuffs

Rice straw and agroindustry-based concentrate feed ingredients were purchased from the local sources. Rice straw was used as a roughage source with the agroindustry-based concentrate mixture to formulate the basal total mix ration for pelleting according to the goats’ nutrient requirement. For the pelleting of feed, a small-scale pelleting machine was designed and fabricated locally. All the roughages were ground to 5 mm using a Hammer mill machine containing a 5-mm sieve.

Preparation of pellets feed

Roughage (rice straw) 40%, Concentrate 60%

Ingredients of concentrate	Percent
Rice polish	50
Maize crush	16
Soybean meal	20
Molasses	10
Salt	2
Dicalcium phosphate	1
Vitamin–mineral premix	0.5
Pellet binder	0.5

Formulation of complete pellet feed was done according to Ahmed *et al.* (2020). Before transferring it to the pelleting machine, an adequate amount of water (about 50%) was added for better mixing. The prepared pellet was sun-dried and stored for 3-4 months before goat feeding.

Adjustment period

Goats were reared under stall feeding conditions and fed complete pellet feed, allowing a 10-day adjustment period. Complete pellet feed was provided at morning time and traditional feed was at noon in the adjustment period.

Feeding trial

There were divided into two treatment groups (T_0 and T_1) having 4 goats in T_0 group and 16 goats in T_1 group in each location. In T_0 group, goats were reared under the traditional semi-intensive system and grazed for 6-7 hours in grazing land for eating fallow/road side green grasses during the day, no or minimal concentrate supplementation and kept inside the shed at night. In T_1 group, goats were reared under stall feeding system and rice-straw based complete pellet feed was provided ad-libitum in a large bowl twice daily in two equal installments (morning and evening) and fresh drinking water was provided to all experimental goats. Animals were weighed every two weeks interval before morning feeding. The feeding experiment lasted for 130 days from 23 May to 30 September 2022.

Data collection

In the experimental period, daily feed supply and left-over, goat initial body weight, animal fortnight weight, daily body weight gain, FCR, vaccination, deworming and others goat related problems were kept in register book regularly. Collected data will be analyzed in accordance with the objectives of the

study. Mean, standard deviation and percentage will be used mainly to illustrate the results. Data were analyzed using the unpaired student t-test along with GLM procedure of SPSS statistical package. Significant differences between two treatments means were measured by Duncan's multiple range test at $P < 0.05$.

Results and Discussion

Feeding trail at Jashore area

The effect of complete pellet feed on performance of cross goat (Jamunapari x Black Bengal Goat) in farmer's level at Modhugram Jashore Sadar upazila is shown in Table 1. In respect to the weight gain of goats, the average body weight change and daily gain was found significantly ($P < 0.01$) higher in complete pellet feeding group than conventional feeding. The average daily gain of treatment group goat were 85.33gm which were nearly doubled than control group that's were 44.25gm. The findings of the present study indicated that the daily weight gain increased about two times resulting of complete pellet feeding when goats were reared under stall feeding system. Similar result was found from a trial conducted by (Dahlan *et al.*, 2000) It was in agreement with Ahmed *et al.* (2020) who reported that feeding complete pellet feed under stall feeding system improved daily body weight of goats (36.96 and 52.46 gm) as compared to traditional rearing (17.76 gm). Variation in weight gain was due to cross breed goat had high average daily gain.

Table 1: Performance of goat fed on complete pellet feed in the on-farm condition

Items	Treatments (mean± SD)		t-statistic	P-value
	T_0 (n = 4)	T_1 (n = 16)		
Initial live weight (kg)	15.20 ± 2.246	17.42 ± 5.66	-0.75	0.461
Final live weight (kg)	19.62 ± 2.63	25.95 ± 6.44	-1.89	0.076
Body weight change (Kg)	4.42 ± 0.57	8.53 ± 2.18	-3.66	0.002
ADG(g/day)	44.25 ± 5.68	85.33 ± 21.84	-3.66	0.002
Feed intake (kg)	-	58.64 ± 6.78	-16.93	-
FCR	-	7.11 ± 1.07	-12.97	-

T_0 = Control (Goats were grazed for 6-7 hours in grazing land during the day, no or minimal concentrate supplementation and kept inside the shed at night); T_1 = goats were reared under stall feeding system and complete pellet feed; mean in the same row having different superscripts are significantly different at values $P < 0.05$.

