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MORPHOMETRIC CHARACTERIZATION OF BLACK BENGAL GOAT AT SAVAR GOAT DEVELOPMENT FARM UNDER FARMING CONDITION

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ABSTRACT

The study was undertaken at Savar Goat Development Farm from January 2019 to December 2019 to characterize black Bengal goat (BBG) of different ages from three months to more than 12 months old of both sexes under farming conditions. Body length was higher in males (34.1, 41.6 and 49.1 cm) than that of females (29.7, 37.2 and 45.8 cm) for age groups 3-6, 6-12 and >12 months of age, respectively. Male goats had higher heart girth (40.8, 51.9 and 55.4 cm) than female goats (39.6, 48.6 and 53.3 cm) irrespective of age. The average (>12 months age) body weight of adult male and female goats was 16.0 and 13.5 kg, respectively. Wither height was higher in adult males (36.1, 46.6 and 52.9 cm) than females (34.7, 42.8 and 49.3 cm) for the same age. The tail length of BBG ranged from 7.45 to 10.4 cm for different age and sex groups. Average male foreleg length in >12 months of age possessed higher than that of female. The average udder length of BBGs were 6.9, 8.5 and 11.6 cm and breadth were 4.3, 6.6 and 8.0 cm, respectively for age groups 3-6, 6-12 and >12 months of age. The average scrotal length of black Bengal bucks at 3-6, 6-12 and more than 12 months were 5.8, 9.3 and 11.2 cm, respectively. It was concluded that body weight has a positive correlation with body length, heart girth, wither height, scrotal length and circumference, and all the parameters were comparatively higher in buck than in do, and it increased linearly with increasing ages.

Keywords: Black Bengal goat, body length, heart girth, wither height, scrotal length and circumference

Introduction

Bangladesh has the fourth highest population of goats and there are about 26.3 million goats in the country (DLS, Livestock economy at a glance, 2018-19). Bangladesh has only one goat breed of its own, popularly known as the black Bengal goat (BBG). It is estimated that more than 90% of the goat population in Bangladesh comprised the black Bengal goat (Husain 1993). There are wide variations in color, body size and weights of goats found in different locations. BBGs have different coat color variations, i.e., black, brown, and white and any combination of those colors (Nozawa and Katsumata 1984). During selecting a goat, attention should be given to the age, growth rate, body weight, heart girth, body length, height at wither and soundness of the sexual organ. Body length and heart girth may be used as good reliable predictors to assess live weight. It has been reported that heart girth in males is a good predictor of live weight in Bengal goats (Bhattacharya *et al.* 1984, Islam *et al.* 1991). There was a correlation of body weight with length, height and heart girth in BBGs (Prasad *et al.* 1981). Correlation of body weight with heart girth was highest and followed by length and height, respectively. The scrotal circumference has excellent value as an indicator of genetic trait, puberty and total spermatozoa production (Ott 1986). Determination of scrotal length and circumference is an essential aspect of breeding soundness examination (BSE). It is known that there are several critical quantitative traits for a goat. Among these, the birth weight and Body weight of goats are considered as necessary. There is a positive correlation between birth weight and growth rate, age at maturity and mature body weight, which influence the future productive and reproductive performance of the animal (Banerjee 1989, Husain *et al.* 1995).

The contribution of livestock in GDP is 1.4% and GDP growth rate of livestock is 3.4%, the share of livestock in agricultural GDP is 13.4%, involved in employment directly 20% and partly 50% (BBS, 2018-19) and the goat population is about 262.6 lakh in the year 2018-19 (DLS, Livestock economy at a glance, 2018-19). Considering the

above facts and circumstances the present study was undertaken to determine the basic morphological characteristics of the buck and doe of Back Bengal goat (BBG).

Materials and Methods

Study area and data collection: A total of 60 animals of different ages from three months to over one year of both sexes were studied throughout the experiment in Savar Goat Development Farm for 1 year from January 2019 to December 2019, located at Savar Upazila in Dhaka. All types of measurements were taken when goats were standing freely and in the metric unit.

Parameters of the study: The following body measurements were considered for the morphometric study of BBG.

Body length: Body length was measured between points of the shoulder and points of the hip.

