Article

Growth and reproductive performances of Hilly Brown Bengal goat under semi-intensive management condition at Naikhongchari hilly areas of Bangladesh

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Abstract: The objective of the study was to evaluate the growth and reproductive performances of Hilly Brown Bengal (HBB) goats of different generations and conducted at Naikhongchari Regional Station Research Farm of Bangladesh Livestock Research Institute. Goats were reared in a plastic slated floor under semi-intensive system and were allowed to graze for 6-7 hours per day. Animals were given a concentrate mixture containing 17% CP, 11 MJ ME/kg DM provided twice daily in the morning and evening at the rate of 1% of their body weight. All goats were kept separately according to sex and age groups to avoid random mating. Natural mating program was performed to improve the economically important traits. Goats were de-wormed and diping on regular intervals and only PPR vaccine was given at the age of 2 months. Data on productive, reproductive and disease incidence of goat were recorded regularly and were analyzed. Results showed that Kid Birth Weight of HBB goats were significantly (P<0.01) differ among generations. Birth weight of G_3 (1.21±0.013 kg) was higher than G_5, G_4, G_2 and G_1 (1.11±0.01 kg). Goat body weight of 3, 6 and 9 months age were non-significant among generations. The age and weight at first conception were significantly (p<0.05) differ among generation. Age at first conception was lower of G_4 (301.57±9.06 days) and higher of G_1 (259.80±18.87 days) but body weight at first conception of G_1 (12.23±0.47 kg) was higher and G_4 was lower (10.65±0.52 kg). Age at first kidding, gestation length and kidding interval was not significant (P>.05) effect on generations. Parity had no significant (P>.05) effect on kid birth weight but significantly (p<0.01) differ of Kid litter weight and litter size. According to birth type single kid was highest birth weight (1.21±0.08 kg) than double kid followed by triplet and quadruplet. Mortality percentage of HBB kids at the age of 0-90 days were 13.08±0.23%. It may be concluded that kid birth weight, age and weight at first conception of HBB goat were significantly (P<.05) affected on generation but age at first kidding, gestation length and kidding interval were non significantly (P<.05) affected.

1. Introduction

The majorities of the tribal people live in the Hilly forests with primitive ways of life. These regions possess slightly different type of genetic resources of livestock and poultry rather than the common indigenous. The priority should be given to increase the milk, meat and egg production from the available genetic resources of livestock through better management, feeding animal health and genetics. In this part, attempt has been taken to improve the production potentialities of the native genetic resources of livestock at Hilly regions. There are about 26.10 million goats in Bangladesh (DLS, 2018). Black Bengal Goat comprises more than 90% of the total goat population (Husain *et al*., 1998). Black Bengal goats bear variety of coat color, black, black and white, brown, brown and white and white coat color. Brown Bengal goat, a variety of Black Bengal goat, is available

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at the hilly districts of Bangladesh. They are reputed to be very hardy and capable of thriving in any adverse environmental condition. The Hilly Brown Bengal (HBB) goats are dwarf breed and are grazing top of the hills. They are known to be famous for its high adaptability, fertility, prolificacy, delicious meat and superior quality skin (Husain *et al.*, 1998, Talukdar *et al.*, 2014). In the hilly areas, goats are regarded as an intimate and integral part of rural farmers and most of the landless and marginal farmers own 1-5 goats and contribute economically to the subsistence farmers in mixed farming systems (Husain, 1993). Goat is also considered as the most promising livestock species for commercial meat (chevon) production. However, systematic information on growth and reproductive performance of HBB goats is very limited. These HBB goats are no doubt a promising treasure of Bangladesh but are going to be extinct. Thus, conservation and preservation of genetic resources as insurance against future needs has become a topic of mounting concern (Crowford, 1984). Therefore, the main objective of the study is to evaluate the growth and reproductive performances of HBB goats of different generation and their improvement and conservation at Naikhongchari.

2. Materials and Methods
2.1. Location of the study
The experiment was conducted at Bangladesh Livestock Research Institute Regional Station Research Farm which is located in Naikhongchari upazilla under Bandarban District.

