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Article

Productive and reproductive performance of Black Bengal Goat under farming condition in Bangladesh

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Abstract: The study was undertaken to evaluate the productive and reproductive performances of Black Bengal Goat (BBG) under farming condition. Data were collected from Bangladesh Livestock Research Institute (BLRI) goat research farm during 2006 to June 2013. Data were analyzed by SPSS version 17.0 statistical computerprogram. The mean of birth weight of kid irrespective ofsex was 1.31 kg. Live weights at 3, 6, 9 and 12 months were 5.65, 9.63, 14.20 and 17.70 kg, respectively. Weaning weight was heavier in second generation (G_2) (5.34 kg) followed by 5.15 kg in first generation (G_1), 4.87 kg in third generation (G_3) and 4.17 kg in foundation stock (G_0) with an overall mean of 4.88 kg. Body weight gain at 0-3 month, 3-6 month, 6-9 month, and 9-12 month ages were 66.34±1.69 g/d, 41.54±2.02 g/d, 49.97±3.10 g/d and 39.28±4.35 g/d, respectively. Body weight gain from 0-12 month age was 56.31±1.40 g/d. Average daily milk yield, lactation length and total milk per lactation were 287.7 ml/d, 61.5 days and 19129.40 ml, respectively. Average age and weight at puberty were 182.7±7.25 days and 9.81±0.34 kg, respectively. Age and weight at 1st service were 187.56±8.33 days and 9.91±0.39 kg, respectively. Number of services per conception was 1.37±0.03. Average litter size, gestation length, post partum heat period, days open and kidding interval were 1.75±0.03, 142.45±0.31 days, 33.39±1.82 days, 46.62±2.86 days and 188.01±2.14 days, respectively. The results indicate that despite of having promising prolificacy and breeding and reproductive efficiency of BBG, still there need to be improved for birth weight, weight gain and milk yield of dam.

Keywords: Black Bengal Goat (BBG); productive performance; reproductive performance

1. Introduction

Black Bengal Goat (BBG) is the heritage and pride of Bangladesh. It is a dwarf breed found almost in all villages of Bangladesh. This breed is famous for its adaptability, fertility, fecundity, delicious meat and superior skin quality (Devendra and Burns, 1983; Husain, 1993). The higher demand of meat and skin in the local as well as foreign markets, focused goat enterprise as extremely important to the vulnerable group of people in the existing socio-economic conditions of the country (Husain *et al*., 1998). To cope with the increasing demand of goat meat (Chevon) by the people, the determinant factors for increasing meat production like birth weight, growth rate and milk yield need to be enhanced in BBG.

Devendra and Burns (1983) suggested that using selection tool for increased milk production; BBG could become an increasingly popular breed. Husain (1993) argued that there is a high potential for its further improvement through selective breeding as there exist large within breed variation and there are individuals with outstanding performance even under field condition. The production efficiency of this goat may be increased through planned breeding program. The reproductive efficiency of goat is very important parameters which is associated with the lifetime productivity of a goat. The kidding interval and number of litter size is very much important for lifetime productivity of a goat.

It has been suggested that in developing countries within breed selection and screening may be used for genetic improvement of local breeds (Bradford and Mayer, 1986; Bradford *et al.*, 1986). So, the present study was undertaken to study the productive and reproductive efficiency of BBG under farming condition of Bangladesh with the aim to formulate a breeding strategy to improve genetically for some economic traits.

2. Materials and Methods

2.1. Source of data

Data were collected from Bangladesh Livestock Research Institute (BLRI) goat research farm during 2006 to June 2013. Data were regularly recorded in various books, cards or forms. Data extracted from these records were transferred into the computer for further processing.

2.2. Management of animals

All studied animals were maintained mostly under intensive management, but were grazed for six hours in a day. Goats were housed in permanent house with slated platform of about one meter above the ground. All goats were kept separately according to their sex and age groups. Bucks and buckling were always kept separately from the does flock to avoid random mating. Castrated goats, milking does, dry does and pregnant does were also kept in separate pen. The goats were grazed from 8.00 A.M to 4.00 P.M with 2 hour rest (12.00 A.M to 2.00 P.M). Concentrates (@ of 2% of body weight) along with cut and carry grasses were supplied according to their age, weight and physiological conditions. A selective breeding program was conducted to improve the economically important traits viz, birth weight, growth rate, live weight, milk yield, prolificacy, survivability and feed efficiency. The sign of heat was observed using a buck in the morning. Does came in estrous were naturally mated with the buck according to the mating plan. Milk was collected twice daily (morning and evening) throughout the whole lactation period. During that time suckling kids were separated from their dams. The birth weights (kg) of newborn kids were taken by digital weighing balance within one hour after birth. The subsequent weights of kids were recorded in the morning before feeding up to fortnight throughout the year. Animals were vaccinated against PPR (Peste Des Petits Ruminants) and anthelmintic were applied twice in a year. External parasites were controlled through dipping the animal in 0.5% melathion or diazinon solution on monthly basis. Sick animals or kids, animals with stunted growth, unthrifty conditions, repeat breeding, severe skin diseases were culled from the flock.