Wither height: Distance from the ground to the point of wither.

Head length and width: Head length is measured from the upper lip to the head's pole. Breadth is the distance between two eyes.

Ear length and breadth: Ear length is the distance between the base and the ear's pinna. Ear breadth was measured at the broadest portion of the ear.

Neck length and breadth: Neck length is the distance between the base of the head and the point of the shoulder. Neck breadth was measured from the middle position of the neck.

Tail length: Length was measured from the base of the tail to the pinpoint of the tail without hair.

Leg length: Fore leg length is the distance from hoof to joint of shoulder and hind leg length is the distance from the hoof to elbow joint.

Udder length and breadth: Length was measured from the base of the teat to the attachment point of the udder and belly. Breadth was measured from the middle portion of the udder.

Teat length and circumference: Teat length was measured from the teat base to pinpoint a teat. Circumference was measured from the middle portion of the teat.

Scrotal length and circumference: Distance between the two-pin point of testes and circumference was measured from the middle portion of two testes.

Statistical analysis: The gathered data were subjected to analysis of variance (ANOVA) using the General Linear Model (GLM) procedure under Statistical Package for Social Science (SPSS) version 16.0. In addition, for significant variables, pair-wise comparison of treatment means was made using Duncan's Multiple Range Test (DMRT).

Results and Discussion

The study was undertaken to characterize morphometric information relating to black Bengal goat (BBG) obtained through initial in-depth monitoring under farming conditions from January 2019 to December 2019 at Savar Goat Development Farm.

The body weight of bucks (7.49±0.1, 11.68±0.1, 16.00±0.1) and does (7.26±0.1, 9.78±0.1, 13.51±0.1) at 3-6, 6-12 and >12 months of age are presented in Table 1 and 2. In all cases, bucks' body weight is higher than does. Rahman (2007) reported that the body weight of male goats at 3-6 and 6-12 months of age was 7.2 and 10.7 kg, respectively, which strongly support the present study results. Alam (2006) studied the body weight of black Bengal males and females and reported that female goats were lighter (6.20 and 13.2 kg) than male goats (7.2 and 15.8 kg) at the age 3-6 months and 12 months which strongly supported the present study. The live weights of male and female in this study were higher than the weights reported by Singh *et al.* (1987), which were 14.9 and 14.3 kg at 12 months of age. The relationship of body weight with body length, heart girth, wither height, scrotal length and scrotal circumference for bucks are presented in Table 3 and 4 respectively. In bucks, the body weight had a highly significant correlation ($P<0.01$) with body length (0.904), heart girth (0.946), wither weight (0.955), scrotal length (0.924) and scrotal circumference (0.929) in Table 3. In does, the body weight of female has a highly significant correlation ($P<0.01$) with body length (0.903), hearth girth (0.944) and wither height (0.941). The findings of the present study strongly support the results of Rahman (2007), who reported the almost similar correlation between body weight and heart girth (0.937), body weight and body length (0.939), as well as body weight and height at wither (0.934).

Table 1. Body traits of black Bengal buck of Savar goat development farm at varying age

Body traits	Number of observation	Age (Month)		
		3-6	6-12	>12
Body weight (Kg)	10	7.5±0.1c	11.7±0.2b	16±0.1a
Body length (cm)	10	34.1±0.7c	41.6±1.1b	49.1±0.9a
Heart girth (cm)	10	40.8±0.4c	51.9±0.3b	55.4±0.2a
Wither height (cm)	10	36.1±0.4c	46.6±0.8b	52.9±0.6a
Tail length (cm)	10	7.5±0.1c	8.4±0.2b	10.4±0.2a
Head length (cm)	10	12.2±0.1c	14.2±0.1b	16.1±0.1a
Head width (cm)	10	8.3±0.1c	10.6±0.1b	10.5±0.3a
Ear length (cm)	10	9.9±0.1c	11.1±0.1b	12.1±0.1a
Ear breadth (cm)	10	5±0.1c	5.6±0.1b	5.9±0.1a
Neck length (cm)	10	10.5±0.2c	12.5±0.3b	14.1±0.3a
Neck breadth (cm)	10	20.6±1.1c	25.2±1.6b	29.9±1.7a
Fore leg length (cm)	10	22.7±0.4c	30.8±0.5b	33.8±0.7a
Hind leg length (cm)	10	23.9±0.5c	31.6±0.7b	40.8±0.5a
Scrotal length (cm)	10	5.8±0.2c	9.3±0.2b	11.2±0.3a
Scrotal circumference (cm)	10	12.9±0.3c	17.3±0.3b	20.3±0.3a

Data expressed as mean ±SE. Means within a row followed by the same letter are not significantly different at $p< 0.05$.

