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Growth performance of graded Brahman calves in selected areas of Mymensingh district

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ABSTRACT

The objectives of this study were to know the growth performance of graded Brahman calves, the phenotypic and genetic correlations between different growth traits and factors related to growth performance of Brahman graded calves in selected areas of Mymensingh district. Data on 422 Brahman graded calves were collected under the project entitled "Genetic improvement of indigenous cattle for beef production through crossing with Brahman cattle by farmers' participatory breeding approach in Bangladesh" under the department of Animal Breeding and Genetics, BAU, Mymensingh. Statistical analyses of all the parameters were done using Statistical Analysis System (SAS). The growth performance and average daily gain of male calves were higher than those in female calves at different growth stages. The highest birth weight and weight at different stages of calves were higher in Bhabakhali and lowest in Dowhakhula area. Sex and area had significant effect ($p<0.05$) on different growth traits of Brahman crossbred calves. Breeding bull had significant effect ($p<0.05$) on nine-month and twelve weight and average daily gain from birth up to twelve month of age. Feeding system had significant effect ($p<0.05$) on different growth traits. Improve feeding would have positive impact on growth performance quite natural. Growth traits were positively correlated to each other and strong phenotypic correlations were observed between weight at nine and twelve-month (0.95), six- and twelve-month (0.94) and six- and nine-month (0.93). It may be concluded that further study with larger sample sizes covering more factors related to growth performance of graded Brahman calves would be required to draw a better conclusion in this regard.

Introduction

Beef consumption will gradually increase over the next ten years. By 2025, it is expected to increase by almost 6% in developed countries, whereas in developing regions it is expected to increase approximately 21% (FAO 2016). Beef consumption per capita in developing world remains low relative to developed countries, at one third in volume terms. It is projected that demand for meat will continue to grow especially in the emerging developing countries and prices will remain at a high level. Bangladesh annually requires 70.52 Lakh Metric Ton of meat but it could only produce 61.52 lakh MT, according to data from Department of Livestock Services (DLS). However, to meet the total yearly meat demand, we depend on foreign countries, especially neighbouring India, for 40% of meat. Bangladesh has a great demand of beef but it has been facing demand and supply mismatches due to insufficient production and supply of beef, low carcass yield of native cattle and recent no cattle export policy of long bordered neighboring country. Under the Beef Cattle Development Project, for the very first time the authority of DLS is pretty much concerned to meet the demand of the cow meat across the country. As part of this programme, 10,000 samples of semen were brought to be used experimentally in Bangladesh in 2008. The semen was experimentally given to contract farmers in 80 upazila. The results from the very beginning of its experiment were reasonably positive. As a result in the fiscial year 2018-19 the production of meat was 75.14 Lakh Metric Ton which was more than demand.

The Brahman breed originated from United States. This breed has some characteristics which make it different from the other breed, are the hump over the shoulder, long legs, large pendulous ears, abundance of loose folds of skin under the neck and smooth hair coat (Peacock *et al*., 1999). According to Bondoc *et al,* (1989), the highly commercial and specialized beef cattle improvement systems practiced in the developed countries may not be biologically and economically suitable in developing situations. Therefore, to accelerate genetic potential of our beef cattle broadly, the crossbreeding within superior local stock can be practiced to meet up future challenge of animal products. The economic benefits obtained from a crossbreeding system can be great, but efficacy of the system depends upon the proper mating of cows to superior and unrelated bulls (Olson, 2011). While using in crossbreeding system Brahman shows greater heterotic (hybrid vigor) advantages than *Bos taurus* breed. So the Brahman breed has contributed

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much in this regard. However, in most aspects, the animal and it's productivity is the result of its genetic make-up or it's genotype responding to the many non-genetic factors which comprise production system, season, feed, environment, area.

