

A STUDY ON PRODUCTIVE AND REPRODUCTIVE PERFORMANCES OF BLACK BENGAL GOAT IN RELATION TO COAT COLORS

MM Mia^{1*}, AK Mondal², MSR Chowdhury³ and MM Mia⁴

¹Department of Poultry Science, Sylhet Agricultural University, Sylhet, Bangladesh.

²Department of Physiology, Sylhet Agricultural University, Sylhet, Bangladesh.

³Department of Medicine, Sylhet Agricultural University, Sylhet, Bangladesh.

⁴Department of Genetics and Animal Breeding, Sylhet Agricultural University, Sylhet, Bangladesh.

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Abstract

The present study was conducted to know the productive and reproductive performance of Black Bengal goats in relation to different coat colors. A total of 609 Black Bengal goats were selected from 35 private owned farms in Sylhet division during November 2017 to October 2018. Average birth weight and adult body weight gain after 12 months of white, solid black, black with Dutch belt spotting, and brown bezoar coat color goats were varied significantly. Birth weight is high in black with Dutch belt spotting coat and the adult weight gain after 12 months is high in solid black coat color. The average daily milk yield and the average lactation period of white, solid black, black with Dutch belt spotting, and brown bezoar coat color goats were varied significantly. The age at puberty varied according to the coat color. The age of first kidding of white, solid black, black with Dutch belt spotting and brown bezoar coat color goats did not vary significantly. The average gestation period in 1st parity, age at first conception and post-partum estrous of Black Bengal goat were not affected by the coat colors. Number of litter per kidding was higher in solid black i.e. the reproductive performance is better in solid black coated goats than that of other coat colors. From the present study, it may be concluded that the performances of solid black color goats were better than other coat colors in terms of adult weight of does, daily milk yield, lactation period, age at puberty, service per conception and litter size.

Keywords: Black Bengal Goat, Coat Color, Productive Performance, Reproductive Performance.

Introduction

Goat is the important and promising livestock species in contributing meat, skins and economic development of poor country like Bangladesh. Goat plays an important role in the livelihood of a large proportion of small farmers particularly women, landless and marginal farmers inhabiting geographically isolated areas, who seldom have other means of survival (Chowdhury *et al.*, 2012). About 26.10 million goats are now rearing throughout the country (DLS, 2018). Bangladesh has only one goat breed of its own, known as the Black Bengal (BB) goat. It is estimated that more than 90% of goat population in Bangladesh comprised the BB goats, the remainder being Jamnapari and their crosses (Husain, 1993). Goat is popularly known as the poor man's cow. In Bangladesh meeting the Sustainable Development Goals by 2030 needs to produce sustainable food and agriculture. Goats can play an important role in the rural economy for its multi-functionalities. Millions of marginal, small farmers and agricultural laborers are getting food and nutrition from goats. BB goat has wider variation in coat color, mature size and weight. Interestingly to the breed name BB is not always solid black in coat color rather in this breed coat color polymorphism does exist. These are variation in coat color like: i) White or tan ii) Bezoar iii) Silver Bezoar iv) Solid Black v) Black with "Toggenburg pattern" of spotting vi) Black with "Dutch belt" spotting (Nozawa *et al.*, 1984; Alam, 2006; Faruque and Khandoker, 2007).

According to Nozawa *et al.* (1984) at least four loci (I, A, D, S) are involved in this polymorphism. Amongst them Black, White (Cream) and Silver Bezoar coat color patterns are very frequent (Faruque and Khandokar, 2007). These coat color types might have some unique features and adaptive advantages to pertinent habitat. In spite of promises of BB goat amongst the world goat genetic resource the systematic information on production parameters in BB goat is very limited (Amin *et al.*, 2001; Faruque *et al.*, 2010). It is obvious that better production efficiency can be obtained from goats when they have a high reproductive efficiency with the potentials for increased litter size and shorter generation interval specifically having higher fertility rate in comparison to other farm animals (Haque *et al.*, 2013). Reproductive efficiency of doe is determined by different processes, for example, the length of the breeding season, cyclic activity, ovulation rate, age at puberty, age at first conception, age at first kidding, birth weight of kids, litter size, kidding interval, fertilization rate, and post-partum anestrus period. Among other factors (e.g., genetic and

*Corresponding author: MM Mia, Department of Poultry Science, Faculty of Veterinary, Animal and Biomedical Sciences, Sylhet Agricultural University, Sylhet-3100, E-Mail: mukterdvm02@gmail.com

environmental), it is essential to compile the parameters by which BB goat can be described distinctively from others, which might be helpful for the breeders as well as farmers for the selection of goat. Therefore, the present study was conducted to assess the productive and reproductive performance of BB goat in relation to their coat colors.