2.3. Record keeping

All animals were ear tagged individually. Herd book, shed book, milking book, kid book mating book, health book, feed register were used for record keeping. All information on productive and reproductive performances wererecorded in an individual data sheet of a book for each of the animal. Records of all kids on birth weight, sex, parity, dams' body weight etc. were also maintained in another record book according to generation. Then all data stored in computer in different files were used for further analysis.

2.4. Statistical analysis

All the relevant data were recorded regularly and put on MS Excel computer program. Data were analyzed by SPSS version 17.0 Statistical computer program.

3. Results and Discussion

3.1. Birth weight

Table 1 shows the average birth weight (Bwt), weight at 3, 6, 9 & 12 months.

The mean of birth weight of kid for bothsexwas1.31 kg which is higher than that reported by (Chowdhury *et al.*, 2002; Hussain, 1999 and Hussain *et al.*, 1996). Acharya (1988) reported that year of birth, season, type of birth, parity, age and weight of dam at kidding significantly affect birth weight. 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). Thus heavier birth weight observed in this study indicates that better environment, especially nutrition and health which would have positive effect on total weaned kid production by reducing the kid mortality and increasing the kid growth rate. Live weights at 3, 6, 9 and 12 month were 5.65, 9.63, 14.20 and 17.70 kg, respectively which were also higher than that reported by Chowdhury *et al.* (2002) and Hussain *et al.* (1996) but lower than that reported by Amin (2000).

The birth weight of male and female kids according to generation and parity are shown in Table 2 and Table 3, respectively.

Male kids had heavier birth weight than those of female kids for G_1 and G_2 but it was higher in female kids for G_3 (Table 2). The overall birth weight of male kids was 1.33±0.02 kg, which is higher than those of female kids of 1.20±0.01 kg (Table 2). In case of male kids birth weight was higher in 7th (1.52±0.05 kg) and 8th parity (1.50±0.10 kg) but lower in first parity (1.22±0.03 kg). On the other hand, female kids had also higher birth weight in 8th parity (1.40±0.07 kg) but lower in 2nd parity (1.10±0.04 kg). The overall birth weight of male kids washeavier (1.33±0.02 kg) than female kids (1.20±0.01 kg) irrespective of parity (Table 3). The overall birth weight of kids was higher in 8th parity (1.44±0.07 kg) but lower in first parity (1.18±0.02 kg). Average birth weight of kids at BLRI goat flockis 1.27±0.01 kg. Between breed differences are primarily genetic which generally depends on the size of adults of the breed and within breed differences are influenced partly by genetic factors but largely by variation within the environment specially nutrition, health and adult weight of dam but not the age of the dam (Prasad *et al*., 1971; Devendra and Burns, 1983). The adult weight of dam and the mean weight of kids born are positively correlated irrespective of the litter size which partly reflects the nutritional status of the dam (Gall, 1981). Acharya (1988) and Husain (1993) reported that year of birth, season, sex, type of birth, parity, age and weight of dam at the kidding significantly affect birth weight. They also reported that variation of birth weight of white, brown and black as 1.12, 1.09 and 0.90 kg, respectively.

3.2. Weaning weight and age at weaning

Weaning weight and age at weaning according to different generations are shown in Table 4. Weaning weight was heavier in G_2 (5.34 kg) followed by 5.15 kg in G_1, 4.87 kg in G_3 and 4.17 kg in G_0 with an overall mean of 4.88 kg.

Khan and Naznin (2013) reported weaning weight of BBG ranging from 5.19±0.358 to 5.63±0.61 kg for male and 5.05±0.28 to 5.54±0.41 kg for female in different farms which closely agrees with this study.

On the other hand weaning age was higher in G_1 (83 days) and then gradually decreases in G_2 (80 days), G_3 (60 days) and G_0 stocks (50 days). Khan and Naznin (2013) reported average weaning age as 4 months (i.e. 120 days) which is higher than these of this study found in different generations (Table 4). This variation could be due to management and nutrition provided by the flock owner.

3.3. Live weight gain

The weight gains of male and female kids upto one year of age in first, second and third generations are presented in Table 5, Table 6 and Table 7, respectively.

Table 5 shows that weight gains in all stages for male kids were significantly higher than those of female kids in $G_1$with an overall gain of 53.02g/d from birth to 12months of age. Table 5 also shows that in G_1, first 3months growth rate (61.38g/d) was faster than those of other stages.

