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A Study on the Reproductive Performance of Does in Different Genetic Groups under Village Condition

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Abstract: In this study sixty three farmers mainly from land-less and small category, having some previous experience of rearing goats were selected. There were three genetic groups viz. I) jamunapari male × black bengal female ii) selected black bengal male × selected black bengal female and iii) random black bengal. Feeding and management systems of keeping goats were almost similar. No extra inputs were provided to them except grazing from morning to evening. The main objective of this study was to investigate the effect of selection and crossbreeding in black bengal goats on various reproductive characteristics. Traits considered for the present study were age at puberty, number of services per conception, gestation length, litter size, age at first kidding, post partum heat period, kidding interval, abortion rate and survival rate of kids. Analysis of variance indicated a highly significant ($p < 0.01$) effect of genetic groups on post-partum heat period, kidding interval and abortion rate. Gestation length was significantly ($p < 0.05$) affected by genetic groups. Age at puberty, number of services per conception, litter size, age at first kidding and survival rate were not affected significantly ($P > 0.05$) by genetic groups.

Key words: Black bengal goat, selective breeding, cross breeding, reproductive performance

Introduction

Goat plays an important role in the rural economy of Bangladesh. Among the Asiatic countries Bangladesh has the second highest goat population estimating about 34.5 million. Goat occupies the first position in terms of population size among ruminants in this country (FAO, 1997).

As stated by Devendra (1992) goat plays an important role in agricultural operation provides valuable food of animal origin like milk, meat, milk products; industrial raw materials like skin, fibres and manures; socio-economic relevance as security income generation and human nutrition and stability to farming system. Land-less and marginal farmers keep one to ten goats with very little input towards the housing and feeding of goats, they obtain meat for home consumption or for sale to obtain some additional cash. The sale of skin and the utilization of dung as organic fertilizer and fuel are the other utilities of goat (Husain, 1993).

Goats in Bangladesh predominantly belong to the native breed i.e, black bengal. While selective breeding to improve growth and meat production of black bengal has been advocated in the past, yet no concrete steps have been taken to design a selective breeding program.

Crossbreeding with some imported breed from India and Pakistan have been performed in some restricted goat producing areas in Bangladesh but its impact has not yet been felt. In fact the blamers prefer to do pure breeding black bengal.

The present study evaluate the performance of various reproductive traits in different genetic groups adjacent to the Bangladesh Agricultural University (BAU), Mymensingh. These genetic groups are:

- A random bred black bengal (RBB)
- Selected black bengal (SBB) based on their phenotypic growth performance for one generation and
- Jamunapari male x black bengal female (JBB).

Materials and Methods

Data this study was accumulated from the experimental unit in some selected areas around the BAU (Bangladesh Agricultural University) campus under the Department of Animal Breeding and Genetics, Bangladesh Agricultural University, Mymensingh, Bangladesh during, 1999. The included data covered a period from 1995 to 1998. A total of 63 female goats (25 RBB, 20 SBB and 18 JBB) were studied for the following performances: age at puberty (AP), number of services per conception (SPC), gestation length (GL), litter size (LS), age at first kidding (AFK), post-partum heat period (PPHP), kidding interval (KI), abortion rate (AR) and survival rate (SR) of kids. As the goats under this study are seasonal breeders, effect of year and season on these traits were found to be negligible.

Feeding and management systems in the villages were almost similar. Grazing on indigenous grasses, occasional feeding of tree leaves, some domestic waste and herbs are the only input given to all the groups of goats. No concentrate was given to any of the groups. As the number of animals in each group for different traits were not same, an orthogonal factorial analysis was done to investigate the differences between genetic groups, interaction between genetic groups and parity and interaction between genetic groups and sex. Harvey's (1990) LSML computer program was used for the analysis of the data. Model for the analysis of variance is given below:

Model1

$$Yijk = \mu + g_i + (g \times p)_{ij} + e_{ijk}$$

Where, Yijk is the k*th* record on trait of doe in the ith genetic group and jth parity
μ = Overall mean
gi = Effect of ith genetic group
(I = 1-3)
$(g \times p)_{ij}$ = Interaction between genetic group and parity
e_{ijk} = Random effect

Model 2

$$Yijk = \mu + g_i + (g \times s)_{ij} + e_{ijk}$$

Where, $(g \times s)_{ij}$ = Interaction between genetic group and sex.

