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Evaluation of Growth Performance of Grade-2 Brahman Crossbred Progeny in a Farmers' Participatory Beef Breeding Program

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Abstract

The study was carried out to compare the growth performance of grade-2 Brahman crossbreds to other available cattle genotypes in Bangladesh. Growth traits were birth weight, weight at 3-, 6-, 9-, 12-month of age and average daily weight gain from birth to 12-month of age. The birth, weight at 3-, 6-, 9- and 12-month were 19.87±0.06, 52.01±0.49, 85.03±0.62, 127.12±0.81 and 171.19±1.20 kg, respectively. The average daily weight gain of calves was 426.00±4.99 g. Area and sex had significant effect ($p<0.01$) on the birth weight, body weight at 3-, 6-, 9- and 12-month of age and average daily weight gain of Brahman calves. Growth performance results on indigenous, Red Chittagong, Pabna, and crosses of Holstein-Frisian, Jersey, Sahiwal and Sindhi cattle were also collected from published literatures, which were compared with 25% Brahman cross calves. Birth weight (19.87±0.87 kg) and yearling or 12-month weight (171.19±17.9 kg) was highest in Brahman cross calves, whereas birth weight (14.81±2.50 kg) was lowest in indigenous calves and yearling weight (92.28±1.73 kg) was in lowest in Sahiwal cross calves. Average daily weight gain was highest (426.00±4.99 g) in Brahman and lowest (146.78±91.96 g) in Indigenous calves. Thus, it may be concluded that growth performance of Brahman cross calves was better than other existing cattle genotypes of Bangladesh. However, further study with large number of samples at different management systems would help to draw a final conclusion.

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Introduction

The livestock sector is highly dynamic globally. In developing countries, it is evolving in response to rapidly increasing demand for livestock products having good genetic merit. Among different factors, livestock performance depends mainly on the genetic potential of the species. Improvement in genetic capabilities as well as environment could be the appropriate way for livestock improvement. According to Bondoc *et al.* (1989), highly commercial and specialized beef cattle improvement systems practiced in the developed countries may not be biologically and economically suitable for developing countries.

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As there is no beef type cattle in the country, therefore, farmers are mainly involved in fattening of either local or upgraded dairy crossed bull calves for increasing the beef production in Bangladesh.

Considering weather, agro-climatic condition, heat tolerance, disease resistance, longevity, grazing ability, calving ease, mothering ability and management, Brahman breed (a type of zebu or humped cattle) is found to be the most suitable and compatible beef breed in tropical and sub-tropical region. A number of American beef breeds have been developed using Brahman genotypes, *e.g.* Brangus, Beefmaster, etc. Brahman bulls weigh from 800 to 1,100 kg and cows from 500 to 700 kg and calves grow very rapidly afterward compared to other breeds. The Brahmans are known to be well adapted in regions with harsh climates and poor grazing situation. They have a greater ability to withstand heat. Their oily skin thought to help repel pests and insects along with a smooth coat. They are also more resistant to parasites and diseases. For these reason, Brahmans have been extensively crossed with cattle genotypes found in tropical countries of the world to explore their advantages in hot climates.

Conversely, the breeds that are close to indigenous stock always bear greater importance for that particular country or region because they can thrive easily in local condition. It is reported that indigenous zebu (humped) cattle of the country are also more disease resistant and capable to thrive well in harsh condition (Majid *et al.,* 1992). Moreover, majority of the poor farmers are more habituated to manage their indigenous stock by following low input management system. Therefore, upgraded Brahman crossed bull may be more adaptable to our agro-climatic condition for beef production. Considering the above facts, the present study was undertaken to select Brahman crossbred breeding bulls from grade-1 population. Therefore, to accelerate genetic potential of our beef cattle broadly, the selective breeding within superior local stock can be practiced to meet up future challenge of animal products. Therefore, the present study was conducted to know the growth performance of 25% graded Brahman cross; and to compare their growth performance with others existing cattle genotypes of Bangladesh under a farmer-participatory up-grading breeding program.