Table 6 shows that weight gains in most of the stages (except 3-6 and 6-9 months) for male kids were significantly higher than those of female kids in G_2 with an overall gain of 56.31g/d from birth to 12months of age. The growth rate in female kids at 6-9 months was significantly higher than those of male kids, while not differed significantly at 3-6 months. Table 6 also shows that in G_2 first 3months growth rate (66.34g/d) was faster than those of other stages.

Table 7 shows that weight gains in all stages did not vary significantly for sex of kids in G_3 with an overall gain of 67.47g/d from birth to 12months of age. Table 7 also shows that in G_3, first 3months growth rate (69.86g/d) was faster than those of other stages.

Weight gains of male and female kids up to one year of age according to different parities are presented in Table 8.In most of the parities, first 3 month growth rates for both male and female kids were higher than those of other parities. However, first 3 month weight gain of male kids was higher in 7th (75.39±5.17 g/d) parity than those of other parities and highest 12 month growth was also found in 7th parity (67.72±4.05g/d). On the other hand, first 3 month weight gain of female kids was higher in 6th parity (71.01±3.30 g/d) than those of other parities and highest 12 month growth rate was also found in6th parity (59.70±3.83 g/d). Table 8 also shows that in most cases, male kids had higher weight gain than those of female kids for different parities.

The growth of kids from birth to adult stage depends on some environmental condition like climate, housing, feeding and diet, level of feed intake and interval factors such as genetic factors on which the growth potential, health, sex and litter size depended. The body weight gains may be improved to certain extend by providing better environmental condition. A high plane of nutrition has a significant effect on growth rate (Devendra and Burns, 1983).

3.4. Lactation length

Lactation length of BBG is given in Table 9. Further, lactation lengths according to different generations are also given in Table 10.

Mean lactation length (61.5 days) found in this study was lower than that of reported by Husain (1999) under rural scavenging condition which could be due to differences of management, feeding and nutrition.

From the Table 10, it appears that lactation length was longer in G_0 stock (71 days) and then gradually decreased in G_1 (69 days), G_2 (63 days) and G_3 (43 days). Amin (2000) stated that lactation length was higher in G_1 (100 days) than that in G_2 (92 days), which is higher than that of this study. Chowdhury and Faruque (2001) shown that lactation length of BBG goat for low feeding was 78 days and for high feeding it was 81 days. Length of lactation provides major contribution to the variation in lactation yield. Lactation length seems to depend more on environmental conditions, particularly feeding, than on breed (Gall, 1981).

3.5. Average daily milk yield

The daily milk yieldis given in Table 9 which shows an average yield of 287.7ml/d. The average daily milk yield found in this study was closer to the report of Husain (1999) under rural scavenging condition. Assuming a daily requirement of at least 200g milk per kid (Devendra and Burns, 1983), milk yield in both reports is much lower than at least of 400g milk per day required to be produced by a twin bearer to suckher kids. Milk production of dam is related to the kid mortality. Husain (1993) reported that milk production of BBG goat is 241ml/days, which is near about the present findings. Chowdhury and Faruque (2001) reported that milk yield of BBG supplying low feeding was 334 ml/day and those of high feeding was 556 ml/day, which werehigher than that of the present findings. The average daily milk yield was higher in G_3 (305.0 ml) than those of other generations (Table 10). These results are contradicted with the result of Amin (2000) who showed that average per day milk yield of BBG goat is lower in G_1 (121 ml) than that in G_2 (143 ml). Milk production of BBG may be varied due to feeding, age of dam, health condition and overall management system. Actually very little information is available in the milk production ability of dwarf goats in the tropics. Milk production is higher in 4^{th} (398 ml/d) and 5^{th} (396 ml/d) parity. Hussain (1993) stated that milk yield of 3^{rd} to 5^{th} parities were significantly higher that of the other parities. Milk producing ability is mainly controlled by genetic properties within and between the breeds but environmental factors also affects the total milk yield (Acharya, 1987)

3.6. Total lactation yield

The total milk yield is given in Table 9 which shows an average lactation yield of 19129.40 ml. This is higher than that reported by Husain (1999) under rural scavenging condition. Chowdhury and Faruque (2001) stated that the total lactation yield of BBG goat was 26.22 kg (i.e. 26220 g) in low feeding and 46.13 kg (i.e. 46130 g) in high feeding which were higher than the present findings. The total lactation yields in different generations are shown in Table 10 which appears that total lactation yield was highest in G_0 (23569 ml) followed by 21276 ml in G_1, 17423 ml in G_2 and 14250 ml in G_3. Amin (2000) stated that average lactation yield of BBG goat in first and second generations were 12 and 13 kg (i.e 12000 and 13000 g, respectively) which were lower than this study. The difference of milk yield among different flock might be due to differences of feeding, nutrition and management.