Results

Analysis of variance (Table 1) shows no significant difference between genetic groups AP, SPC , LS, AFK and SR whereas, differences between for GL, PPHP, KI and SAR were significant ($p < 0.05$). Interaction variances were non-significant for a few traits (Table 1). However most of the other traits were not studied for interaction variance as the number of does giving records for these traits were much less than the expected numbers of does in these groups.

The highest value of age at puberty was observed in JBB (301.94 ± 18.47 days) and the lowest in RBB (250.28 ± 15.67 days). The overall mean was observed as 267.61 ± 9.96 days (Table 2). Maximum and minimum number of services were required for each successful conception for RBB (1.24 ± 0.06) and

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Table 1: Summary showing the effects of genetic group and genetic group × parity and genetic group × sex interaction on various traits as determined by ANOVA

Trait	Genetic group	Genetic group × parity	Genetic group × sex
Age at puberty (d)	NS	-	-
No. of services per conception	NS	NS	-
Gestation length (d)	*	NS	-
Litter size at birth	NS	NS	-
Age at first kidding (d)	NS	-	-
Post-partum heat period (d)	**	-	-
Kidding interval (d)	**	-	-
Abortion rate (%)	**	-	-
Survival rate (%)	NS	-	NS

* ($P<0.05$), ** ($P<0.01$), NS = Non significant ($P>0.05$)

Table 2: Least squares means and standard errors on the different reproductive traits of three genetic groups of does

	JBB		SBB		RBB		
Parameter	n	LSM ± SE	n	LSM ± SE	n	LSM ± SE	Overall mean
Age at puberty (d)	18	301.94±18.47	20	250.6 ±17.52	25	250.28 ±15.67	267.61± 9.96
No of services per conception	48	1.18 ± 0.06	67	1.18 ±0.06	71	1.24 ±0.06	1.19±0.03
Gestation length (d)	24	142.06^{b} ± 0.32	36	143.10^{ac} ±0.24	44	143.22^{a} ±0.24	142.79±0.15
Litter size at birth	48	1.15± 0.07	67	1.29 ± 0.07	71	1.11 ±0.07	1.18 ±0.04
Age at first kidding (d)	14	431.71 ± 32.13	19	397.42 ± 11.29	21	411.0 ±17.27	411.59±11.38
Post-partum heat period (d)	14	103.79^{b} ± 21.43	19	123.05^{ab} ±18.40	21	197.80^{a} ±17.49	141.55±11.07
Kidding interval (d)	6	242.50^{b} ± 31.91	17	276.00^{b} ±18.96	20	346.85^{a} ±17.47	288.45±13.67
Abortion rate (%)	48	25.00^{a} ± 4.55	67	5.97^{b} ± 3.85	71	8.45^{b} ±3.74	13.14± 2.35
Survival rate (%)	36	84.05 ±4.95	63	95.24 ±3.72	65	89.14 ±3.70	89.47± 2.43

RBB = Random black bangal, Means with different superscript in the same row differ significantly ($p< 0.05$) by LSD test, n = Number of observation, LSM = Least square mean, SE = Standard error, JBB = Jamunuparomale x black bangal female, SBB = Select black bangal male x Selected black bangal female

Table 3: Least-squares means with standard errors for survival rate (%) in different genetic groups and sexes

	Genetic group			
Effect	JBB	SBB	RBB	Overall mean (pooled genetic group)
Male	80.77±6.47	93.33±5.41	90.22±4.76	88.11±3.13
Female	88.42±7.74	97.08±5.16	87.00±5.89	90.84±3.64
Overall mean (pooled sexes)	84.59±0.04	95.20±3.74	88.62±3.76	-

both for JBB and SBB (1.18±0.06) respectively. The gestation length was affected significantly ($P<0.05$) by genetic group but the effect of genetic group × parity interaction on gestation length was not significant ($P>0.05$) (Table 1).