Feeding trail at Dhamrai area

The effect of complete pellet feed on performance of BBG in farmer's level at Shorifbagh village in Dhamrai upazila is shown in Table 2. In treatments, there was no significant difference in the average final body weight of goats during the days of rearing. However, in respect to the weight gain of goats, the average body weight change and daily gain was found significantly ($P < 0.01$) higher in complete pellet feeding group than conventional feeding. The findings of the present study indicated that the daily weight gain increased about two and

half times resulting of complete pellet feeding when goats were reared under stall feeding system. It was in agreement with report of Ahmed et al. (2020) about feeding complete pellet feed under stall feeding system improved daily body weight of goats (36.96 and 52.46 gm) as compared to traditional rearing (17.76 gm). Similarly, Sultana et al. (2015) observed that Black Bengal goats' average daily weight gain is 27.6, 35.1, 43.2, and 43.8 gm per day when offered ad-libitum green grass with 150, 200, 250, and 300 gm concentrate mixture, respectively.

Table 2: Performance of goat fed on complete pellet feed in the on-farm condition

Items	Treatments (mean± SD)		t-statistic	P-value
	T0 (n = 4)	T1 (n = 16)		
Initial live weight (kg)	15.90 ± 3.09	13.64 ± 5.38	1.10	0.300
Final live weight (kg)	17.87 ± 3.20	19.41 ± 5.92	-0.70	0.499
Body weight change (Kg)	1.97 ± 0.31	5.77 ± 1.29	-10.62	0.000
ADG(g/day)	27.43 ± 4.30	80.19 ± 17.91	-10.62	0.000
Feed intake (kg)	-	35.13 ± 0.59	-	-
FCR	-	6.36 ± 1.34	-5.80	0.000

Table 3: Comparative data of goat fed on complete pellet feed in different location

Parameters	Jashore Sadar, Jashore		Dhamrai, Dhaka	
	Treatment (T ₁)	Control (T ₀)	Treatment	Control
Breed	Cross (JGxBBG)	Cross (JGxBBG)	BBG	BBG
FCR	7.11		6.36	
Daily weight gain	85.33	46.17	80.19	27.43
Feed cost/kg body gain(tk.)	156.5	264	139.92	300
Feed cost/kg meat gain	313	528	279.84	600
Total cost per kg weight gain	203.45	343.2	181.82	390
Total benefit/kg weight gain	450	450	450	450
BCR	2.21	1.31	2.47	1.15

Considering meat price 900/- kg; 50% dressing percentage and pellet feed cost tk. 22/-

T₀ = Control (Goats were grazed for 6-7 hours in grazing land during the day, no or minimal concentrate supplementation and kept inside the shed at night); T₁ = goats were reared under stall feeding system and complete pellet feed; mean in the same row having different superscripts are significantly different at values $P < 0.05$.

The FCR values didn't show significant differences between the treatment groups. BBG had an FCR of 6.36, while crossbreed goats had an even better FCR of 7.11. Pelleting of mash ration improved daily weight gain and reduced feed per kg gain in lambs and kids compared to conventional ration (Reddy and Reddy, 2003). But, Average daily gain Crossbreed goat were slightly higher than Black

Bengal goat and significantly higher in treatment groups in compare to control group in selected areas. Feed cost in treatment group were lower than in control group. This result is in agreement with findings of (Rashid et al., 2012), who reported that lowest feed cost (BDT 150.93) per kg weight gain by complete feed compared to conventional grass and concentrates-based feeding system (BDT

226.08). BCR in complete pellet feeding Black Bengal goat were 2.47 in compare with complete pellet feeding cross goat 2.21 and in control group black Bengal 1.15 and cross breed 1.31 respectively. Ahmed *et al.* (2020) also got better BCR (1.93) in complete pellet feeding black Bengal goat group. The results of this study suggested that complete pellet feeding would be more economical for commercial goat production under stall fed condition, and farmers would be more benefited using complete pellet feed compared to conventional grass and concentrate fed. No disease or digestive abnormalities were observed during the experimental period. Using rice straw-based complete pellet feed indicated that pellet feeding did not alter the normal digestive function and physiological changes in feed metabolism.