3.7. Age and weight at puberty

Average age at puberty was higher in G_1 (205 days) than that in G_2 (160 days) which averaged at about 183 days (Table 11). On the other hand, weight at puberty was higher in G_2 (9.83 kg) than in G_1 (9.79 kg) with an overall mean of 9.81 kg (Table 11). Chowdhury and Faruque (2001) stated that age at first heat of BBG goat was found as 216 days and that of weight at first heat as 8.89 kg, which were very closer with the results of this study. Amin (2000) also stated average age at 1^{st} heat of selected BBG goat as 249 days and those of random population goats as 241 days and weight at 1^{st} heat of selected BBG goat as 10.81 kg and those of random population goat as 9.19 kg in G_1. On the other hand, age at first heat of selected BBG goat was 241 days and those of random population was 258 days and weight at first heat of selected BBG goat was 9.73 kg and those of random population was 9.07 kg, respectively in G_2. The results of his study were higher for age at puberty, however, more likely for weight at puberty than the present findings. The sexual maturity of goat depends on the breed, the system of management, level of nutrition and season of birth (Mukunday, 1983), weight at puberty varies from 9.2 to 18.0 kg in some Indian small and dwarf breeds (Rahman *et al*., 1977).

3.8. Age and weight at first service

Table 11 appears 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. On the other hand, 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. Chowdhury and Faruque (2001) has shown the average age at 1st service of BBG goat as to be 10.98 months which was higher than that of the present findings.

3.9. Number of services per conception

It can be observed from the Table 11 that number of services per conception was decreasing with progressing the generations with an overall mean of 1.37. The lowest number of services required for each conception was found in G_2 (1.09) followed by G_1 (1.47) and G_0 stock (1.56). Number of services per conception was found lowest (1.27) in 1thparity (Table 12). Average number of services per conception of 1.45 was reported by Chowdhury and Faruque (2001), which was not affected significantly ($p>0.05$) by level of feeding or parity. Amin *et al*., (2001) also found that the number of services per conception in BBG goat ranged from 1.10 to 1.22. Their results seem to be very closely agreement with the present findings.

3.10. Litter size

Litter size was decreasing with progressing generations with an overall size of 1.75. Table 11 shows that litter size was highest in G_0 stock (1.89) followed by G_1 (1.70) and G_2 (1.67). According to parity, highest litter size (2.63) was found in 7th parity (Table 12). Litter size of BBG goat ranged from 1 to 3 that were reported by Chowdhury and Faruque (2001). Devendra and Burns (1983) stated that average litter size of BBG goat ranges from 1.4 to 2.15. Amin *et al*. (2001) confirmedthe reputation of BBG goat for high fecundity. Amin (2000) reported litter size of selected BBGgoat as 1.96 and those of random population goat as 1.68, while in G_1 and in G_2 those were 2.15 and 2.18, respectively. He also stated that litter size may be increased by selective breeding within breed for heavier live weight. Average litter size of BBG does inthis study appears to be smaller than those (2.09 in India and 2.31 in Bangladesh) cited by Devendra (1985), larger (1.4) than reported of Devendra and Burns (1983) and close to Husain (1993). They reported that season and year do not show any significant effect on litter size.

3.11. Gestation length

Average gestation length was higher in G_0 stock (144 days) and it gradually decreased in G_1 (143 days) and in G_2 (139 days) (Table 11). Results agreed with the results of Husain (1993) who had shown the gestation length of BBG goat ranged from 142 to 146 days. Gestation length in different parities ranged from 140 to 150 days (Table 12). Chowdhury and Faruque (2001) stated gestation length of BBG goat as 146, 147, 142 and 146 days at 1st, 2nd, 3rd and 4th parity, respectively. They also stated that parity has no significant effect on gestation length. Sundarsanan and Rajan (1973) reported that parity of dam affects gestation length. A positive correlation was reported between gestation length and the weight of kid at birth and weight of doe at service (Mishra *et al*., 1979). In small dwarf breeds gestation length ranges from 143 to 147 days (Slater and Bhatia, 1935; Ali *et al*., 1973; Mukundan *et al*., 1983). It was also reported that older animals have extended gestation length and more litter is responsible for shorter gestation period (Hafez, 1984). However, 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).

3.12. Post partum heat period

From the Table 11, it appears that post partum heat period was shorter in G_1 (28 days) than those in G_0 (30 days) and in G_2 (42 days) with an average period of 33 days. Post partum heat period was shorter in 6th parity (19 days) (Table 12). This result was closely in agreement with the result of Chowdhury and Faruque (2001) who reported that post partum heat period was lower (20 day) in 4th parity. The interval between parturition and first post partumoestrus is an important trait, which contributes greatly to productive efficiency in goats. The earlier a doe returns to oestrus after parturition, the earlier it can be bred resulting in a shorter kidding interval with more efficient reproduction (Agrawal *et al*., 1992). This interval varies among breeds, location, nutrition, seasons and parities (Singh *et al*., 1986; Prakash and Khan, 1988). In small breed, it varies from 40 to 88.2 days (Ali *et al*., 1973; Prasad, 1979; Sahni, 1979; Mukundan *et al*., 1983; Singh *et al*., 1986). Post partum heat for Bengal goat as reported by Arora (1992) was 89.6±15.08 days. Husain (1993) also reported that the post partum heat period of BBG goat ranged from 68 to 85 days which is higher than that of the present findings.