Table 2 indicated the litter size of different genetic groups and maintained a pattern like SBB>JBB>RBB. The Selectively Bred Black Bengal showed the highest litter size. The overall litter size was found to be 1.18±0.04. The effects of genetic group and genetic group×parity interaction on litter size were insignificant ($P>0.05$) (Table 1).

The overall age at first kidding, post-partum heat period, kidding interval, abortion rate and survival rate were found to be 411.59 ±11.38 days, 141.55±11.07 days, 288.45±13.67 days, 13.14 ±2.35 (%) and 89.47±2.43 (%) respectively (Table 2).

Discussion

The present study was conducted in the villages with three genetic groups JBB, SBB and RBB. Their reproductive performance in village conditions, although relatively lower than in the established farms, showed that the selected black bengal for higher growth is also better for most of the reproductive traits, RBB is also better than the JBB which shows the importance of pure breeding under village conditions where optimum housing condition and nutrition are not given to goats.

The overall result of this study on age at puberty was 267.61 ± 9.96 days is almost similar to 269.4 days as reported by Panigrahi and Mohapatra (1997). Age at puberty was found to be much higher in JBB compared to SBB and RBB. This is due to the fact that black bengal is known to be a breed with high fecundity and reaching early maturity. Smaller sample size was responsible for non-significance between these groups. Among the other factors influencing age at puberty like care, management and nutrition, the genetic effect is more pronounced Ali *et al*. (1973). The analysis of variance showed that no. of services per conception was not affected significantly ($P>0.05$) by genetic group and genetic group×parity interaction. The insignificance differences may be due to improper detection of heat, improper time of servicing. Maximum number of services were required for

Table 4: The ranking of genetic groups on the basis of reproductive performance

	Ranking performance (Best to worst)	
Trait	1	3
Age at puberty (d)	RBB	JBB
Number of services per conception	SBB	RBB
Gestation length (d)	JBB	RBB
Litter size	SBB	RBB
Age at first kidding (d)	SBB	JBB
Post-partum heat period (d)	JBB	RBB
Kidding interval (d)	JBB	RBB
Abortion rate (%)	SBB	JBB
Survival rate (%)	SBB	JBB

RBB = Random black bangal, Means with different superscript in the same row differ significantly ($p< 0.05$) by LSD test, n = Number of observation, LSM = Least square mean, SE = Standard error, JBB = Jamunuparomale x Black bangal female SBB = Select black bangal male x Selected black bangal female

each successful conception in RBB (1.24 ± 0.06) but number of services per conception were similar for JBB and SBB (1.18 ± 0.06). These results were almost similar to the findings of Koratkar *et al.* (1998).

There is no difference between genetic groups in gestation length. This is expected. Most of the literature reported gestation length ranged between 139 and 153 days (Sinha and Sahni, 1982). Between parity differences in gestation length in all the three groups were very minimum and not significant.

The overall litter size of 1.18 ± 0.04 as observed in this study is less than that of 1.93 ± 0.05 as reported by Husain (1993) for black bengal goats and also is less than 1.70 ± 0.12 as reported by Mia (1992). Litter size at birth was almost same for all the genetic groups. This is the data of first parity usually from 2nd parity and in sub-sequent parities, litter size for black bengal is expected to increase.

Although there is no significant difference between genetic groups with regard to age at first kidding, both the Black Bengal groups were found have given birth to kids at an a early age. Differences between RBB and SBB (Table 2) may be due to chance variation. The overall age at first kidding was calculated to be 411.59 ± 11.38 days with a range of 397.42 ± 11.29 to 431.71 ± 32.13 days (Table 2). Similar results was found by Mynuddin and Wahab (1989).

Khalter and Mishra (1977) and Bhoite *et al.* (1995) found that farm, year, season and breed had no significant effects on age at first kidding but the opposite results were found by Kumar *et al.* (1980) and Nahardeka *et al.* (1995). They observed that year season and breed had a significant effects on age at first kidding. Three genetic groups indicated that JBB had higher age at first kidding than SBB and RBB. The average age at first kidding of RBB was higher than that of SBB but the difference was not statistically significant ($P > 0.05$). The age at first kidding did not differ significantly from others (Table 2). The variation of age at first kidding is partly environmental and partly genetic in nature.

