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Original Research Paper

Preliminary Study on Different Productive and Reproductive Traits of Black Bengal Goats in West Bengal

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ABSTRACT

Regarding experimentation on different productive and reproductive characters, it was noted that, the body weight was higher (up to 100 weeks) in the first treatment group than the other groups after weaning. Female kids of three months of age were placed in three groups with five numbers in each group; 1st TG with supplementary nutrition and a buck, 2nd TG with supplementary nutrition and 3rd TG as control. Puberty came to the first group, at an earlier age (8 to 9 months) with lower body weight (10 kg), than the other groups (11 to 12 and 14 to 15 months for second and third group, respectively). The age of kidding time was also earlier in first group (16 months) than the rest of the groups (~21 and ~23 months for second and third group, respectively). Three animals out of five could attain pregnancy under treatment group three. According to the experimental plan, all the animals experienced operational stress, resulted into a number of services for each animal. The first group showed regular estrous, so, they had more number of services (3.6) to attain pregnancy than the other two groups (2.2 and 2 for second and third group, respectively). The gestation length had no effect on the non-hormonal factors. The first group of animals came to post-partum estrous earlier (3 to 6 weeks) than the other two.

Keywords: Black Bengal Goat, Reproductive Productive Traits, Litter size

Goat keeping has several advantages, like diverse ecological adaptability over a wide range of agro climatic conditions, faster multiplicity, smaller body size, easy handling, efficient digestive and reproductive performances, better disease tolerance, substantial contribution in the rural economy in relation to nutritional contribution, as well as, crisis management etc. Goats require minimal capital investments; hence it is truly termed as 'poor man's cow'. There is high commercial value and demand of good price for goat in the market at all the times (Ramdas, 2000). According to the FAO, India ranked second in goat population (125.7 million) after China (149.3 million) in the world (FAO, 2008). India ranked second in the goat meat production. There is no religious taboo regarding the consumption of goat meat in India. Goat milk is the source of protein and has medicinal value (www.agricultureinformation.com). The goat population in India is about 17 percent of the world's total goat population. As per the recommendations by Indian Council of Medical Research (ICMR), the daily allowance of meat is 34 g, but the per capita meat consumption is as low as 14 g per day. Regarding the population of goat in India, it was 14 crore according to the 18th Livestock Census, Government of India, which was 12 crore during 2003 (17th Livestock Census, Government of India). The total goat population in West Bengal was 1.5 crore in the year 2007 (Eighteenth Livestock

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Census, Government of India). There are thirty four descriptive breeds of goats in India (www.nbagr.res.in). Black Bengal Goat is famous for the delicious meat and superior quality skin. More people like chevon (goat meat) over beef. But the production of chevon is only 10 percent of the total meat.