Recent evidence suggests that beef from cattle with a high percentage Brahman parentage has lower marbling and less tender on average than beef from other breeds. No effort has been made to improve carcass quality traits in the Brahman. Because of the importance of the Brahman breed to beef production. The average weight of pure adult Brahman male and female are 1100 and 500-600 kg respectively. Haque *et al*. (2016) found 179.03±1.9 5kg average weight and 446.51±16.04 g average daily gain at twelve month of age of graded Brahman calves (25%) which is higher than the deshi cattle (about 90-100kg). It has the higher heat tolerance and resistance ability against parasites that led to the widespread interest to research their utility in crossbreeding programs, the high solar energy tolerance, ambient temperature and humidity; and the ability to utilize high fiber forages that gives much interest of rearing it. Average birth weight and growth rate is higher for Brahman graded calves which is the most crucial factor for growth performance. For above reasons farmers' are getting interested in rearing Brahman graded calves. The present study was therefore undertaken to know the growth performance, the phenotypic and genetic correlations between different growth traits and factors related to growth performance of graded Brahman calves in selected areas of Mymensingh district.

Materials and Methods

Data collection

The data for this present experiment was collected on the growth performance of 422 Brahman cross (25%) calves from ongoing project under the Department of Animal Breeding and Genetics entitled, "Genetic improvement of indigenous cattle for beef production through crossing with Brahman cattle by farmers' participatory breeding approach in Bangladesh". In this project, 4 (four) Brahman crossbred (graded) breeding bulls were selected (Bull ID: ABG011, ABG012, ABG013 and ABG014) and used on the basis of their average daily gain, physical appearance and libido. The selected bulls were reared at the Artificial Insemination Center of Bangladesh Agricultural University for semen collection in order to inseminate the indigenous cow to improve beef production potentialities in the progeny. Weight of graded calves were taken by using digital weighing balance from birth upto six-month of age. From nine month of age weight was taken by using following Shaeffer's formula, described by Hossain and Akhter (1999) as follows:

$$\text{Live weight (kg)} = \frac{\text{Body length} \times (\text{Heart girth})2}{300 \text{x} 2.2}$$

Average daily gain for calves were calculated by the following formula

$$\text{Average daily gain(g)} = \frac{\text{Final weight} - \text{Initial weight}}{365}$$

The study was conducted between May 2018 to March 2019.

Study site

In this study three villages were considered named Boera, Bhabokhali and Dowhakhola in Mymensingh district and were monitored to know the effect of some factors related to growth performance.

Traits under study

Studied traits on Brahman graded calves were bull, sex, feeding system, and area of study.

Population size and data structure

Deshi cows were inseminated with the graded Brahman (50% Brahman bull×50% indigenous) semen in the selected areas of Mymensingh city, Bangladesh and a total of 4000 of 25% crossbred (graded) calves were produced and out of them data on 422 (those have all records) were considered in this study. Population size and data structure of Brahman crossbred calves are presented in Fig. 2 and Fig. 3.

Statistical analysis

After collecting data on graded calves from record sheet the AI field worker and Upazila Livestock Office of the selected areas, pre-tabulation task of the collected data was done and records on graded progeny were entered in Excel sheets of Microsoft office computer program for further analyses. Effect of area, bull, sex and feed on growth performance of graded were estimated on birth weights three-month, six-month, nine-month, twelve-month and average daily gain. The sorted data were analyzed to obtain results of ANOVA by using Statistical Analysis System (SAS, 1998) computer package and DUNCAN test was performed to separate mean values in case of significant factors.

Statistical model for growth traits

$$Y_{ijkl} = \mu + B_i + F_j + S_k + A_l + e_{ijkl}$$

Where, Y is a dependent variable (individual animal records for the animal), μ is the overall mean, B_i is the effect of bull, F_j is the effect of feeding system, $S_k$is the effect of sex, A_l is the effect of area, e_{ijkl} is the residual error.

Results

Effect of sex on growth traits at different stages

Growth performances of male and female cross calves of Brahman (ignoring bull effect and area) are presented in Table 1. The table shows that male calves had higher birth weight, three-month, six-month, nine-month, twelve-month weight than those of female calves. Sex had significant effect ($p<0.01$) on birth weight between male and female calves and weight at different stages.