In this study the overall post-partum heat period of 141.55 ± 11.07 days was higher than that reported by Arora (1992) and Singh *et al.* (1987). Post-partum heat period (days) was found to be significantly different ($P < 0.01$). However this difference may be attributed to less care and nutritional input for the black bengal. Some of the crossbred are given more attention by the villagers because of its higher growth, which is not reported in this paper. Table 2 shows a comparative performance record of other breeds of goats or crossbred. Black Bengal under village condition in Mymensingh was comparable to or even better than the other types with respect to age at first kidding but its post-partum heat period was much higher than the other breed. Therefore a thorough study is required in village conditions of Bangladesh to see whether the fecundity traits can be improved with better nutrition to goats.

Kidding interval depends on post-partum estrus and the optimum time for mating. Highly significant difference between genetic groups is perhaps due to failure in the observation of subsequence heat after parturition in the villages. Constant vigilance is needed to obtain correct estimate of kidding interval. The overall kidding interval of 288.45 ± 13.67 days for this study is higher than that reported by Husain (1993) who found kidding interval of 220.55 ± 2.88 days for Black Bengal goats. Kidding interval of 284.70 days for Malabari females and of 299.3 days for Jamunapari × Malabari females was reported by Raja and Mukundan (1975). These findings were almost similar to the present results. The very short kidding interval of Black Bengal goats allow them to produce kid even twice in a year. This is again a very significant feature of their reproductive ability and can be exploited through little improvement in management specially feeding to increase the economic gain per year.

Least significant difference (LSD) test with three genetic groups showed that SBB had lower abortion rate than that of RBB and JBB. Abortion rate of RBB was higher than that of SBB (Table 2) but the difference was not statistically significant ($P > 0.05$). Abortion rate of SBB and RBB differed significantly ($P < 0.01$) than JBB.

Ribas *et al.* (1998) observed the abortion rate 0.05, 0.20, 0.06, 0.08 and 0.08% for Saanen, Nubian, Toggenburg, Alpine and criollo goats respectively. This result is much lower than this study.

Higher abortion rate in JBB compared to SBB and RBB can not be easily explained, this needs to be further investigated whether crossbred experience more stress than the pure bred during pregnancy period. Inability of the dwarf female parents to sustain high embryonic growth rate of the kids may also be a possibility.

The overall survival rate of 89.47 ± 2.43 % for this study is almost similar to that reported by Husain (1993) who found the survival rate of 91.3 % in 1 to 2 months of age for 4 regions. Singh *et al.* (1991b) observed significant effect of breed, sex, birth weight and season on survival rate but opposite result was observed by Singh (1991) for black bengal, Jamunapari × Black Bengal and Beetal × Black Bengal goats. A number of factors such as birth weight of kid, age and weight of dam, parity of the dam, gestation length, age and sex of the kid, insufficient milk of the dam just after kidding, lack of proper care, infectious diseases and overall faulty husbandry practices are known to influence the survivability of kids.

One of the most important traits in tropical goats percent survival rate of kids was thoroughly studied. Selected Black Bengal and Random Bred Black Bengal had higher survival rate than the crossbred. The supports the usual belief that the mothering ability of the Black Bengal goat is better, although in many earlier studies, kid mortality in Bengal goats and other dwarf breeds of goats were reported to be very high 50-80% (Kanaujia *et al.*, 1985. Surprisingly in this study, survival rate of female goats was higher in JBB and SBB and lower in RBB compared to male (Table 3).

This ranking may change if data of 2nd parity and third parity is compared, there is no clear-cut indication that crossbred could be better than the purebreds. From the data it is obvious that the Selected Black Bengal is better than the crossbred in most of the traits (Table 4).

This study was carried out in villages near the BAU, Mymensingh. Replication of this study in other villages may not give similar results, as there are distinct variations between villages in terms of goat husbandry. Even there are variations between individual goat keepers with respect to their ability in managing goats under sub-optimum nutrition. Therefore it can be concluded that under village conditions, pure breeding of Black Bengal could be a better strategy for future provided the Black Bengal are selected on the basis of their phenotypic body weight.

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