Bang. J. Anim. Sci. 2008, 37(2) : 8 - 16 ISSN 0003-3588

MORPHOMETRIC CHARACTERIZATION AND RELATIONSHIP OF BODY WEIGHT WITH LINEAR BODY MEASUREMENTS IN BLACK BENGAL BUCK

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Abstract

The present study was conducted at the Artificial Insemination Center, Bangladesh Agricultural University, Mymensingh to record the Black Bengal bucks morphology and to relate body weight with different body measurements. A total of 22 Black Bengal bucks of different ages were taken and were divided into six age groups (0, 3, 6, 9, 12 and 15 months). The body weight of Black Bengal bucks at 0, 3, 6, 9, 12 and 15 months of age were 1.21 ± 0.12, 4.26 ± 0.25, 7.68 ± 0.31, 12.76 ± 0.42, 16.56 ± 0.57 and 21.82 ± 0.70 kg respectively. Age had a significant effect ($P<0.05$) on heart girth, body length and height at wither ($P<0.05$) except the measurement of height at wither at 0 and 3 months. The measurement of fore and hind leg length, head length and width, ear length and breadth and also tail length differed significantly ($P<0.05$) between the age groups. The average scrotal circumferences (SC) were recorded as 4.85 ± 0.22, 10.35 ± 0.39, 15.42 ± 0.34, 18.05 ± 0.24, 19.72 ± 0.33 and 20.83 ± 0.41 cm at 0, 3, 6, 9, 12 and 15 months of age, respectively and differed significantly ($P<0.05$) with the advancement of age. Animals of the same age group supposed to be similar in conformation. Body weight was highly correlated ($P<0.01$) with heart girth (0.94), body length (0.95) and height at wither (0.96).

Key words : Morphometric characteristics, Body weight, Black Bengal Buck

Introduction

The acute shortage of genetically superior buck throughout the country is one of the major constraint of goat production in Bangladesh. Existing haphazard breeding system may lead to the extinction of the genetic potential of Black Bengal goat which requires selection of superior buck. During selection of buck attention should be given on the age, growth rate, body weight and soundness of the sexual organs. Adult body weight is important economic factor which influence the growth and production pattern of goat and has more influence mainly on the growth of kids (McGregor, 1984). As Black Bengal goats are being reared primarily for meat production, body weight and growth rate are considered as the most

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(Received : October 14, 2008)

important factor. In such case, body length and heart girth may be used as good reliable predictors to assess live weight (Bhattacharya *et al.,* 1984; Islam *et al.,* 1991). On the other hand, the measurement of scrotal circumference (SC) is necessary to predict semen output. From this point of view, morphometric of Black Bengal buck is inevitable for the selection and to predict the body weight as well as their production performances. Inspite of its potentiality, no substantial work has not been done on the phenotypic characterization of buck. The present investigation was designed to obtain some basic morphometric information and to relate body weight with different body measurements of Black Bengal buck.

Materials and Methods

A total of 22 Black Bengal bucks of different ages were taken which were divided into six groups of 0, 3, 6, 9, 12 and 15 months of age. The bucks of one group were also included in the next group with their advancement of age. The number of bucks was 5, 5, 5, 17, 9, and 6 for the above age groups, respectively. The bucks were fed with Napier and German grass twice daily as per requirement. Each buck was supplemented with commercial concentrate (crude protein content: 120g/kg DM and energy content: 10.4 MJ ME/kg DM) in the morning and again in the afternoon at the rate of 100gm and also supplied with germinated gram (20gm/buck/day). Clean water was made available at all the times. All bucks were vaccinated against *Peste des Petits Ruminants* (PPR) and dewormed routinely with *Ivermectin* thrice yearly. The flock was maintained under semi-intensive system. Individual pen was provided for each buck (10 sq.ft) in the shed with the provision of sufficient access to fresh air and their movement freely and they were allowed to graze for 1-2 hours daily. In the present study, body weight (kg), heart girth (cm), body length (cm), height at wither (cm), fore and hind leg length (cm), head length and width (cm), ear length and breadth (cm), tail length (cm) and scrotal circumference (cm) were studied.