Table 1. Mean and standard deviation (SD) of different productive parameters of BBG at BLRI.

Parameter	Range		Mean value		
	Min	Max	N	Mean	SD
Bwt (kg)	0.4	2.6	1282	1.31	0.35
3m bwt (kg)*	2.1	10.25	454	5.65	1.55
6m bwt (kg)*	3.0	16.60	302	9.63	2.37
9m bwt (kg)*	1.4	25.0	244	14.20	3.43
12m bwt (kg)*	9.6	32.0	138	17.70	3.91

*3m, 6m, 9m and 12m bwt represent 3 month, 6 month, 9 month and 12 month body weight respectively.

Table 2. Birth weight (kg) of male and female kids according to the generation.

Generation	Male	Female	Overall	Sig. level
G_1	1.30^{a}±0.02 (348)	1.18^{b}±0.02 (314)	1.24±0.01 (662	***
G_2	1.40^{a}±0.02 (155)	1.24^{b}±0.02 (131)	1.33±0.02 (286)	***
G_3	1.30^{b}±0.05 (17)	1.34^{a}±0.06 (11)	1.32±0.04 (28)	*
Overall	1.33^{a}±0.02 (520)	1.20^{b}±0.01 (456)	1.27±0.01 (976)	***

Figures in the parenthesis indicate the number of samples; *-p<0.05; ***-p<0.001; means with uncommon superscript within the same row differed significantly (p<0.05); G_1-1st generation; G_2-2nd generation; G_3-3rd generation.

Table 3. Birth weight (kg) of male and female kids according to the parity.

Parity	Male	Female	Overall
1	1.22^{d}±0.03 (115)	1.14^{d}±0.03 (113)	1.18^{c}±0.02 (228)
2	1.30^{c}±0.03 (112)	1.10^{d}±0.04 (78)	1.22^{c}±0.02 (190)
3	1.30^{c}±0.04 (74)	1.18^{cd}±0.03 (85)	1.23^{c}±0.03 (159)
4	1.38^{bc}±0.04 (68)	1.32^{bc}±0.04 (57)	1.35^{ab}±0.03 (125)
5	1.40^{b}±0.04 (56)	1.31^{bc}±0.04 (42)	1.36^{ab}±0.03 (98)
6	1.38^{b}±0.06 (41)	1.23^{c}±0.05 (30)	1.32^{b}±0.04 (71)
7	1.52^{a}±0.05 (35)	1.26^{c}±0.05 (32)	1.40^{a}±0.04 (67)
8+	1.50^{a}±0.10 (19)	1.40^{a}±0.07 (19)	1.44^{a}±0.07 (38)
Sig. level	*	*	*

Figures in the parenthesis indicate the number of samples; *-p<0.05; means with uncommon superscript in the same column differed significantly (p<0.05).

Table 4. Weaning weight and age at weaning of BBG goat according to generation.

Parameters	Generations				Overall mean
	G_0	G_1	G_2	G_3	
Weaning weight (kg)	4.17±0.14 (127)	5.15±0.37 (157)	5.34±0.16 (168)	4.87±0.39 (21)	4.88±0.07 (473)
Weaning age (days)	50 ±1.82 (137)	83±1.64 (155)	80±2.27 (168)	60±5.26 (21)	68.25±0.08 (481)

Figures in the parenthesis indicate the number of samples; G_0- foundation generation; G_1-1st generation; G_2-2nd generation; G_3-3rd generation.

Table 5. Weight gain (g/d) of male and female kids upto one year of age in first generation (G_1).

Sex	Growth rate (g/d) for different ages				
	0-3 month	3-6 month	6-9 month	9-12 month	0-12 month
Male	65.54^{a}±1.27 (179)	43.89^{a}±1.77 (123)	52.89^{a}±2.68 (96)	57.98^{a}±5.68 (53)	55.97^{a}±1.07 (179)
Female	56.58^{b}±1.21(155)	37.56^{b}±1.71 (107)	51.16^{b}±2.57 (91)	41.82^{b}±6.59 (46)	49.65^{b}±1.17 (155)
Overall	61.38±0.91 (334)	40.95±1.25 (230)	52.05±1.86 (187)	50.47±4.37 (99)	53.02±0.80 (335)
Sig. level	**	**	*	**	**

Figures in the parenthesis indicate the number of samples; *-p<0.05; **-p<0.001; uncommon superscript in the same column indicate significance difference (p<0.05).