Effect of area on growth traits at different stages

Area had significant effect ($P<0.05$) on birth weight and weight at different stages (three-month weight, six-month weight, nine-month weight, twelve-month weight) (Table 2). The highest birth weight was observed in Bhabakhali (19.48±0.14 kg) and lowest birth weight was in Dowhakhola (17.94±0.10 kg). Bhabakhali had higher six-, nine- and twelve-month weight than that of two areas named (Boera, Dowhakhola). The higher growth performance in this area might be due to better feeding or management practices.

Average daily gain

The gradual increase of average daily gain of Brahman cross calves (both sexes) are graphically shown in Fig. 1, where age of calves is shown in X axis and average daily gain at different stages is shown in Y axis. This Figure shows that average daily gain of calves is enhanced as age progresses. However, progress in average daily gain of male calves was higher than the progress in average daily gain of female calves.

Effect of breeding Bull on growth traits at different stages

We used four Brahman cross breeding bulls (ABG011, ABG012, ABG013 and ABG014) for this study. Weight at different stages of Brahman cross calves produced from these bulls are shown in Table 3 with mean values along with standard error. We didn't find any significant effect of bull on birth weight, three-month weight, six month weight of calves, while bull had significant effect on nine month weight calves. Bull had significant effect on average daily gain on birth up to twelve month weights.

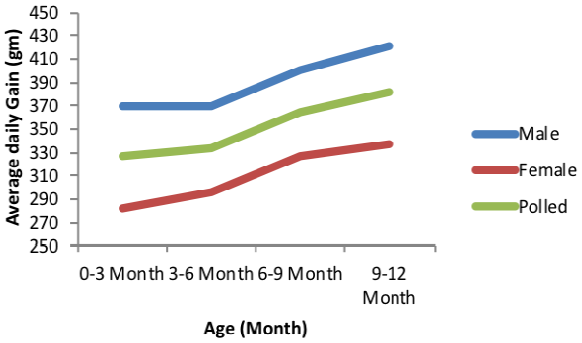

Fig. 1. Effect of average daily gain of Brahman cross calves from birth to twelve month of age

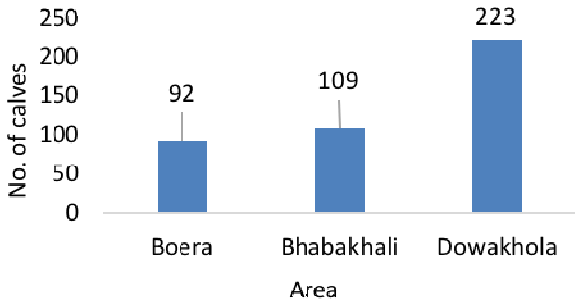

Fig. 2. Population size of graded Brahman calves among three areas

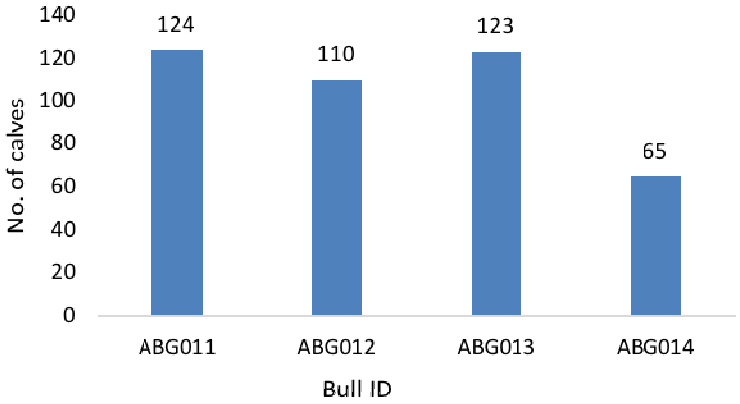

Fig. 3. No. of graded calves produced from four different bulls

Table 1. Effect of sex on growth performances of Brahman graded calves at different stages