REVIEW OF LITERATURE

Gupta *et al.* (1964) reported 145 days gestation length for Black Bengal goats. Ali *et al.* (1973) reported that the averaged birth weight was 1.60 lb. They also reported that the age at first conception averaged 10.0 month, length of estrous cycle 20.0 days, age at first kidding 15.0 month, gestation length 143.0 days, services/conception 1.14. Rahman *et al*. (1977) reported that the age at first estrus and at first kidding averaged 10.26 ± 1.78 and 15.27 ±1.76 month respectively. Ali (1980) reported that the birth weight of Black Bengal male and female kids averaged 1.80 and 1.75 1b respectively. Acharya (1982) reported the birth weight of Black Bengal goat was 1.31 ± 0.01 kg. Kumar and Singh (1983) reported that the birth weight of Saanen, Jamunapari, Barbari, crossbred and Black Bengal goats averaged 3.29, 2.38, 1.80, 1.32 and 1.21 kg respectively ($p<0.001$). Pattanaikand Mishra (1985) reported that the body weight of Bengal goats at birth and 3, 12, 15 and 24 months averaged 1.20, 4.80, 11.80, 13.80 and 16.70 kg respectively. Malik *et al.* (1986) reported that the Black Bengals birth weight and body weights at 1, 2 and 3 months of age (1.31 ± 0.04, 2.84 ± 0.10, 4.01 ± 0.17 and 5.29 ± 0.24 kg, $p<0.05$). Singh (1987) reported that the birth weight of Bengal goats averaged 1.18 ± 0.04 to 1.43 ± 0.4 kg for males (and 1.01 ± 0.04 to 1.22 ± 0.05 kg for females. Birth weight was highest in the wet season and lowest in autumn/winter. He also reported that the in Black Bengal goats gestation period averaged 145.2 days, service period 48.0 days, age of firstestrus 10.5 months, number of services per conception 1.2.Husain *et al*. (1990) reported that the age at first kidding was 11.33-18.47 months, number of services per conception 1.07-1.32 and service period 46.1-61.8 days in Black Bengal goat. Misraand Sinha (2001) reported that overall means of age at sexual maturity, age at fist kidding and service period were 230.61 ± 3.40, 501.70 ± 21.62 and 60.11 ± 5.70 days, respectively in Black Bengal goat. Hossain *et al*. (2004) observed that young female attained puberty at an age and weight of 209 ± 32.25 days and 8.08 ± 1.28 kg respectively. Mean age and weight at first kidding were 401.5 ± 32.08 days and 15.41 ± 1.35 kg, respectively. Post-partum heat was 48 days for first parity. Samanta *et al*. (2009) reported that in female reproduction characters that age of puberty, age at first mating, age at first kidding, number of service per conception in natural service, gestation period, service period, length of estrus cycle, and kidding interval were 185 ± 0.10 days, 237.87 ± 0.695 days, 380.458 ± 0.695 days, 1.15 ± 0.03, 144.776 ± 0.159 days, 62.84 ± 1.24 days, 18.6 ± 0.03 days and 204.597 ± 1.201 days. Kumar *et al*. (2011) reported that the overall means were 388.88 days and 536.04 days for age at first conception and age at first kidding, respectively. Genetic group and birth weight had significant effect, while litter size at birth and season of birth had non-significant effect on these traits. Black Bengal goats had significantly lower age at first conception and age at first kidding. Khan and Naznin (2013) reported that the average age at sexual maturity of Black Bengal goat was 8 months.

MATERIALS AND METHODS

The experiment was conducted in Completely Randomized Design (CRD) with three treatments, viz. (i) Nutritional Effect and buck effect, (ii) Nutritional effect and (iii) Control. There were five female Black Bengal kids of three months of age in each group. The first group of animals was allowed to graze *ad lib* and the only were kept with a buck while the other two groups of animals were stall fed with the similar type of grass *ad lib*. The animals of TG-1 and TG-2 were also provided with concentrate feed supplement (21% CP) @ 10g per kg body weight per day in two divided doses. The animals under control group were neither provided the concentrate feed mixture nor kept with the buck. All the animals were placed in comfortable sheds and were under standard management practices. Different reproductive parameters viz, age, of 1st estrus, number of services per conception, length of gestation, age of 1st kidding, kidding size and post-partum heat were recorded as per standard protocol. The data were analysed statistically by the analysis of variance (ANOVA) method, described by Cochroan and Cox (1967) and Panse and Sukhatme (1967). Error mean square by Fisher and Snedecor's F-test method was followed to test significance of

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different sources of variation. The standard error (S_e) and test of significance have been provided in the tables of results to compare the mean values.