Materials and Methods

A total of 609 BB goats were selected from 35 private owned farms in Sylhet division during November 2017 to October 2018. Data on birth weight, age at puberty, age at first conception, gestation period and age at first kidding, post-partum estrous, kidding interval, was taken from 50 kids, 69 goats, 58 does, 56 does and 38 does, 67 does, 40 does, respectively. Data on milk production, lactation period, number of services per conception, litter size and adult body weight of does at first parity were taken from 38 does, 43 does, 63 does, 45 does and 42 does, respectively from different farms. Goats were maintained by farmers themselves under semi intensive system. The goats were kept in open air with shed at day time but confined at night. Goats were allowed to graze in roadside or agricultural land supplemented with grain feeds. The does were served naturally when they were in estrous. Routine vaccination and deworming was practiced by the farmers and animals were treated by veterinarians in case of diseases. The productive traits analyzed in this study were birth weight, lactation period, milk yield, litter size and adult weight. The reproductive traits analyzed were age at puberty, age at first conception, gestation period, age at first kidding, kidding interval, postpartum estrous and number of services per conception.

The raw data were managed in office excel spread sheet. Computation of comparison means with ANOVA was conducted using Statistical Package for Social Science (SPSS) version 16. Comparison mean statistics were performed to see the significant differences among the coat colors. The significance of differences in various measurements was tested using Duncan's Multiple Range test. All the analysis was performed at the 0.05 significance level.

Results and Discussion

Productive parameters

Birth weight

Average birth weight of white, solid black, Black with Dutch belt spotting and brown bezoar coat color goats were 682.86 ± 62.37 , 790.87 ± 88.21 , 891.67 ± 51.49 , 862.50 ± 86.97 g, respectively (Table 1). Birth weight among the different coat color differ significantly ($p < 0.05$). Birth weight in Black with Dutch belt spotting coat color goat is higher compared to white, solid black and brown bezoar. This variation may occur due to the genetic involvement. Within-breed, variation in birth weight is partly genetic but largely due to variation within the environment, especially nutrition and health (Devendra and Burns, 1983). These findings were not supported by Mia et al. (1993) and Chowdhury et al. (2012) who reported the birth weight of BB as 1350 g.

Adult weight

Adult weight gain after 12 months of white, solid black, Black with Dutch belt spotting and Brown bezoar coat color does were 10.62 ± 2.03 , 13.31 ± 1.30 , 12.79 ± 1.84 , 11.79 ± 1.79 kg, respectively (Table 1). Body weight among the coat color differ significantly ($p < 0.05$). Body weight of solid black is higher than the white, Black with Dutch belt spotting and brown bezoar coat color does. In the age of 12 months, white (13.95kg) and silver bezoars (13.65kg) type goats were found consistently heavier than black (12.74kg) goats (Siddiqua and Amin, 2009). Effect of coat color on body weight at 12 month in this study were also dissimilar to the observations of Alam (2006) and Hasan et al. (2003) who found higher body weight in white type goat compared to black type at the given ages.

Milk yield

Average daily milk yield of white, solid black, black with Dutch belt spotting and brown bezoar coat color goats were 230.00 ± 64.03 , 346.15 ± 74.89 , 288.89 ± 60.09 and 321.43 ± 85.91 ml, respectively (Table 1). Daily milk yield varies with the coat colors. The daily milk yield is higher in solid black and brown bezoar coat color goats than the white and black with Dutch belt spotting. Milk yield was ($p < 0.05$) highest in white goat (366.84ml) and lowest in black (248.83ml) goat (Siddiqua and Amin, 2009). Average milk yield of BB goats in the present study was lower than reports of Alam (2006) and, Chowdhury and Faruque (2001). Higher milk yield of solid black and brown bezoar type goat might contribute in higher live weight of kids. Milk yield was positively correlated with the nutrition, age, genotype and season (Chowdhury et al., 2002; Mia et al., 1993).