2.2. Feeding and rearing system
The studied of HBB goats were maintained in a semi-intensive rearing system. Females were allowed to graze for 6 hours (from 9 AM to 3 PM) with 1-hour rest (1:00 PM to 2:00 PM). Kids up to three months of age were allowed to graze with their mother. Bucks were allowed to graze for 2 hours (from 7 AM to 9 AM) in morning and one hour in afternoon. Animals were given a concentrate mixture containing 17% CP, 11 MJ ME/kg DM provided twice daily in the morning and evening at the rate of 1% of their body weight for different categories as pregnant and milking does, dry goats, growers, kids and bucks.

2.3. Housing
Goats were housed in a plastic slated floor of 1m above from the ground. Bucks and bucklings were always kept separately from the does herd to avoid unplanned mating. Young kids were kept in a separate room with facilities for temperature control, feeding and watering provision and with adequate bedding materials during winter season. All goats were kept separately according to sex and age groups to avoid random mating.

2.4. Breeding program
Natural mating program was performed to improve the economically important traits. The physical sign of heat (barking, swelling and mucus discharge of vulva, jumping on other animal, off-feed) was observed with a buck every day morning. Female in estrous were mated with the buck naturally according to mating chart that has been planned previously.

2.5. Health care and diseases
Animals were vaccinated against PPR (Peste Des Petits Ruminants) for two times in a year. Kids were also vaccinated against PPR after two months of age. De-worming program was done every three month in a year and animals were dipped in 0.5% melatheon solution for each month. Necessary treatments were provided against specific diseases according to the suggestion of Veterinarian. Sick animals or kids, stunted growth, unthrifty condition and any severe skin diseases were also regularly treated and culled.

2.6. Reproductive characteristics
Data on productive, reproductive and disease incidence traits were recorded during 2015 to 2018. Reproductive traits studied were: litter size (LS), litter weight (LW), kid birth weight (KBW), gestation length (GL), age at first conception (AFC), age at first kidding (AFK) and kidding interval (KI). Mortality of HBB goat kids was also recorded. All the information about production and reproduction were recorded in an individual data sheet for each of the animal.

2.7. Statistical analysis
The statistical analysis of the data was performed using compare mean with one way ANOVA and univariate analysis of variance procedure of SPSS 17.0 package. The difference between treatments means were examined by using Duncan Multiple Range Test (DMRT).

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3. Results and Discussion

3.1. Effect of generation on growth performance of HBB goats

Results showed that kid birth weight of generation$_1$ were significantly (P<0.01) differ with other generation of G_2, G_3, G_4 and G_5. Birth weight of G_3 (1.21±0.013 kg) was higher than G_5, G_4, G_2 and G_1 (1.11±0.01 kg) (Table 1). Jalil *et al*. (2016) reported that average birth weight of Black Bengal goat at generation$_0$, generation$_1$ and generation$_2$ were 1.24±0.01, 1.33±0.02 and 1.32±0.04 kg respectively which is slightly higher than the present study. Akter *et al*. (2006) showed the average body weight at birth of Black Bengal goat was 0.96 ± 0.04, 1.02 ± 0.08 and 1.12 ± 0.11 kg at 1st, 2nd and 3rd generation respectively in selected group which is slightly lower than the findings. Result also showed that body weight of 3, 6 and 9 months age of HBB goats were non-significant among generations (Table 1). Within breed, variation in birth weights is partly genetic, but largely due to variation within the environment, especially nutrition, management and health (Devendra and Burns, 1983). Body weight of G_5 was higher at 3, 6, and 9 months of age than G_1, G_2, G_3, and G_4. Jalil *et al*. (2016) observed that the weaning weight were 5.15±0.37 kg, 5.34±0.16 kg, 4.87±0.39 kg and 4.17±0.14 kg at generation 1st, 2nd, 3rd and foundation stock (G_0) respectively with average mean 4.88±0.07 kg which is slightly higher than the present study. Akter *et al*. (2006) also observed that the average weaning age is 3 months and their weight in selected groups of Black Bengal goat was 4.99 ± 0.15, 4.64 ± 0.33 and 4.07 ± 0.42 kg at 1st, 2nd and 3rd generation respectively which closely agrees with the study.

Table 1. Effect of generation on growth performance of hilly Brown Bengal goat.