Conclusion

The results suggest that rice-straw based complete pellet feed could be an alternative ready feed and more economical for commercial goat production under stall feeding system in farmers level. The daily weight gain of 85.33 and 80.19 grams for crossbreed goats and BBG respectively, using complete pellet feed technology, shows a clear advantage over traditional goat farming methods in Bangladesh. Thus, it is expected that the famers will be economically more benefited with minimum feed cost compared to conventional grass, urea molasses straw and concentrate-based feeding system.

Acknowledgments

This research was funded by PIU-BARC, NATP-2 Project, Bangladesh Agricultural Research Council, Farmgate, Dhaka, Bangladesh, through Competitive Research Grant sub-projects. We also grateful to the authority of goat production research division for providing complete pellet feed.

Conflict of interest

There is no potential conflict of interest in this study, including preparing the manuscript and publications.

References

- Ahmed, S., Rakib, M.R.H., Hemayet, M.A., Roy, B.K., & Jahan, N. (2020). Effect of complete pellet feed on commercial goat production under the stall-feeding system in Bangladesh. *J Adv Vet Anim Res.*, 7(4):704-709.
- Barkley M.E., Knoll K., Kime L.F., Harper J.K. State College, PA: The Pennsylvania State University; 2012. Meat goat production. Penn State Extension.
- Bhardwaj J.K., Kumar V., Saraf P., Kumari P., Mittal M. (2018). Current status and changing national scenario of goat population: A review. *Agril Rev.*, 39(2):91-103
- Dahlan I, Islam M, Rajion M.A., (2000) Nutrient intake and digestibility of fresh, ensiled and pelleted oil palm (*Elaeis guineensis*) frond by goats. *Asian-Aus. J.Anim.Sci.*,13:1407-1413.
- DLS (2023). Livestock Economic at a glance. DLS Report, Department of Livestock Services, Dhaka, Bangladesh.
- FAO (2008). Production Year Book. Food and Agriculture Organization, Rome. 41:89.
- Goetsch A.L, Gipson T.A., Askar A.R., Puchala R. (2010). Invited review: feeding behavior of goats. *Journal of Animal Science.*, 88:361–373
- Hassan M.R., Talukder M.A.I., 2011Comparative performance of different regional native sheep in Bangladesh. *J Bangladesh Vet.*, 28(2):85-94
- Huque K.S. (2012). Changes in and challenges of Bangladesh livestock. BLRI Newsletter 3: Bangladesh Livestock Research Institute, Dhaka, Bangladesh, p 1.
- Melanie E.B., Karen K., Lynn, F.K. & Jayson K.H. (2012). Meat goat production. Agriculture Alternatives, The Pennsylvania State University, State College, PA.
- Rashid, M.A., Khan M.J., Khandoker M.A.M.Y. & Akbar M.A., Monir (2016). Compound pellet on performance of growing black bengal goat. *IOSR J Agric Vet Sci.*, 9(2):43-50.
- Reddy G.V.N. & Reddy J.L. (2003). Effect of cotton stalks based complete diet on growth and carcass characteristics in sheep and goat in field condition. *Indian J. Anim. Nutr.*, 20:97-100.
- Sultana N, Alimon A.R., Huque K.S., Sazili A.Q., Yaakub H., Hossain J. (2015). The feeding value of Moringa (*Moringa oleifera*) foliage as replacement to conventional concentrate diet in Bengal goats. *Adv Anim Vet Sci.*, 3(3):164-173.
- Sultana, N., Rakib, M.R.H., Hossain, S.M.J. Ahmed, S., Ershaduzamman, M. & Talukder, M.A.I. (2017). Effect of replacement of conventional concentrate in a rice straw diet by moringa foliage on lamb production performances. *J Exp Agril Int.*, 15(5): 1-14.