Stages	Mean ±SE (kg)		Level of Significance
	Male (217)	Female (205)	
BWT	18.96± 0.11	17.18± 0.12	*
WT3	52.17± 0.45	43.59± 0.47	**
WT6	85.60± 0.58	71.38± 0.60	**
WT9	127.02± 0.89	106.46± 0.92	**
WT12	172.90±1.15	141.40± 1.19	**
$ADG12_{(0-12)}$	421.78± 2.93g	337.60±3.01g	**

Figures in the parentheses indicate the number of observation; BWT, birth Weight; WT3, three-month weight; WT6, six-month weight; WT9, nine-month weight; WT12, twelve-month weight; $ADG_{(0-12)}$, average daily gain from birth up to twelve months;*, p<0.05; **, p<0.01

Table 2. Effect of area on growth performances of Brahman graded calves at different stages

Stages	Mean ±SE (kg)			Level of Significance
	Boera (92)	Bhabakhali (109)	Dowhakhola (221)	
BWT	19.08^{b}±0.16	19.48^{a} ±0.14	17.94^{c}±0.10	*
WT3	50.68^{a}±0.80	49.67^{a}±0.74	46.06^{b}± 0.52	*
WT6	81.68^{a}±1.12	81.75^{a}±1.03	75.94^{b}±0.72	*
WT9	121.85^{a}±1.67	122.24^{a}±1.54	112.47^{b}±1.08	*
WT12	163.77^{a}±2.33	164.39^{a}±2.14	151.69^{b}±1.50	*

Figures in the parentheses indicate the number of observation; BWT, birth weight; WT3, three-month weight; WT6, six-month weight; WT9, nine-month weight; WT12, twelve-month weight; Means with uncommon superscripts within the same row differed significantly ;*, p<0.05.

Table 3. Effect of bull on growth trait of Brahman graded calves from birth up to twelve month age produced from different bulls

Stages	Breeding bulls Mean ±SE (kg)				Level of Significance
	ABG011 (124)	ABG012 (110)	ABG013(123)	ABG014 (65)	
BWT	18.61± 0.15	18.55± 0.16	18.49± 0.15	18.78± 0.20	NS
WT3	48.98± 0.72	47.02± 0.76	47.45± 0.71	48.86± 0.98	NS
WT6	80.13± 1.01	78.13± 1.07	78.14± 0.99	78.04± 1.37	NS
WT9	119.08^{b}± 1.52	115.00^{a}± 1.61	116.81^{b} ±1.48	117.05^{b} ±2.05	*
WT12	162.10^{a}± 2.09	154.71^{b}± 2.22	155.91^{b} ±2.04	156.33^{b}±2.84	*
$ADG_{(0-12)}$	416.19± 3.37^{ab}g	419.84± 3.58^{a} g	415.85± 3.38^{ab}g	410.22± 4.66^{b}g	*

Figures in the parentheses indicate the number of observation; BWT, birth weight; WT3, three-month weight; WT6, six-month weight; WT9, nine-month weight; WT12, twelve-month weight; $ADG_{(0-12)}$, average daily gain from birth up to twelve months; Means with uncommon superscripts within the same row differed significantly; NS, not significant *, p<0.05.

Table 4. Effect of feeding system on growth traits of Brahman graded calves from birth up to twelve month of age

Stages	Feeding system Mean ±SE (kg)		Level of Significance
	Improve Feeding (91)	Poor Feeding (331)	
BWT	18.83±0.17	18.52±0.09	NS
WT3	55.59±0.72	45.91±0.38	*
WT6	84.90±1.11	76.98±0.58	*
WT9	127.09±1.66	114.27±0.87	*
WT12	172.68±2.28	153.45±1.20	*
$ADG_{(0-12)}$	421.48±5.92g	369.73±3.10g	*

Figures in the parentheses indicate the number of observation; BWT, birth weight; WT3, three-month weight; WT6, six-month weight; WT9, nine-month weight; WT12, twelve month weight; $ADG_{(0-12)}$, average daily gain from birth up to twelve months; Means with uncommon superscripts within the same row differed significantly (p<0.05).