Table 1. Values of productive traits of white, solid black, black with Dutch belt spotting, and brown bezoar coat color goats

Parameters	(Mean ±SD)				Level of significance
	White	Solid black	Black with Dutch belt spotting	Brown bezoar	
Birth weight (g)	682.86 ^d ±62.37 (7)	790.87 ^c ±88.21 (23)	891.67 ^a ±51.49 (12)	862.50 ^b ±86.97 (8)	0.001
Adult weight of does (kg)	10.62 ^b ±2.03 (12)	13.31 ^a ±1.30 (16)	12.79 ^b ±1.84 (7)	11.79 ^b ±1.79 (7)	0.002
Milk yield (ml/day)	230.00 ^c ±64.03 (9)	346.15 ^a ±74.89 (13)	288.89 ^b ±60.09 (9)	321.43 ^b ±85.91 (7)	0.005
Lactation period (day)	75.71 ^c ±6.07 (7)	93.89 ^b ±10.36 (18)	87.50 ^c ±8.80 (6)	110.83 ^a ±9.00 (12)	0.001

Parenthesis indicates sample size, Different superscript in a row indicates differ significantly, same superscripts indicates not significant differences

Reproductive parameters

Age at puberty

Pubertal age of white, solid black, black with Dutch belt spotting and brown bezoar coat color goats were 180.00±16.12, 163.59±17.74, 165.00±15.00 and 185.88±11.07 days, respectively (Table 2). The age at puberty varied ($p < 0.05$) according to the coat color. Chowdhury (2002) reported that the age at 1st heat varied considerably between goats with a mean of 216 days (7.2 months), which is higher than the present result observed in BB goat. Solid black coat color goat attained early sexual maturity than the others coat colors.

Age at first conception

Age at first conception in white, solid black, black with Dutch belt spotting and brown bezoar coat color goats were 224.62±8.34, 219.00±8.66, 225.45±8.20, 222.14±9.13 days, respectively (Table 2). Age at first conception did not vary ($p > 0.05$) with coat color. The conception were similar among the coat color. Hassan *et al.* (2010) reported that the mean age at first pregnancy of Jamunapari goats was 395.4 ± 29.6 days with a range of 12-13 months which is dissimilar with the result of the present study.

Age at first kidding

Age at first kidding of white, solid black, black with Dutch belt spotting and brown bezoar coat color goats were 378.40±7.09, 371.25±10.24, 380.62±11.78, 372.22±10.34 days, respectively (Table 2). Hasan *et al.* (2007) reported that in BB goat the average age at first kidding was 360.5±10 days which are very close to the present findings but interestingly there were no significant variation along with different coat color.

Kidding interval

Kidding interval of white, solid black, black with Dutch belt spotting and brown bezoar coat color goats were 196.00±9.6, 183.16±11.8, 190.71±15.92 and 183.89±13.64 days, respectively (Table 2). Kidding interval of solid black coated goat was slightly lower i.e. the reproductive performance is better in solid black coated goat than white, black with Dutch belt spotting and brown bezoar coat color goats but there was no significant difference among the colors. Hassan *et al.* (2007) reported that the average kidding interval in BB goat was 179±20 days that are close to the present study. In this study, it is stated that kidding interval may not be affected by coat colors.

Table 2. Values of reproductive traits of white, solid black, black with Dutch belt spotting and brown bezoar coat color goats