Generation	Parameters (kg)			
	Birth wt. (Mean±SE)	3-m wt. (Mean±SE)	6-m wt. (Mean±SE)	9-m wt. (Mean±SE)
G-1	1.11^b± 0.01 (75)	4.69±0.15	7.12±0.28	8.65±0.38
G-2	1.16^{ab}±0.016 (61)	4.47±0.16	7.07±0.29	8.52±0.23
G-3	1.21^a±0.013 (51)	4.71±0.15	7.43±0.22	9.68±0.32
G-4	1.18^a±0.012 (67)	4.90±0.21	7.21±0.32	8.96±0.30
G-5	1.20^a±0.031 (23)	5.03±0.24	7.86±0.50	9.15±0.85
Sig. level	**	NS	NS	NS

Sig=Significance; m=month; G=Generation; Figure in the parenthesis indicates the number of observation. Means with different superscripts within the same column differ significantly. **=Significant at 1% (p<0.01) level of probability, NS=Non significant (p>0.05).

3.2. Effect of generation on reproductive traits of HBB goats

From the Table 2, results showed that age at first conception were significantly (p<0.05) differ among generations. Age at 1st conception was higher in G_1 (259days) and lower in G_4 (201 days). On the other hand, WFC were also significantly (p<0.01) differ among generations whereas WFC of G_1 was slightly higher in G_1 (13.23 kg) than that of G_2 G_3 and G_4 (9.87 kg) with an overall mean of 11.96 kg. Chowdhury and Faruque (2001) has shown that the average age at 1st service of BBG goat as to be 10.98 months which was higher than that of the present findings. Jalil et al. (2016) observed that age at 1st service was higher in G_1 (212 days) than that in G_2 (162 days) with an overall mean of 188 days. He also observed that weight at 1st service was slightly higher in G_1 (9.94 kg) than that in G_2 (9.87 kg) with an overall mean of 9.91 kg. Age at first kidding, Gestation length and kidding interval was not significant (P>.05) effect on generation (Table 2). Average AFK was higher in G_1 (406.6) and lower in G_4 (348.85). Kumar et al., (2011) observed that the overall means were 388.88 days and 536.04 days for age at first conception and age at first kidding, respectively which is higher than the findings. Husain (1993) agreed with the results who had shown that the gestation length of BBG goat ranged from 142 to 146 days. Gestation length reported to be dependent on season, year (Gupta et al., 1964) and also kid birth weight and weight of dam at mating (Mishra *et al*., 1979) not parity Chowdhury and Faruque (2001). Result also showed that KI was lower in G_4 and higher in G_1. Husain (1993) agrees with the findings that kidding interval of BBG goat ranged from 210 to 230 days. Jalil *et. al*., (2016) disagrees with the findings that kidding interval was shorter in G_1 (183 days), higher in G_2 (196 days) and intermediate (185 days) in G_0 with an overall mean of 188 days.

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Table 2. Effect of generation on reproductive traits of HBB goats.

Generation	Parameters				
	AFC (d) (Mean±SE)	WFC (kg) (Mean±SE)	AFK (d) (Mean±SE)	GL (d) (Mean±SE)	KI (d) (Mean±SE)
G-1	259.80[a]±18.87 (52)	13.23[b]±0.47	406.60±19.02	146.80±0.78	225.90±10.27
G-2	236.27[ab]±11.36 (38)	12.09[ab]±0.48	381.45±11.44	145.18±0.69	217.72±7.76
G-3	228.65[ab]±9.07 (27)	11.89[b]±0.47	375.33±9.22	146.66±0.68	216.11±8.30
G-4	201.57[b]±9.06 (23)	10.65[a]±0.52	348.85±9.45	147.28±0.74	211.42±10.39
Sig. level	*	**	NS	NS	NS

AFC=Age at first conception, WFC=weight at first conception, AFK=age at first kidding, GL=Gestation length, KI=kidding interval, Sig=Significance; Means with different superscripts within the same column differ significantly. *=Significant at 5% (p<0.05) level of probability, ** =Significant at 1% (p<0.01) level of probability, NS=Non significant (p>0.05).