Table 5. Phenotypic correlations among the growth traits of Brahman graded calves at different stages

Growth trait	WT3	WT6	WT9	WT12
BWT	0.63	0.74	0.75	0.71
WT3		0.88	0.86	0.87
WT6			0.93	0.94
WT9				0.95

BWT, birth Weight; WT3, three-month weight; WT6, six-month weight; WT9, nine-month weight; WT12, twelve month weight;

Effect of feeding system on growth traits

From the Table 4 we found that when improve feeding was practiced, the weight gain at different ages and average daily gain from birth up to twelve month of age were higher than that of poor feeding. Here improve feeding means of practicing both grazing and concentrate and poor feeding means only grazing. Improve feeding was practiced in Bhabkhali area and poor feeding was practiced in Dowhakhola area and found significant effect on growth performance. So, feeding system had significant effect on three-month, six-month, nine-month and twelve month weight of calves and average daily gain from birth up to twelve month.

Phenotypic correlation among growth traits

Phenotypic correlation among the growth traits of Brahman cross calves at different ages is summarized in Table 5. Birth weight, three-, six-, nine-, twelve-month weight and average daily gain from birth up to twelve month, all are positively correlated to each other. Strong correlations were found between weight at nine-month and weight at twelve-month (0.95), between weights at six- and twelve-month (0.94) and between weights at six- and nine-month (0.93).

Discussion

Birth weight of calves

The average birth weight of 25% Brahman male and female calves was 18.96±0.11 kg and 18.17±0.12 kg, respectively (Table 1) that were lower than the result found by Cunningham *et al*. (2005) and Antonio *et al*. (2006), respectively, according to them average birth weight for Brahman cross calves (male and female) were 35.4 and 30.7 kg respectively. The highest birth weight 19.48±0.14 kg was observed in Bhabakhali and the lowest birth weight was (17.94±0.10 kg) in Dowhakhola (Table 2). The birth weight of calves at Boera area (19.08±0.16 kg) (Table 3) stood in an intermediate position. Area and sex had significant ($p<0.05$) effect on birth weight of 25% Brahman cross calve. The values of birth weight of the present study were comparable to the value reported by Haque *et al*. (2011) that the birth weight of Brahman cross calves was 22.25±5.60 kg for male and 20.33±3.88 kg for female calves (average 21.38±4.98 kg). According to Plasse *et al.* (2002) the average weights for birth and weaning were 28.2 kg, 157.5 kg and 292.4 kg, respectively, in Brahman cattle in Venezuela which was much higher than the value of the present findings. The birth weight of the present study was closely related to the values of 21.1 kg and 22.00 kg as observed by Vargas *et al*. (1999) and Keith *et al*. (2010), respectively. Lee and Pollak (1997) found significant effect of sex on birth weight of calves that was agreed with the present study. According to Dillon *et al.* (2015), the Brahman-cross calves exhibit unusual inheritance of birth weight: Brahman-sired crossbreds out of females were heavier with greater difference between sexes than calves of the reciprocal cross.

Growth rate at different stages

The average three-month weight of 25% Brahman male and female calves were 52.17±0.45 and 43.59±0.47 kg, respectively (Table 1). The average three month weight (52.17± 0.45 kg) of male calves was similar to the average three month weight of male calves (53.53±1.13 kg) found by Haque *et al.* (2016). The average six-month weight of 25% Brahman cross male and female calves were 85.60±0.58 and 71.38±0.60 kg, respectively. The average six-month weight of 25% Brahman cross calves was (78.7±0.54 kg),the weight found from the study was much lower than the findings reported by Chen *et al.* (2012) of Piedmontese and Nanyang as 194 kg, and was comparatively close to Haque *et al.* (2016) 86.61±2.02 kg, respectively.