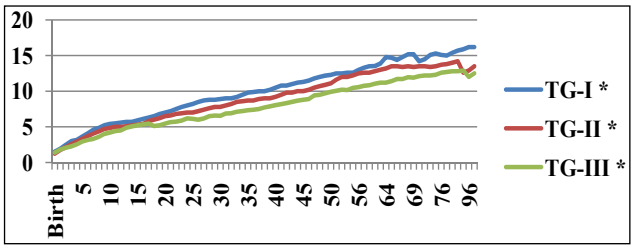
RESULTS AND DISCUSSION

Different productive and reproductive parameters

1. Body weight gain of animals under three treatment groups

The body weights of all the animals under first group of treatment increased consistently with their age (Fig. 1). The animals under second and third group also showed increased body weight gain. Although the animals of the first and second treatment group received same concentrate feed, the increase in body weight of the first treatment group was more than that of the second group. This might be because of the peculiar feeding habit of the goat. Goats are sensitive animals regarding feeding. Basically goats are 'browsers'. They nibble trees, bush leaves and grass. Their digestive system is adapted to extract more nutrients from such feed, because the growing portions of the plants are good source of vitamins and minerals. For this they were allowed to graze for at least six to seven hours every day, followed by feed supplementation with concentrate feed mixture. Because of this fact, the first group of animals showed better body weight gain throughout the experiment period. Although the second group of animals received same kind of grass, they could not attain body weight like the first group of animals, because they could not browse as per their choice and they were not provided with the social interaction by presence of buck. The third group of animals showed lower body weight gain than the other groups because of not having concentrate feed mixture, stall feeding and lack of exercise. Hence, it can be said that grazing in the field with good pasture quality along with concentrate feeding and allowing the animals to be reared with proper social interaction with buck are the best management system for better production, followed by reproduction.

The average body weights of the female goats of first treatment group suddenly decreased from 15.2 to 14.2 kg at 69 to 70 weeks of age because of first parturition. After that they regained their body weight in about two weeks (Fig. 1). Similarly, the average body weight of the second group also showed similar pattern of decline at 90 to 92 weeks of age as a result of parturition. Three animals out of five from the third group became pregnant at 96 weeks of age and decline of average body weight was observed.



[X-axis represents age (weeks) and Y-axis represents body weight (kg) of animals]

Fig. 1: Average body weight (kg) of animals under different treatments at different stages from birth [TG-1*= nutrition and buck effect; TG-2*= nutrition; TG-3*= control (without nutrition and buck effect)]

2. Age and weight of animals to attain puberty

Black Bengal goats are one breed, which has no seasonal variation regarding estrous cycle. Several symptoms of heat were noticed, like vocalization, wagging of tail, mounting, aggression, unusual feeding pattern and some physical changes. The induction of puberty in female goats is manipulated by various factors, like permanent exposure to male animal, good plane of nutrition, etc. In the present study, it was evident that the animals under first treatment group showed symptoms of puberty at the age between eight to nine months (Table 1

Table 1: Age (days) of first service of animals under different treatments

Animal number in respective treatment group		1	2	3	4	5	Mean
Treatment Group (TG)	TG-1*	259	252	273	252	259	259.0
	TG-2*	345	343	355	340	347	346.0
	TG-3*	421	411	428	436	415	422.2

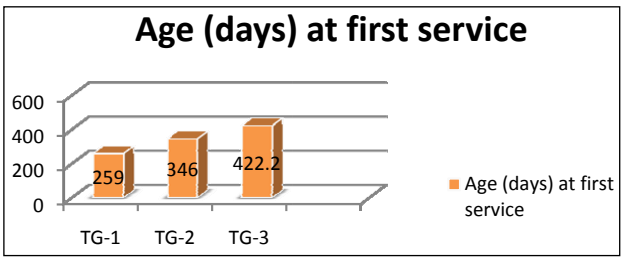
S_e= 2.74; significant at 1% level.

Table 2: Weight (kg) of the animals at puberty under different treatments

Animal number in respective treatment group		1	2	3	4	5	Mean
Treatment Group (TG)	TG-1*	10	9.5	10.5	9	11	**10**
	TG-2*	11	10.6	10.8	11.2	11.9	**11.1**
	TG-3*	11.2	10.8	11	11.2	11	**11.04**

S_e = 0.216; significant at 5% level.

and Fig. 2). In contrast, the animals under second and third treatment group attained puberty later than the first group which was about eleven to twelve months and thirteen to fourteen months, respectively. The average age of the animals under three treatment groups were 259, 346.0 and 422.2 days, respectively, the differences being highly significant (1% level). The average body weights of the animals at puberty were 10 kg, 11.1 kg and 11.04 kg for first, second and third treatment group respectively (Table 2). The average weight of the animals under the first treatment group was lower than that of the second and third groups; whereas there was no significant difference between that of the second and third group (Table 2).