Statistical analysis

The data generated from this experiment were entered in Microsoft Excel worksheet, organized and processed for further analysis. Data were analyzed using SAS (Statistical Analysis System, 1998) package program in accordance with the principles of CRD (Steel and Torrie, 1980) and Duncun's Multiple Range Test (DMRT) was also done to identify the significant differences between the mean values when analysis of variance (ANOVA) showed significant differences (Snedecor and Cochran, 1980).

Results and Discussion

The mean values phenotypic characters are presented in Table 1.

Body weight

The average body weight of Black Bengal bucks at 0, 3, 6, 9, 12 and 15 months of age were found to be 1.21 ± 0.12, 4.26 ± 0.25, 7.68 ± 0.31, 12.76 ± 0.42, 16.56 ± 0.57 and 21.82 ±

0.70 kg respectively (Table 1). No significant difference was reported in body weight among the animals of the same age group but it varied significantly (P<0.05) in different age groups. Husain *et al.* (1996) reported that the body weight of Black Bengal bucks at birth, 3, 6, 9 and 12 months of ages were 0.94, 4.79, 7.91, 11.04 and 15.24 kg respectively which were in agreement with the result of the present study. In another study, Alam (2006) reported 1.18, 4.17, 6.78, 10.91 and 13.22 kg body weight of bucks at birth, 3, 6, 9 and 12 months, respectively which were more or less similar with the results of the present study. Similar findings were also observed from the result of many other investigators (Hasanat *et al.*, 2003; Islam *et al*., 1991 and Singh and Sengar, 1990). But the result of the present study contradicted with the findings of Singh *et al.* (1979); Khan *et al.* (1992) who reported comparatively lower body weight than the result of the present findings. This might be due to physical condition of the selected animals, agro-climatic condition, nutritional level, housing, disease control and other managemental systems.

Heart girth

The heart girth of Black Bengal bucks at 0, 3, 6, 9, 12 and 15 months of age are shown Table 1. It was reported that age had a significant effect (p<0.05) on heart girth but there exist no significant difference among the animals of the same age group for this trait. The average heart girth of the present study at 6, 9 and 12 months of age strongly collaborated with the findings of Alam (2006) who reported that the heart girth of Bengal bucks were 51.39, 54.61 and 57.54 cm at the similar age groups. The findings of the present study were also in close association with the result of many other investigators (Hasanat *et al.,* 2003; Islam *et al.,* 1991 and Singh *et al.,* 1979). But the present result contradicted with the findings of Khan *et al.* (1992) who reported 54.03 cm heart girth at 15.08 months of age in female goats and this variation might be due to sex difference.

Body length

The body length of Black Bengal bucks at 0, 3, 6, 9, 12 and 15 months of age Table 1 shows. Body length differed significantly (P<0.05) in different age groups but no significant difference was observed among the animals of the same age group. The average body length of the present study at 6, 9 and 12 months of age was in consistent with the findings of Alam (2006) who reported the body length of White Bengal bucks were 42.83, 47.18 and 50.69 cm respectively at the similar age groups. In another study, Hasanat *et al.* (2003) reported the average body length of Black Bengal buck was 47.07 ± 0.43 cm at 12 months of age which strongly supported the present result. But the present result contradicted to some extend with the findings of Islam *et al.* (1991) who reported comparatively lower body length. This variation might be due to nutritional level, disease control and other managemental factors.

Height at wither

In the present study, it was observed that height at wither significantly (P<0.05) differed (Table 1) between different age groups except 0 (at birth) and 3 months age group which were almost similar. On the other hand, no significant difference was observed among the animals of the same age group. Hasanat *et al.,* (2003) reported that the height at wither was

48.50 ± 0.42 cm at 12 months of age in Black Bengal buck which is similar to the present result. The average body length of the present study at 6, 9 and 12 months of age collaborated with the findings of Alam (2006) who reported 42.11, 45.00 and 48.00 cm height at wither respectively at the similar age group in White Bengal bucks. However, no reliable citations were available to support the results of height at wither at 0, 3 and 15 months of age to compare with observed values.