The average nine month weight of 25% Brahman male and female cross calves were 127.02±0.89 kg and 106.46±0.92 kg, respectively which was much lower than the findings found by Neser *et al.* (2012) of which was 227.6 kg for Brangus but was found higher than the findings reported by Afroz *et al.* (2011), Rabeya *et al.* (2009), and Carew *et al.* (1986) which were 116.85, 108.09, and 123.0 kg for crossbred, respectively. Area and sex had significant ($p<0.01$) effect on nine-month weight. The average twelve-month weight of 25% Brahman cross male and female calves was 172.90±1.15 kg and 141.40±1.19 kg, respectively. The average twelve-month weight of 25% Brahman cross calves was(157.6±1.12 kg)when using polled data the weight found from the study was much lower than the findings found by Holloway *et al.* (2005) of Brangus was as 248 kg.

The average daily weight gain of 25% Brahman cross calves from birth up to twelve month was 421.78±2.93g for male and 337.60±3.02g for female that was similar to the findings found by Antonio *et al.* (2006) who observed mean average daily gain of calves to be 429g in summer season. By comparing offspring from Brahman and Tuli sires Chase *et al.* (2004) reported that offspring from Brahman sires had a higher average daily gain in weight than those from Tuli sires that was similar to the findings from Herring *et al.* (1996) and Holloway *et al.* (2002). On the other hand, from an experiment Chase *et al.* (2004) observed that animals with Brahman cross calves were higher in average daily weight gain at weaning. Calves produced by Brahman sires were heavier at weaning than calves sired by Angus and Romosinuano were observed by Riley *et al.* (2002). Haque *et al*. (2016) found that these variation probably due to genotype and environmental variations, feeding system.

Sex

From Table 1, it shows that there was significant ($p<0.01$) differences on birth weight between sexes. The average birth weight of Brahman male and female cross calves were 18.96±0.11 and 17.18±0.12 kg, respectively.

It is clear that birth weight of male calves was higher than female calves but Messine *et al.* (2007) reported non-significant difference (p>0.05) of birth weight on sex which did not support the present study. The present study supported the result found by Afroz *et al.* (2011), Habib *et al.* (2009), Rabeya *et al.* (2009) and Alam *et al.* (2007) that sex had significant effect on birth weights of local and crossbred calves.

Bull

Individual bull had no significant effect (p>0.05) on birth weight of calves, three-month weight, six-month weight but significant (p<0.05) effect on nine-month weight and twelve-month weight (Table 3) was noticed. Bull had significant effect (p<0.05) on average daily gain from birth upto twelve month of age (Table 3). Hoque *et al* (2016) found significant effect (p<0.05) of bull on average daily gain of Brahman cross calves from birth up to twelve month age. The variations of results in 9 month twelve between progeny of different bulls might be due to non-genetic factors such as feed, nutrition and management practices by the farmers.

Phenotypic correlations

Birth weight, three- month, six- month, nine-month, twelve-month weight and average daily gain from birth up to twelve month, all are positively correlated to each other. Strongest correlations were found between weight at nine-month and weight at twelve-month (0.95), between weight at six-month and twelve-month (0.94), between weights at six-month and nine-month (0.93) and between weights at three-month and six-month (0.88) (Table 5). Hoque *et al* (2016) found strong phenotypic correlations between birth weight and weight at three month (0.65), between weight at six and nine month (0.65) which were lower than the present findings. From above it is indicated that selection based of body weight at one stage of growth will also improve the body weight at other stages.

Conclusion

From overall discussion it may be concluded that growth performance of Brahman graded male calves were higher at different stages, positively strong phenotypic correlation were found between different growth traits, factors related to growth performance had significant effect on growth traits of Brahman graded calves at different stages. For rearing Brahman cattle, farmers' have lower veterinary cost because of high disease resistance, less inputs because of natural grazing and better prices of beef for a much longer period than other breed. Brahman breed may be an asset for our country, so more steps should be taken for extension and improvement of this breed. In future further study with more information and increased sample size in more areas needed to explore the breed potentiality in Bangladesh.

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