[X-axis represents different treatment groups and Y-axis represents age (days) of the animals]

Fig. 2: Age (days) of first service of animals under different treatments

The induction of puberty is influenced by different external factors like, nutrition, season of year, proximity of male, climate and disease. Nutrition is one of the important factors regarding attaining puberty, because well fed animals reach better body weight. 'Male effect' is mediated by pheromonal and sensory cues influencing hypothalamic GnRH secretion. Anthropomorphic extrapolation has assumed that animals living in tropics reach puberty at an earlier age than those in temperate climate. Any kind of disease interferes with the growth rate directly or indirectly, which delays the onset of puberty (David *et al.* 2001). The result of the present experiment suggested the same, as explained by David *et al.* (2001), and the findings were similar with that of Hossain *et al.* (2004), where it was noted that young female attained puberty at an age and weight of 209 ± 32.25 days and 8.08 ± 1.28 kg respectively. It was reported by Faruque *et al.* (2010) that the young Black Bengal female goats attained puberty at an age and weight of 186.02±10.52 days and 9.4±0.52 kg, respectively. In case of intensive rearing system it took 139 days to show first heat compared to 198 days in semi-intensive rearing system.

3. Age and weight of animals at first kidding

It was evident from the present study that the first parturition of the animals under the first treatment group was earlier than the second and third group of animals (Table 3 and Fig. 3). Average days required for first kidding in first treatment group was noted as 489.4 days; whereas average days required for animals under second treatment group was 636.4 days. It was interesting to note that all the animals under the third treatment group could not attain successful pregnancy during the experimental period. Only three animals out of five had parturition at the average age of 670.6 days. As per the design of the experiment, all the animals were experienced surgical stress after attaining puberty through exploratory laparotomy. The animals under first and second treatment group could recover from the stress of the operation because of getting good plane of nutrition. But on the contrary, the animals under the third treatment group could not recover properly from the stress of operation due to lack of nutrition. As a result, some of them could not become pregnant successfully within the period of experimentation. Regarding the average body weight of the animals before parturition after first pregnancy, under two treatment groups it was recorded that the animals of both the groups attained 14.2 kg body weight, while the animals of the third group attained 13.0 kg (Table 4 and Fig. 4). Although the first and second treatment group showed same body weight before

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Table 3: Age (days) of first kidding of animals under different treatments

Animal number in respective treatment group		1	2	3	4	5	Mean
Treatment Group (TG)	TG-1*	491	483	477	491	505	489.4
	TG-2*	651	622	635	641	633	636.4
	TG-3*	No Kidding	672	661	No Kidding	679	670.6

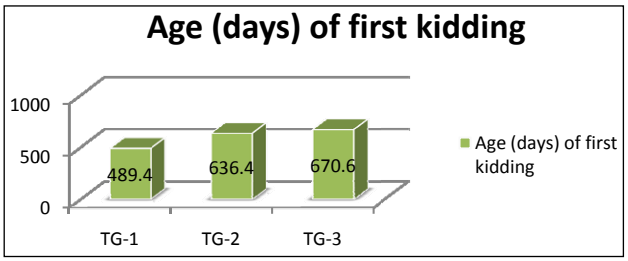
S_e = 11.23; significant at 1% level.

Table 4: Weight of the animals (kg) before parturition after first pregnancy under different treatments

Animal number in respective treatment group		1	2	3	4	5	Mean
Treatment Group (TG)	TG-1*	13.5	14.5	13	16.5	13.5	14.2
	TG-2*	14	14.5	13	15	14.5	14.2
	TG-3*	No Kidding	13	13.2	No Kidding	12.8	13.0

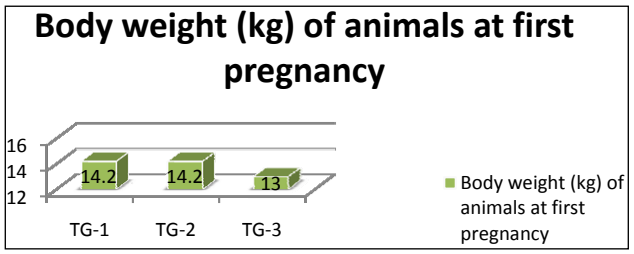
S_e = 0.27; significant at 5% level.

parturition but the second group had higher age at that time, which indicated good body weight was essential for better reproductive performances. The weight of animal is related to the age of puberty. Lower body weight causes delayed puberty. In the present experiment, it was evident that the third group attained puberty with lower body weight at later age than that of the first and second group.