Length of fore and hind leg

From Table 1, it was observed that the fore leg length at 12 and 15 months of age was similar and significantly ($P<0.05$) higher than that of other age groups but no significant difference was found among the animals of the same age group. The same results were observed in case of hind leg length. In a study, Alam (2006) reported 24.17, 25.93 and 26.79 cm fore leg length and 27.67, 29.04 and 30.58 cm hind leg length respectively at 6, 9 and 12 months of age respectively which were in close agreement with the result of the present study. Similar result was also observed from the investigation of Hasanat *et al.* (2003) who reported the average fore and hind leg lengths of Black Bengal goats were 25.91 and 30.80 cm for male at 12 months of age.

Head length and width

The head length and width of Black Bengal bucks at 0, 3, 6, 9, 12 and 15 months of age are shown Table 1. Statistical analysis revealed that the head length was significantly ($P<0.05$) different in different age groups. On the other hand, though the head width at 15 months of age was significantly ($P<0.05$) higher but it was found statistically similar at 6, 9 and 12 month of age. However, no significant difference was reported among the animals of the same age group for both these traits. Alam (2006) who reported the average head lengths of white Bengal bucks were 15.00, 16.64 and 18.00 cm respectively which were in close agreement with the result of the present study. Hasanat *et al.* (2003) observed 15.53 and 9.71 cm head length and width respectively at 12 months of age in Black Bengal bucks which were 7% and 22% lower than the results of the present study. This might be due to individual variation of the selected animals and lower number of observations.

Ear length and breadth

The length of ear at 0 and 3 months were significantly ($P<0.05$) different from each other whereas similar ear length was observed in between 6 and 9 months (Table 1). It was also observed that the ear length at 12 and 15 months of age were almost similar and significantly ($p<0.05$) higher than that of other age groups but there exist no significant difference among the animals of the same age group. The same results were found in case of ear breadth. Alam (2006) reported 11.58, 11.94, 12.62 and 5.30, 5.75, 5.90 cm ear length and breadth at 6, 9 and 12 months of age respectively which was in agreement with the results of the present study. Gall (1996) observed that the ear length of Black Bengal goats was 11.5 to 14.1 cm at 12 months of age which also collaborated with this study and similar result was also observed from the investigation of Hasanat *et al*. (2003). On the contrary, Singh *et al* (1981) reported the average ear length of Black Bengal goats at 0-3, 3-6 and 6-12 months of age

were 7.7, 8.7 and 9.8 cm respectively which are lower than the present study. This might be due to physical condition of the selected animals and minimum data structure.

Tail length

The tail length of Black Bengal bucks 15 months of age was found to be 11.58 ± 0.38 cm respectively (Table 1) which was significantly (P<0.05) higher than that of other age groups. Singh *et al.* (1979) conducted an experiment with Black Bengal goat and found that the tail length at 12 months of age was 11.3 ± 0.25 cm which was higher than the result of the present study. Singh *et al.* (1981) reported the average tail length of Black Bengal goat at 0-3, 3-6 and 6-12 months of age were 7.9 ± 0.29, 10.0 ± 0.24 and 10.1 ± 0.29 cm respectively which also differed from the results of the present study. This might be due to physical condition of the selected animals, agro-climatic condition and minimum data structure.