Table 6. Weight gain (g/d) of male and female kids upto one year of age in second generation (G_2).

Sex	Age				
	0-3 month	3-6 month	6-9 month	9-12 month	0-12 month
Male	69.65^{a}±2.24 (67)	40.68±2.93 (37)	46.53^{b}±3.85 (29)	42.12^{a}±4.34 (16)	58.71^{a}±1.92 (67)
Female	61.70^{b}±2.44 (48)	42.56±2.75 (31)	53.80^{a}±4.92 (26)	36.26^{b}±7.81 (15)	52.95^{b}±1.92 (48)
Overall	66.34±1.69 (115)	41.54±2.02 (68)	49.97±3.10 (55)	39.28±4.35 (31)	56.31±1.40 (115)
Sig. level	*	NS	*	*	*

Figures in the parenthesis indicate the number of samples; *-p<0.05; **-p<0.001; uncommon superscript in the same column indicate significance difference (p<0.05)

Table 7. Weight gain (g/d) of male and female kids upto one year of age in third generation (G_3).

Sex	Age				
	0-3 month	3-6 month	6-9 month	9-12 month	0-12 month
Male	69.80±8.47 (6)	66.67±0.00 (1)	55.00±0.00 (1)	-	67.70±8.10 (6)
Female	69.98±2.80 (3)	55.56±0.00 (1)	-	-	67.02±2.59 (3)
Overall	69.86±5.53 (9)	61.11±5.56 (2)	-	-	67.47±5.29 (9)
Sig. level	NS	-	-	-	NS

Figures in the parenthesis indicate the number of samples; NS- not significant (p>0.05); - means sample not available to include in the analysis.

Table 8. Weight gain (g/d) of male and female kids according to the parity upto one year of age.

Parity	Age group (month)	Male	Female	Overall
1	0-3	60.12±2.90 (47)	55.09±2.38 (50)	57.52±1.87 (97)
	3-6	35.53±3.43 (27)	35.34±3.30 (28)	35.43±2.36 (55)
	6-9	52.72±3.76 (20)	56.60±5.92 (26)	54.92±3.70 (46)
	9-12	42.88±6.17 (11)	45.06±10.38 (9)	43.86±5.61 (20)
	0-12	52.39±2.68 (47)	49.61±2.15 (50)	50.95±1.71 (97)
2	0-3	66.99±2.17 (59)	56.23±2.31 (33)	63.13±1.70 (92)
	3-6	38.87±2.97 (38)	35.00±3.23 (23)	37.41±2.21 (61)
	6-9	50.43±4.78 (26)	42.61±6.83 (17)	47.33±3.95 (43)
	9-12	52.64±4.84 (12)	44.13±5.32 (11)	48.57±3.62 (23)
	0-12	56.35±1.89 (59)	48.07±2.36 (33)	53.38±1.53 (92)
3	0-3	68.75±2.73 (41)	56.62±2.38 (39)	62.84±1.93 (80)
	3-6	42.01±3.91 (26)	39.94±2.53 (26)	40.97±2.31 (52)
	6-9	58.57±5.02 (23)	50.49±3.58 (24)	54.44±3.09 (47)
	9-12	57.81±4.51 (18)	38.46±7.96 (13)	49.70±4.51 (31)
	0-12	58.05±2.12 (41)	48.96±1.59 (39)	53.62±1.42 (80)
4	0-3	73.08±2.12 (38)	62.21±2.86 (30)	68.28±1.84 (68)
	3-6	45.35±2.49 (30)	34.84±3.47 (24)	40.68±2.17 (54)
	6-9	48.99±6.49 (27)	47.40±4.02 (22)	48.28±3.97 (49)
	9-12	56.63±11.07 (15)	50.32±9.06 (12)	53.83±7.24 (27)
	0-12	59.67±1.34 (38)	51.45±2.59 (30)	56.05±1.44 (68)
5	0-3	57.13±2.68 (31)	55.46±3.02 (28)	56.34±1.99 (59)
	3-6	47.11±4.04 (20)	48.25±4.90 (19)	47.66±3.12 (39)
	6-9	56.75±5.91 (15)	62.07±6.70 (18)	59.64±4.49 (33)
	9-12	68.13±30.74 (8)	57.06±3.93 (10)	61.98±13.39 (18)
	0-12	52.98±3.20 (30)	54.23±2.88 (28)	53.58±2.15 (58)
6	0-3	74.85±2.85 (17)	71.01±3.30 (13)	73.19±2.15 (30)
	3-6	49.65±4.51 (11)	43.28±6.13 (10)	46.61±3.73 (21)
	6-9	46.79±2.45 (9)	47.22±5.57 (8)	46.99±2.82 (17)
	9-12	41.67±3.69 (5)	43.89±15.19 (4)	42.65±6.51 (9)
	0-12	63.08±2.76 (17)	59.70±3.83 (13)	61.61±2.26 (30)
7	0-3	75.39±5.17 (15)	59.99±4.27 (12)	68.54±3.70 (27)
	3-6	65.86±9.98 (9)	40.76±6.22 (8)	54.05±6.64 (17)
	6-9	43.61±7.55 (4)	59.44±0.00 (1)	46.78±6.65 (5)
	9-12	-	-	-