Table 2. Body traits of black Bengal doe of Savar goat development farm at varying age

Body traits	Number of observation	Age (Month)		
		3-6	6-12	>12
Body weight (Kg)	10	7.3±0.1c	9.8±0.1b	13.5±0.1a
Body length (cm)	10	29.7±0.8c	37.2±0.9b	45.8±1.2a
Heart girth (cm)	10	39.6±0.1c	48.6±0.3b	53.3±0.4a
Wither height (cm)	10	34.7±0.3c	42.8±0.8b	49.3±0.3a
Tail length (cm)	10	7.4±0.1c	7.7±0.2b	8.6±0.2a
Head length (cm)	10	11.9±0.2c	13.9±0.2b	15.1±0.1a
Head width (cm)	10	8.1±0.1c	8.9±0.1b	9.9±0.1a
Ear length (cm)	10	9.7±0.1c	11.3±0.2b	12.1±0.1a
Ear breadth (cm)	10	4.8±0.1c	5.1±0.1b	5.4±0.1a
Neck length (cm)	10	11.6±0.2c	13.3±0.2b	14.3±0.3a
Neck breadth (cm)	10	18.8±0.4c	22.7±0.3b	24.9±0.4a
Fore leg length (cm)	10	20.5±0.3c	27.5±0.6b	34.1±0.7a
Hind leg length (cm)	10	23.9±0.4c	31.4±0.4b	37.7±0.8a
Udder length (cm)	10	6.9±0.3c	8.5±0.3b	11.6±0.3a
Udder Breadth (cm)	10	4.3±0.2c	6.6±0.2b	8±0.2a
Teat length (cm)	10	1.2±0.1c	2.6±0.1b	3.9±0.1a
Teat Circumference (cm)	10	7.1±0.2c	8.7±0.2b	8.9±0.5a

Data expressed as mean ±SE. Means within a row followed by the same letter are not significantly different at $p< 0.05$.

Table 3. Correlation of body weight with body length, heart girth, wither height, scrotal length and scrotal circumference in black Bengal buck

	Body weight	Body length	Heart girth	Wither height	Scrotal length
Body weight	-	-	-	-	-
Body length	0.904**	-	-	-	-
Heart girth	0.946**	0.855**	-	-	-
Wither height	0.955**	0.847**	0.939**	-	-
Scrotal length	0.924**	0.891**	0.938**	0.929**	-
Scrotal circumference	0.929**	0.856**	0.921**	0.905**	0.909**

**Mean with different superscripts are significantly different (P<0.01)

The body length of black Bengal bucks at 3-6, 6-12 and more than 12 months were 34.1±0.7, 41.6±1.1 and 49.1±0.9 cm, respectively. On the other hand, the body length of black Bengal does at 3-6, 6-12 and more than 12 months were 29.7±0.8, 37.2±0.9 and 45.8±1.2 cm, respectively. The study revealed that at different age bucks, body length is always higher than does. Hasanat *et al.* (2003) also reported that sex had a significant influence (P<0.01) on body length. It was observed that body lengths in male have a highly significant correlation (P<0.01) with body weight (0.904), heart girth (0.855), wither height (0.847), scrotal length (0.891) and scrotal circumference (0.856) in Table 4. The relationship of body length with body weight, heart girth and wither height for does are presented in Table 4. It was observed in does that body length has a highly significant correlation (P<0.01) with body weight (0.903), heart girth (0.944) and wither height (0.941).