Table 1. Different body traits at varying age of Black Bengal buck

Parameters	Age group (Month)					
	0 (At birth)* (n=5)	3 month* (n=5)	6 month* (n=5)	9 month* (n=17)	12 month* (n=9)	15 month* (n=6)
Body weight (kg)	1.21^{f}±0.12	4.26^{e}±0.25	7.68^{d}±0.31^{d}	12.76^{c}±0.42	16.56^{b}±0.57	21.82^{a}±0.70
Heart girth (cm)	26.35^{f}±0.38	35.67^{e}±0.40	51.10^{d}±0.82	54.26^{c}±0.64	59.08^{b}±0.87	63.25^{a}±1.07
Body length (cm)	24.15^{f}±0.38	29.70^{e}±0.75	41.20^{d}±0.76	43.87^{c}±0.54	47.83^{b}±0.75	51.25^{a}±0.92
Height at wither (cm)	26.30^{e}±0.35	28.45^{e}±0.80	39.95^{d}±0.70	43.73^{c}±0.55	47.92^{b}±0.76	51.21^{a}±0.93
Fore leg length (cm)	15.95^{d}±0.23	18.22^{c}±0.34	23.67^{b}±0.37	24.82^{b}±0.27	26.64^{b}±0.37	27.50^{a}±0.45
Hind leg length (cm)	17.90^{e}±0.23	20.19^{d}±0.36	25.55^{c}±0.38	27.29^{b}±0.34	31.14^{a}±0.47	32.41^{a}±0.58
Head length (cm)	8.6^{f}±0.36	12.05^{e}±0.31	14.40^{d}±0.33	15.39^{c}±0.19	16.67^{b}±0.26	17.63^{a}±0.32
Head width (cm)	7.00^{c}±0.18	7.45^{c}±0.19	11.45^{b}±0.51	11.70^{b}±0.25	12.33^{b}±0.34	14.00^{a}±0.41
Ear length (cm)	6.70^{d}±0.29	8.95^{c}±0.18	11.05^{b}±0.29	11.40^{b}±0.19	12.69^{a}±0.27	13.00^{a}±0.33
Ear breadth (cm)	3.95^{d}±0.09	4.12d±0.14	5.30^{c}±0.09	5.66^{bc}±0.09	5.90^{ab}±0.12	6.19^{a}±0.15
Tail length (cm)	5.15^{d}±0.17	6.10^{d}±0.26	8.75^{c}±0.26	8.86^{c}±0.23	10.25^{b}±0.31	11.58^{a}±0.38
Scrotal circumference (cm)	4.85^{f}±0.22	10.35^{e}±0.39	15.42^{d}±0.34	18.05^{c}±0.24	19.72^{b}±0.33	20.83^{a}±0.41

^{abcde} Means with different superscripts differed significantly within the row (p<0.05)

Scrotal circumference (SC)

The average scrotal circumference of Black Bengal bucks were recorded 4.85 ± 0.22, 10.35 ± 0.39, 15.42 ± 0.34, 18.05 ± 0.24, 19.72 ± 0.33 and 20.83 ± 0.41 cm at 0, 3, 6, 9, 12 and 15 months, respectively (Table 1). The scrotal circumference differed significantly (P<0.05) with the advancement of age. Shamsuddin *et al*. (2000) reported that the mean scrotal circumference of Black Bengal buck at puberty ranged from 14.0 to 16.0 cm which strongly supported the results of the present study. The measurement of scrotal circumference at 15 months of age strongly coincided with the result of Igboeli (1974) who obtained the mean scrotal circumference of 20.9 ± 0.3 cm for native Zambian bucks. But no authentic citations

were available to support these results of scrotal circumferences at 0, 3 and 12 months of age.

Relationship of body weight with heart girth, body length and height at wither in Black Bengal buck

The relationship of body weight with heart girth, body length and height at wither were graphically presented in Figure 1, Figure 2 and Figure 3. From the figures, it was observed that body weight was highly significantly correlated ($P<0.01$) with heart girth (0.94), body length (0.95) and height at wither (0.96). Noran and Mukherjee (1997) reported that increase in body length, chest circumference and height at withers reflected significantly ($P<0.001$) on the increase of body weight of the bucks which was in agreement with the findings of the present study.