[X-axis represents the treatment groups and Y-axis represents the age (days) of first kidding.

Fig. 3: Age (days) of first kidding of animals under different treatments



[X-axis represents different treatment groups and Y-axis represents body weight (kg) of the animals at first pregnancy].

Fig. 4: Weight of the animals (kg) before parturition after first pregnancy under different treatments

The findings of the present study corroborated with the findings of Hossain *et al.* (2004). It was reported by Kumar *et al.* (2011) that Black Bengal goats had significantly lower age at first conception and age at first kidding. The mean age and weight at first kidding were 401.5 ± 32.08 days and 15.41 ± 1.35 kg, respectively, in Black Bengal goats. According to the present result the age of first kidding was higher than the findings by Hossain *et al.* (2004). This might be due to operational stress of the animals as stated earlier.

4. Number of services required to attain successful pregnancy

After attaining puberty the animals were not pregnant with a single service. Animal of all the groups required more than one services to attain successful pregnancy. Average number of required services varied among the animals of three treatment groups. The first, second and third group of animals required 3.6, 2.2 and 2.0 services, respectively, to attain successful pregnancy. On the contrary, only three animals under third treatment group became pregnant with less number of services. Two animals under third treatment group could not become pregnant even after few services (Table 5).

The number of services for successful pregnancy was less in number among the animals under the second and third treatment group than the first group. Animals under second and third treatment group had no 'buck effect'. So, there was long time anestrous and animals were not serviceable at the anestrous period eventually. These animals were in estrous only for two to three times before attaining successful pregnancy. So, they experienced

Table 5: Number of services required to attain successful pregnancy of animals under different treatments

Animal number in respective treatment group		1	2	3	4	5	Mean
Treatment Group (TG)	TG-1*	4	3	4	3	4	3.6
	TG-2*	2	3	2	2	2	2.2
	TG-3*	No Pregnancy	2	2	No Pregnancy	2	2.0

S_e = 0.04; significant at 5% level.

Table 6: Length of gestation period of animals under different treatments

Animal number in respective treatment group		1	2	3	4	5	Mean
Treatment Group (TG)	TG-1*	147	148	147	149	148	147.8
	TG-2*	148	146	147	148	149	147.6
	TG-3*	No Pregnancy	147	145	No Pregnancy	149	147.0

S_e = 1.84; not significant.

less number of services to attain the pregnancy. The number of estrous of the animals under first treatment group was more than that of the rest of the two groups. The estrous cycle was regular in the animals of the first group. Probably due to operational stress, they could not become pregnant with one or two services, but became pregnant earlier than the second group due to availability of buck as per their need. It was noticed that, the animals with more than one parity could successfully complete their pregnancy period with successful kidding (NFBSFARA-Annual Report, 2009) even after exploratory laparotomy. But in the present study all the animals needed more than one services to attain successful pregnancy as all animals were in first parity and experienced operational stress. Animals of the first and second groups had good plane of nutrition. So, even after operational stress all of the animals could attain successful pregnancy after a number of services. But the third group had no 'buck effect' as well as good nutrition. That is why; all the animals could not overcome the operational stress after laparotomy. They also needed on an average two services to become pregnant successfully. As per the findings of Faruque *et al.* (2010) the number of services required for each successful conception was 1.16±0.019. The findings of Garci *et al*. (1996), Amin *et al.* (2001) and Faruque *et al.* (2002) were also similar. The findings of the present study were different from them because of the fact that, the animals experienced operational stress at an early age which might be the cause of more number of services per pregnancy.

5. Length of gestation period

The length of gestation period was 147.8, 147.6 and 147.0 days of the animals under the first, second and third treatment groups respectively (Table 6). There was no variation among the animals of different treatment groups, regarding the gestation period of the animals. Only three animals out of five of the third group experienced pregnancy. Thus, it can be said that nutrition and buck effect have no influence on the gestation period of goat.