The heart girth of black Bengal bucks at 3-6, 6-12 and more than 12 months were 40.8±0.3, 51.8±0.3 and 55.4±0.2 cm, respectively. On the other hand, the heart girth of black Bengal does at 3-6, 6-12 and more than 12 months were 39.6±0.1, 48.6±0.2 and 53.3±0.4 cm, respectively. It was observed that the hearth girth of the buck has a highly significant correlation (P<0.01) with body weight (0.946), body length (0.855), wither height (0.939), scrotal length (0.938), and scrotal circumference (0.921). On the other hand, heart girth does have a highly significant correlation (P<0.01) with body weight (0.944), body length (0.892) and wither height (0.947). The study revealed that at different age bucks' heart girth are always higher than does. The heart girth reported by Singh et al. (1987) for male was almost similar, but that of female was lower in comparison to the present study.

The wither height of black Bengal bucks at 3-6, 6-12 and more than 12 months were 36.1±0.4, 46.5±0.8 and 52.9±0.6 cm, respectively. On the other hand, the Wither height of black Bengal does at 3-6, 6-12, and more than 12 months were 34.6±0.3, 42.8±0.8 and 49.3±0.3 cm, respectively. It was found that wither height of buck has a highly significant correlation (P<0.01) with body weight (0.955), body length (0.847), heart girth (0.939), scrotal length (0.929), and scrotal circumference (0.905). On the other hand, wither height of does has a highly significant correlation (P<0.01) with body weight (0.941), body length (0.898) and heart girth (0.947). Rahman (2006) reported that wither height of black Bengal bucks at 3-6, 6-12 and >12 months of age were (36.1, 46.1 and 51.9 cm), respectively, the results of the present study.

The tail length of black Bengal bucks at 3-6, 6-12 and more than 12 months were 7.4±0.1, 8.4±0.2 and 10.4±0.1 cm, respectively. On the other hand, the tail length of black Bengal does at 3-6, 6-12 and more than 12 months were 7.3±0.1, 7.8±0.2 and 8.6±0.2 cm, respectively. The

Table 4. Correlation of body weight with body length, heart girth and wither height in black Bengal do

	Body weight	Body length	Heart girth
Body weight	-	-	-
Body length	0.903**	-	-
Heart girth	0.944**	0.892**	-
Wither height	0.941**	0.898**	0.947**

**Mean with different superscripts are significantly different (P<0.01)

study revealed that at a different age, bucks' tail length is always higher than does.

The head length of black Bengal bucks at 3-6, 6-12 and more than 12 months were 12.2±0.1, 14.2±0.1 and 16.1±0.1 cm, respectively. On the other hand, the head length of black Bengal does at 3-6, 6-12, and more than 12 months were 11.9±0.2, 13.9±0.2 and 15.1±0.1 cm, respectively. The study revealed that at a different age, bucks' head length is always higher than does. Hasanat (2003) reported that the head length of males and females at 12 months of age was 16.5 and 15.5 cm, which are very close to the present study results.

The head width of black Bengal bucks at 3-6, 6-12 and more than 12 months were 8.2±0.1, 10.6±0.1 and 10.5±0.2 cm, respectively. On the other hand, the head width of black Bengal does at 3-6, 6-12, and more than 12 months were 8.1±0.1, 8.9±0.1 and 9.8±0.1 cm, respectively. The study revealed that at a different age, bucks' head width is always higher than does. Rahman (2007) found the lower the head width of black Bengal male and female at 12 months of age than the present study.

The Ear length of black Bengal bucks at 3-6, 6-12 and more than 12 months were 9.90±0.08, 11.1±0.1 and 12.1±0.1 cm. On the other hand, the Ear length of black Bengal does at 3-6, 6-12 and more than 12 months were 9.6±0.1, 11.3±0.2 and 12.0±0.1 cm respectively. The study revealed that at different age bucks' Ear length are slightly lower than does. The Ear breadth of black Bengal bucks at 3-6, 6-12 and more than 12 months were 5.0±0.1, 5.6±0.1 and 5.9±0.1 cm. On the other hand, the Ear breadth of black Bengal does at 3-6, 6-12 and more than 12 months were 4.8±0.1, 5.1±0.1 and 5.4±0.1 cm respectively. The study revealed that at different age bucks' Ear breadth are always higher than does. Hasan *et al.* (2003) found the average ear length and breadth of black Bengal bucks and does at 12 months of age were (12.8, 5.5) and (12.7, 5.4) cm, respectively which are in close agreement with the results of this study.