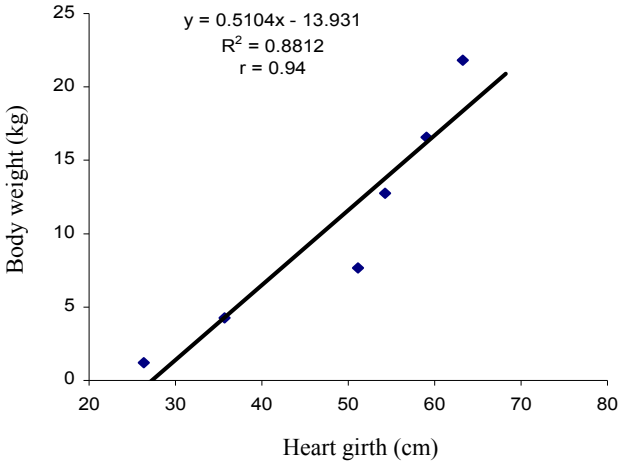

Fig. 1. Relationship between body weight and heart girth in Black Bengal bulk

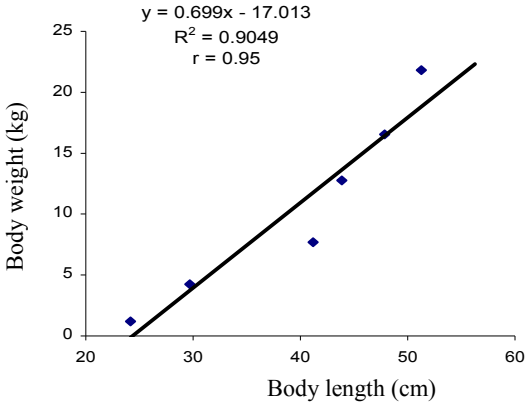

Fig. 2. Relationship between body weight and body length in Black Bengal bulk

Singh *et al*. (1987) reported body weight was significantly correlated value of with chest circumference in brown Bengal does and grey Bengal goats. Tandon (1966) also reported significant association between chest girth and body weight in Beetal goats which was also in consistent with the findings of the present study. The present findings also collaborated with the result obtained by Singh *et al.* (1981) who reported height at wither was significantly correlated with live weight. The results of the present study were found to be higher than the findings of Khan *et al.* (2006) who observed positive correlation of body weight with heart girth (0.64), body length (0.49) and height at wither (0.75) at 4-12 months of age in Beetal goats. This might be due to variation in breed, birth weight of the individual, agro-climatic condition, nutrition, managemental condition and lower sample size of the present study. The relationship between body weight and chest girth can be explained by intimate association between body weight and growth of muscles, bones and visceral organs (Prasad *et al.*, 1981). They also reported that the relationship between body weight and body length might be due to close association between weight and growth of muscles and bones leading to increase in body length.

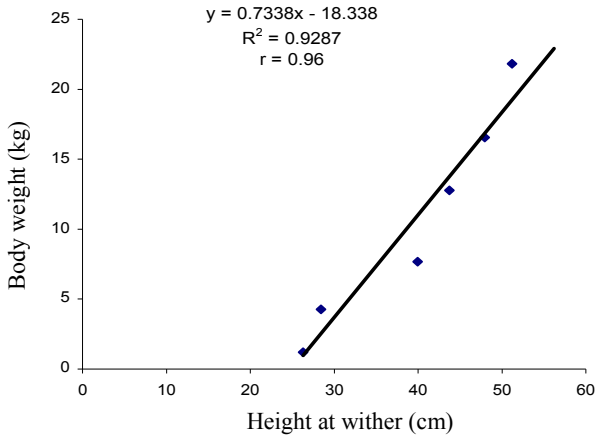

Fig. 3. Relationship between body weight and height at wither in Black Bengal bulk

From the regression analysis shown in the above figure 1, 2 and 3, it explains that for 1 cm increase of heart girth resulted in 0.5104 kg increase of body weight (Y = 0.5104X - 13.931). On the other hand, body weight increased about 0.699 and 0.734 kg for 1 cm increase of body length (Y = 0.699X - 17.013) and height at wither (Y = 0.7338X - 18.338) respectively. These findings implied that heart girth, body length and height at wither may be used for the prediction of body weight as well as production.

Conclusion

It is concluded that bucks of the same age group did not vary in different body measurements. But age had a significant effect on different body parameters. Moreover,

heart girth, body length and height at wither strongly and positively correlated with body weight. So they can be used as good selection criteria for predicting body weight and meat production from goat which might play a major role for minimizing the huge animal protein gap of our country. In this regard, future studies need to be conducted throughout the buck population of Bangladesh.

Acknowledgements

Major funding for this research has been provided through a grant from the United States Department of Agriculture (USDA), foreign agriculture service. The logistic support received from the Department of Animal Breeding and Genetics, Bangladesh Agricultural University is gratefully acknowledged.

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