Average gestation length observed was 143.33+0.68 days by Faruque *et al*. (2010). In West African Dwarf goats gestation length was reported as 141.3+4.7 days by Otchere and Nimo (1975) and 146.2+2.7 days by Montsma *et al*. (1981). But Gupta *et al.* (1964) reported 145 days gestation length for Black Bengal goat. The observation of the present study regarding gestation period of Black Bengal goats varied between 146 to 149 days which corroborated with the previous studies.

6. Time required for coming to post-partum heat after first parturition

It was noticed that the time, required for coming to post-partum estrous after first parturition, varied among the three treatment groups (Table 7). It was noted that the animals under the first treatment group showed estrous symptoms soon after parturition within three to six weeks (Table 7). Among the animals under second treatment group only two animals came to estrous after parturition. The time taken for coming to estrous was much higher (10 to 13 weeks) than those of first group

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Table 7: Time required (week) to come to post-partum estrous after first parturition

Animal number in respective treatment group		1	2	3	4	5
Treatment Group (TG)	TG-1*	4	3	6	5	5
	TG-2*	10	13	Showed no estrous	Showed no estrous	Showed no estrous
	TG-3*	No Pregnancy	Showed no estrous	Showed no estrous	No Pregnancy	Showed no estrous

and the rest three animals showed no estrous symptoms after parturition within the period of experimentation. On the other hand, among the animals under third treatment group,three animals did not show estrous after first pregnancy during the time of experimentation, while two animals did not attain pregnancy within the particular period.

The reason behind this result may be explained by the presence of bucks among the animals under first treatment group. The animals under first and second treatment group received same type of feeding. So, nutritionally they were not in much different condition, they were different only in respect of buck effect. Presence of buck among the first group of animals helped them to come to estrous earlier than the second and third group of animals. Animals under third group had no good nutritional support and effect of buck. So, the animals after first kidding did not come to post-partum heat within the period of experimentation.

It was reported by Hossain *et al.* (2004) that the post-partum heat was 48 days for first parity.

SUMMARY AND CONCLUSION

Different productive and reproductive characters were noted for all animals under three treatment groups. The body weight of the kids, recorded weekly up to 100 weeks, increased consistently with their age, and varied significantly among the treatments after weaning. The animals of the first treatment group, with nutritional and buck effect, showed higher body weight than that of the other two groups. The control treatment group recorded the lowest range of body weight. Although the first and second group of animals received similar type of nutrition, the first group showed higher body weight, which might be due to getting more nutrients by browsing habit, social interaction and physical exercise. While studying the age and weight of the female goats at pubertal age, it was noticed that the animals of the first, second and third treatment groups attained puberty at 8 to 9, 11 to 12 and 14 to 15 months of age, with body weights of 10, 11.1 and 11.04 kg, respectively. Regarding the age and weight of the animals under each treatment group, it was observed that the first service of all the animals did not terminate into pregnancy. The first two groups had kidding at 16 to 17 and 21 to 22 months, respectively. In the third group, three animals out of five became pregnant and gave birth to kids at 22 to 23 months of age. The body weights of three groups were 14.2, 14.2 and 13 kg, respectively, at first kidding. Although the body weights of first two groups were same at the time of kidding, but the second group had kidding about 5 months later than the first group. The third group was nutritionally deficient and had kidding with lower body weight and higher age. Investigation for number of services per pregnancy revealed that the number of services required to attain successful pregnancy was 3.6, 2.2 and 2.0, respectively for the animals of first, second and third treatment group. The first group showed regular estrous symptoms more in number due to presence of buck. Instead of having good nutrition, the second group had no regular estrous due to absence of buck to give positive stimuli. The length of gestation of all the animals under three treatment groups (147.0 to 147.8) was similar without any significant variation. While investigating the time required to come to post-partum estrous after first parturition, it was noted that 3 to 6 weeks' time was taken by the first treatment group, 16 to 30 weeks for two animals out of five for second treatment group, whereas no animal of the third group showed estrous during the time of experiment.

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