Parity	Age group (month)	Male	Female	Overall
	0-12	67.72±4.05 (16)	53.56±3.28 (12)	61.65±2.98 (28)
8	0-3	67.20±7.22 (4)	62.21±0.00 (1)	66.20±5.68 (5)
	3-6	-	49.44±0.00 (1)	49.44±0.00 (1)
	6-9	-	49.44±0.00 (1)	49.44±0.00 (1)
	9-12	-	-	-
	0-12	67.20±7.22 (4)	54.23±0.00 (1)	64.61±6.16 (5)
Overall	0-3	66.73±1.10 (252)	57.97±1.08 (206)	62.79±0.80 (458)
	3-6	38.80±1.46 (139)	43.30±1.52 (161)	41.21±1.07 (300)
	6-9	52.28±2.19 (124)	51.75±2.27 (117)	52.02±1.57 (241)
	9-12	46.46±3.33 (59)	54.30±4.54 (69)	50.68±2.90 (128)
	0-12	57.33±0.96 (252)	51.02±0.96 (206)	54.50±0.70 (458)

Figures in the parenthesis indicate the number of samples; - means sample not available to include in the analysis

Table 9. Mean and standard deviation (SD) of milk production traits and litter size of BBG at BLRI.

Parameter	Range			Mean value	
	Min	Max	N	Mean	SD
Daily milk yield (ml/d)	130	550	423	287.7	120.55
Total milk yield (ml)	9850	27500	423	19129.40	2733.0
Lactation length (days)	11	204	735	61.50	25.66

Table 10. Milk production performance of BBG according to generation.

Parameters	Generations			
	G_0	G_1	G_2	G_3
LL (d)	71.0±1.80 (279)	69.0±5.80 (346)	63.0±3.34 (104)	43.0±7.31 (6)
DMY (ml)	305.0±9.49 (279)	274.8±27.84 (34)	248.0±11.67 (104)	323.0±71.14 (6)
TMY (ml)	23569.0±1148.63 (279)	21275.59±3475.37 (34)	17423.0±1455.46 (104)	14250.0±3992.70 (6)

Figures in the parenthesis indicate the number of samples; G_0- foundation generation; G_1-1st generation; G_2-2nd generation; G_3-3rd generation; LL-lactation length; DMY-average daily milk yield; TMY-total milk yield; d-days; ml-milliliter.

Table 11. Reproductive performance of BBG goat according to generation.

Parameters	Generations			Overall mean
	G_0	G_1	G_2	
AP (d)	-	205.35±8.70(43)	160.22±13.26(9)	182.7±7.25(52)
WP (kg)	-	9.79±0.37(34)	9.83±0.57(6)	9.81±0.34 (40)
AFS (d)	-	212.22±9.53(41)	162.89±14.05(9)	187.56±8.33(50)
WFS (kg)	-	9.94±0.41(28)	9.87±0.54(6)	9.91±0.39(34)
NSC (no.)	1.56±0.06(246)	1.47±0.07(154)	1.09±0.09(21)	1.37±0.03(421)
WPL (g)	435.22±10.45(178)	369.27±8.24(172)	374.23±16.49(26)	392.91±6.34(376)
LS (no.)	1.89±0.04(382)	1.70±0.57(186)	1.67±0.13(27)	1.75±0.03(595)
GL (d)	144.59±0.71(244)	143.05±0.80(144)	139.71±1.36(21)	142.45±0.32(409)
PPHP (d)	30.33±1.85(230)	27.72±2.29(102)	42.13±13.04(08)	33.39±1.82(340)
EC (d)	16.31±2.21(97)	16.48±2.14(52)	14.5±4.33(04)	15.76±2.10(153)
DO (d)	45.67±2.98(201)	41.94±3.16(103)	52.25±10.92(08)	46.62±2.86(312)
KI (d)	185.24±2.48(241)	182.92±3.14(103)	195.87±10.66(08)	188.01±2.14(352)

G_0- foundation generation; G_1-1st generation; G_2-2nd generation; AP-age at puberty; WP-weight at puberty; AFS-age at first service; WFS-weight at first service; NSC-number of services per conception; WPL-weight at placenta; LS-litter size; GL-gestation length; PPHP-postpartum heat period; EC-Estrous cycle; DO-days open; KI-kidding interval; Figures in the parenthesis indicate the sample size.