Parameters	(Mean \pm SD)				Level of significance
	White	Solid black	Black with Dutch belt spotting	Brown bezoar	
Age at puberty (d)	180.00 ^a \pm 16.12 (11)	163.59 ^b \pm 17.74 (32)	165.00 ^b \pm 15.00 (9)	185.88 ^a \pm 11.07(17)	0.001
Age at first conception (d)	224.62 \pm 8.34 (8)	219.00 \pm 8.66 (25)	225.45 \pm 8.202 (11)	222.14 \pm 9.13 (14)	0.155
Age at first kidding (d)	378.40 \pm 7.09 (5)	371.25 \pm 10.24 (16)	380.62 \pm 11.78 (8)	372.22 \pm 10.34 (9)	0.156
Kidding interval (d)	196.00 \pm 9.61 (5)	183.16 \pm 11.81 (19)	190.71 \pm 15.92 (7)	183.89 \pm 13.64 (9)	0.179
Gestation period (d)	153.12 \pm 8.83 (9)	151.36 \pm 9.90 (21)	155.50 \pm 8.31 (11)	150.62 \pm 8.73 (15)	0.57
Post-partum estrous (d)	36.88 \pm 5.93 (8)	31.88 \pm 6.56 (24)	35.77 \pm 9.32 (13)	34.50 \pm 6.37 (22)	0.230
Number of services per conception (no)	2.18 ^a \pm 0.98 (11)	1.17 ^c \pm 0.46 (29)	1.46 ^b \pm 0.66 (13)	1.50 ^b \pm 0.70 (10)	0.001
Litter size (no)	1.33 ^b \pm 0.70 (9)	2.19 ^a \pm 0.65 (16)	2.00 ^a \pm 0.70 (9)	2.00 ^a \pm 0.63 (11)	0.002

Source: Authors' estimation, 2016. Parenthesis indicates sample size. Different superscripts in a row indicate differ significantly.

Gestation period

Average gestation period in 1st parity of white, solid black, black with Dutch belt spotting and brown bezoar coat color goats were 153.12 \pm 8.83, 151.36 \pm 9.90, 155.50 \pm 8.31 and 150.62 \pm 8.73days, respectively (Table 2). There were no significant difference ($p>0.05$) among the coat color. Bhowmik *et al.* (2014) reported that the period of gestation may not affected by the parity and age of the does. Although goat gestation period is constant at around 146 days (Devendra and Burns, 1983), yet it may be affected by factors like kid birth weight and weight of dam at mating (Mishra *et al.*, 1979).

Post-partum estrous

Post-partum estrous in white, solid black, black with Dutch belt spotting and brown bezoar coat color goats were 36.88 \pm 5.93, 31.88 \pm 6.56, 35.77 \pm 9.32 and 34.50 \pm 6.37 days, respectively (Table 2). It was showed that there were no significant different in post-partum estrous among the coat colors. Post-partum estrous of BB goat was not affected by the coat colors.

Number of services per conception:

Average number of services per conception in white, solid black, black with Dutch belt spotting and brown bezoar coat color goats were 2.18 \pm 0.98, 1.17 \pm 0.46, 1.46 \pm 0.66 and 1.50 \pm 0.70, respectively (Table 2). The number of services per conception was significantly varied with coat color. Number of services per conception was lower in solid black i.e.the reproductive performance is better in solid black coated goat than white, Black with Dutch belt spotting and Brown bezoar coat color goats.The reproductive performance in terms of services per conception was lower in white coat color goats than the solid black, Black with Dutch belt spotting and Brown bezoar coat color goats.

Litter size

Average number of litter per kidding in white, solid black, black with Dutch belt spotting and brown bezoar coat color goats were 1.33 \pm 0.70, 2.19 \pm 0.65, 2.00 \pm 0.70 and 2.00 \pm 0.63, respectively (Table 2). The number of litter per kidding was significantly varied($p<0.05$) with coat color. Number of litter per kidding was higher in solid black i.e.the reproductive performance is better in solid black coated goat than white, black with Dutch belt spotting and brown bezoar coat color goats.The reproductive performance in terms of litter size was lower in white coat color goats than the solid black, black with Dutch belt spotting and brown bezoar coat color goats. Hasan *et al.* (2014) reported that overall litter size was 1.60 \pm 0.06 under semi-intensive condition, and 1.46 \pm 0.05 under extensive condition. Litter size might be affected by nutritional level, body weight, parity, age and genetic factors.

From the present study it may be conclude that the performances of solid black color goats are better than other coat colors in terms of adult weight of does, daily milk yield, lactation period, age at puberty, number of services per conception and litter size. It may be suggested that solid black coat color goat performed better than the white, black with Dutch belt spotting and brown bezoar coat color. Further studies may be conducted to determine specific genes responsible for better performance in solid black color BB goats.

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