The neck length of black Bengal bucks at 3-6, 6-12 and more than 12 months were 10.5±0.2, 12.4±0.3 and 14.1±0.3 cm respectively. On the other hand, the tail length of black Bengal does at 3-6, 6-12 and more than 12 months were 11.5±0.1, 13.3±0.2 and 14.2±0.2 cm respectively. The neck breadth of black Bengal bucks at 3-6, 6-12 and more than 12 months were 20.6±1.1, 25.2±1.6 and 29.9±1.7 cm respectively. On the other hand, the neck breadth of black Bengal does at 3-6, 6-12 and more than 12 months were 18.7±0.3, 22.6±0.3 and 24.9±0.4 cm respectively. The neck length of does are slightly higher than buck.

The fore leg length of black Bengal bucks at 3-6, 6-12 and more than 12 months were 22.7±0.4, 30.7±0.4 and 33.7±0.7 cm respectively. On the other hand, the fore leg length of black Bengal does at 3-6, 6-12 and more than 12 months were 20.5±0.2, 27.5±0.5 and 34.1±0.6 cm respectively. The study revealed that at different age bucks' fore leg length is always higher than does. The hind leg length of black Bengal bucks at 3-6, 6-12 and more than 12 months were 23.8±0.5, 31.6±0.7 and 40.71±0.48 cm respectively. On the other hand, the hind leg length of black Bengal does at 3-6, 6-12 and more than 12 months were 23.9±0.3, 31.4±0.4 and 37.7±0.8 cm respectively. The study revealed that at different age bucks' hind leg length is always higher than does. Rahman (2007) reported that the fore and hind leg lengths of black Bengal bucks at 3-6, 6-12 and more than 12 months of age were (15.9, 23.6, 24.8 cm) and (17.9, 25.5, 27.2 cm), respectively.

The scrotal length at 3-6, 6-12 and more than 12 months were 95.8±0.2, 9.2±0.2 and 11.2±0.3 cm and scrotal circumference were 12.9±0.3, 17.3±0.2 and 20.2±0.3 cm, respectively (Table 2). It was found that scrotal length has a highly significant correlation ($P<0.01$) with body weight (0.924), body length (0.891), heart girth (0.938), wither height (0.929), and scrotal circumference (0.909). Scrotal circumference has highly significant correlation ($P<0.01$) with body weight (0.929), body length (0.856), heart girth (0.921), wither height (0.905), scrotal length (0.909). Rahman (2007) reported that the scrotal circumference of black Bengal bucks at 3-6, 6-12 and 12 months were 5.85, 9.40, 11.42 cm, which strongly supports the results of the present study. Samsuddin *et al.* (2000) reported that the mean scrotal circumference of black Bengal buck at 3-6, 6-12 and more than 12 months were 13.0, 18.0 cm and 21 cm which is slightly higher than the present study.

The udder length of black Bengal does at 3-6, 6-12, and more than 12 months were 6.9±0.3, 8.5±0.3 and 11.6±0.2 cm, respectively (Table 2). On the other hand, the udder breadth of black Bengal does at 3-6, 6-12 and more than 12 months were 4.3±0.2, 6.5±0.1 and 8.0±0.2 cm, respectively (Table 2). No available literature was cited on the mammary gland of BBG. Udder length may be varied due to age and hand milking of doe. The teat length of black Bengal does at 3-6, 6-12 and more than 12 months were 1.2±0.1, 2.6±0.1 and 3.9±0.1 cm, respectively

(Table 2). On the other hand, the teat circumference of black Bengal does at 3-6, 6-12 and more than 12 months were 7.1±0.2, 8.6±0.1 and 8.9±0.5 cm, respectively (Table 2). Teat length and circumference depends upon age and milking of doe. Literature is not available to compare for this trait with others.

Conclusions

This study revealed that the most of the parameters in male were higher than females, and increased linearly with increasing ages. Body weight had a strong positive correlation with body length, heart girth, wither height, scrotal length and scrotal circumference.

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