Table 12. Reproductive performances of goat according to parity.

Traits	Parity								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
NSC (no.)	1.27 ±0.07 (77)	1.49 ±0.11 (73)	1.51 ±0.10 (79)	1.54 ±0.10 (59)	1.67 ±0.16 (51)	1.71 ±0.19 (35)	1.28 ±0.15 (25)	1.88 ±0.22 (17)	1.60 ±0.40 (5)
WPL (g)	325.85 ±8.36 (106)	390.74±1 1.69 (54)	413.90±2 2.55 (41)	411.79±1 3.67 (42)	443.19±2 0.38 (47)	474.57±2 5.13 (35)	502.69±2 6.59 (26)	430.00±3 0.65 (20)	341.67±3 2.70 (6)
LS (no.)	1.31 ±0.04 (194)	1.81 ±0.06 (114)	2.05 ±0.08 (85)	2.13 ±0.09 (61)	2.14 ± 0.13 (51)	2.24±0.1 6 (38)	2.63 ±0.19 (27)	2.35 ± 0.22 (20)	1.83 ±0.31 (6)
GL (d)	143.99 ±1.38 (74)	145.18±1 .86 (72)	143.37±1 .29 (81)	144.07±0 .66 (57)	143.04±0 .78 (48)	143.62±0 .95 (34)	142.60±0 .77 (25)	140.36±2 .05 (14)	150.50±3 .38 (4)
PPHP (d)	38.00 ±11.00 (2)	40.26 ±3.76 (78)	32.05 ±2.85 (78)	20.13 ±1.36 (56)	25.19 ±3.97 (47)	19.18 ±1.99 (34)	26.96 ±2.65 (25)	26.56 ±6.04 (16)	90.25 ±41.95 (4)
EC (d)	14.25 ±2.96 (8)	24.48 ±5.13 (25)	19.20 ±3.08 (30)	14.13 ±5.31 (30)	12.81 ±1.86 (26)	9.20 ±1.05 (15)	21.57 ±7.21 (7)	13.50 ±2.23 (10)	7.00 ±2.00 (2)
DO (d)	144.00 ±0.00 (1)	57.06 ±5.55 (70)	43.55 ±3.31 (75)	28.20 ±1.85 (54)	48.32 ±8.05 (44)	37.37 ±5.62 (30)	40.75 ±10.26 (20)	47.57 ±7.45 (14)	65.50 ±32.33 (4)
KI (d)	-	196.31±4 .60 (96)	186.28±4 .08 (76)	171.15±2 .11 (54)	182.02±5 .87 (46)	178.24±3 .61 (34)	182.35±8 .47 (26)	182.87±6 .52 (15)	178.00±6 .74 (5)

NSC-number of services per conception; WPL-weight at placenta; LS-litter size; GL-gestation length; PPHP-postpartum heat period; EC-Estrous cycle; DO-days open; KI-kidding interval; Figures in the parenthesis indicate the sample size.

3.13. Days open

Table 11 reflects that days open was found shorter in G_1 (42 days) than those in G_0 (46 days) and in G_2 (52 days) which averaged the duration of 47 days. Table 12 shows that days open was found longest in 1st parity (144 days) and shortest in 4th parity (24 days). The trend was decreasing gradually up to 4th parity and increased gradually later on. Days open depends on post partum heat period and gestation length. There appears to have no other literatures on this regards on BBG for this trait.

3.14. Kidding interval

From Table 11, it appears 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 days of 188. Kidding interval was found longer in 2nd parity (196 days) and shorter in 4th parity (171 days). The trend of kidding interval among parities was not regular. Husain (1993) reported that kidding interval of BBG goat ranged from 210 to 230 days, which was higher than that of the present findings. He also stated that birth type and year had no significant effect on kidding interval. Length of post partum heat period is only the determinant factor for the variation of kidding interval. The higher kidding interval of 282 days for Bengal goats in India was reported by Acharya (1992) and Arora (1992). The results of this study are closelycoincided with thereport of Chowdhury and Faruque (2001) for BBG goat.

4. Conclusions

From the results of this study, reproductive performance potentials of BBG goats seem to be promising although in some cases birth weight, milk yield and growth rates are relatively low compared to large goats from other parts of the world as per literature's value available in the world. But higher prolificacy and fertility, lower maturity age, non-seasonality and relatively shorter kidding interval are the prominent beneficial traits for BBG goats. Furthermore, there is a large variation within breed and there are some individuals with outstanding performance even under the field conditions which might be the resources for breeders to develop this promising goat through planned breeding and selection.

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Conflict of interest
None to declare.

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