3.3. Effect of Parity on KBW, KLW and LS of HBB goats

Results showed that parity had no significant (P>.05) effect on kid birth weight but significantly (p<0.01) differ of Kid litter weight and litter size (Table 3). Islam *et al*. (2016) and Talukder *et al*. (2010) agrees with the findings that the effects of parity were non-significant (P>0.05) on kid birth weight. Jalil *et al*. (2003) observed that birth weight of kids were no consistent trends according to parity in Black Bengal goat. Result also showed that KLW of 3rd parity was higher and lower in 1st parity. On the other hand, LS was increasing with progressing parity with an overall size of 1.69. The present result is in agreement with the findings of Chowdhury *et al*. (2002), who reported that litter size was affected by parity, age, genetic and environmental factor. They also reported that litter size increased significantly (p<0.01) as parity progressed. Jalil *et al*. (2016) reported that average litter size of Black Bengal goat was reported at 1st, 2nd and 3rd parity were 1.31±0.04, 1.81±0.06 and 2.05±0.08 respectively which is similar with the findings.

Table 3. Effect of Parity on KBW, KLW and LS of HBB goats.

Parity	Parameters		
	KBW (kg) (Mean±SE)	KLW (kg) (Mean±SE)	LS (No.) (Mean±SE)
P-1	1.17±0.031 (44)	1.40[e]±0.52	1.20[a]±0.022
P-2	1.16±0.02 (39)	1.80[d]±0.63	1.60[b]±0.11
P-3	1.13±0.02 (38)	2.16[b]±0.31	1.70[ab]±0.13
P-4	1.18±0.04 (33)	1.94[c]±0.34	1.90[ab]±0.04
P-5	1.09±0.06 (32)	2.26[a]±0.41	2.06[ab]±0.03
Sig. level	NS	**	**

KBW=kid birth weight, KLW=kid litter weight, LS=litter size, Sig=Significance; Means with different superscripts within the same column differ significantly. **=Significant at 1% (p<0.01) level of probability, NS=Non significant (p>0.05).

3.4. Kid birth weight according to birth type of HBB goats

From the findings, it was showed that birth weight has significant (p<0.05) effect on birth type whereas single kid was highest birth weight (1.21±0.08 kg) than double kid (1.15±0.13 kg) followed by triplet and quadruplet kids (Table 4). Weight up to weaning is the function of birth weight and maternal ability. The kids born singly are heavier than multiple born kids because they get larger amount of milk from their dam and proper space during the fetus development. Parajuli *et al.* (2014) report significant effect of birth type on birth weight, pre weaning weight, weaning weight, four months weight, six month and weight at nine month in Terai goat.

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Table 4. Birth weight of kid according to birth type.

Parameters	Single birth (Mean±SE)	Double birth (Mean±SE)	Triple birth (Mean±SE)	Quadruplet (Mean±SE)	Sig. level
Birth wt. kg	1.21[a]±0.08 (61)	1.15[b]±0.13 (78)	1.10[b]±0.17 (43)	1.08[ab]±0.13 (16)	*

Sig=Significance; Means with different superscripts within the same row differ significantly. *=Significant at 5% (p<0.05) level of probability. Figure in the parenthesis indicates the number of observation, HBB=Hilly Brown Bengal.

3.5. Kid mortality according to age of HBB goats

Kid's mortality were higher during 0 to 90 days of age than more than 90 days (Table 5). Kid mortality of Black Bengal goat was influenced by weight of doe, parity, birth weight, milk yield, season, feeding, housing and disease and could be as low as 7.0 % if properly managed (Chowdhury *et al*. 2002). The significantly higher mortality rate was observed in summer (13.04±0.05%) for the period of 0 to 3 months of age and lower in winter season (9.00±0.02). Mortality rate in nucleus breeding flock (NBF) in the present study was higher with the finding of Ahmed (2006) who reported that mortality rate of Black Bengal was 10.5±2.32. High mortality of kid on summer may be due to under nutrition and increased susceptibility to diseases. Kid mortality was 17% in rural scavenging system (Husain 1999) which increased with litter size.

Table 5. Kid mortality of HBB goats according to age.

Kid age	Mortality (%)
0-90 days	13.08±0.23 (188)
90-180 days	5.31±0.41
>180 days	2.12±0.63

Figure in the parenthesis indicates the number of observation

4. Conclusions

It may be concluded that kid birth weight, age and weight at first conception of HBB goat were significantly (P<.05) affected on generation but age at first kidding, gestation length and kidding interval were non significantly (P<.05) affected. According to parity, kid litter weight and litter size were also significantly affected. It may be suggested that HBB goats need to be conserved and improved further through selective breeding and better management system.

Conflict of interest

None to declare.

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