Materials and methods

Source of data

This comparative study was carried out using growth performance data on 225 Brahman (25%) cross calves under the project entitled "Evaluation of growth performance and adaptability of Brahman cross calves to local environment of Bangladesh" under the Department of Animal Breeding and Genetics, Bangladesh Agricultural University, Mymensingh. For this experiment, Brahman crossbred (graded) breeding bulls (Bull ID: ABG011, ABG012, ABG013 and ABG014) had been selected based on average daily weight gain, physical appearance and libido which had been fostered at the artificial insemination (AI) center of Bangladesh Agricultural University for collection of semen. In the respective areas, indigenous cows were inseminated by AI using collected semen to improve beef production potentialities. Calves produced from them were used as experimental animal in this study. Besides this, the growth performance data of indigenous, Red Chittagong, Pabna, crosses of Holstein-Frisian, Jersey, Sahiwal and Sindhi cattle were collected from published literatures to compare the performance between Brahman cross calves and available cattle genotypes of Bangladesh.

Traits considered for the study

Traits that were considered for the study were birth weight, weight at 3-, 6-, 9- and12-month of age, and average daily weight gain from birth to 12-month of age.

Birth weight, and weight at 3- and 6-months

The birth weight was taken using the digital weighing machine within 24 hours after birth. Weight at 3- and 6-months of age from 225 Brahman crossbred calves were taken in the morning with a digital weighing machine at fasting condition.

Weight at 9- and 12-months

Weight at 9- and 12-months (yearling) of age were recorded from 225 Brahman crossbred calves in kilogram (kg) calculated according to Shaeffer's formula. To enumerate these weights of Brahman crossbred calves, hearth girth (smallest circumference of body immediately behind the shoulder) and body length (distance from point of shoulder to pin bone) were measured in inches by using measuring tape in the morning before the animals were fed. The Shaeffer's formula as described by Hossain and Akhter (1999) as follows-

$$live\ weight\ (kg) = \frac{Body\ weigh \times (Heart\ girth)^2}{300 \times 2.2}$$

Average daily gain

Average daily weight gain is a significant factor in assessing growth rates of calf. The weight gained per day per calf during birth to 12-month is termed as the average daily gain. Average daily gain was calculated in gram (g) by the following formula:

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

Population size

A total of 422 of 25% crossbred (graded) calves were born at the respective area from selected cows and out of them data on 225 Brahman crossbred calves (those have all records) were considered in this study. Information on available genotypes of cattle of Bangladesh such as Indigenous, Red Chittagong, Pabna and crosses of Holstein-Frisian, Jersey, Sahiwal and Sindhi were also collected from different published literatures to compare the growth performance with 25% Brahman cross calves.

Data input, processing and statistical analysis

After collecting, processing and synthesizing the data were analyzed to obtain results of ANOVA by using Statistical Analysis System (SAS, 1998) computer package. DUNCAN test was performed to separate

mean values for identifying significant value. Results of published literature on available genotypes were used as secondary data to make comparison between different genotypes.

Results and discussion

Birth weight

The mean values with standard errors of birth weight of Brahman cross calves of different areas (Boera, Bhabakhali and Dowakhola) are shown in Table 1. Using pooled data analysis, it was observed that area had significant ($p<0.05$) effect on birth weight of calves. The highest birth weight was observed in Bhabakhali and the lowest was in Dowakhola. However, no significant effect on birth weight of male or female progeny was found.

Table 1. Mean±standard errors of birth weight of Brahman crossbred calves in different study areas

Area	Boera	Bhabakhali	Dowakhola	Sig. level
Pooled	19.87^{b}±0.13 (65)	20.25^{a}±0.06 (77)	19.53^{c}±0.09 (83)	*
Male	20.30± 0.12 (48)	20.30±0.06 (75)	20.40±0.09 (32)	NS
Female	18.60±0.14 (17)	19.00±0.00 (2)	19.00±0.04 (51)	NS

Means with different superscripts within the same row differed significantly; NS, not significant; *, $p<0.05$; Figures in the parentheses indicate the number of observation.

The mean values along with standard errors of birth weight of different genotypes are shown in Table 2.

Table 2. Range and mean birth weight of calves of different genotypes

Genotype	Number of observation	Birth weight (kg)	
		Range	Average
Brahman crossbred	225	18.00 - 25.00	19.87
Indigenous	23	10.18 - 24.10	14.81
Red Chittagong	38	14.10 - 18.47	15.39
Pabna	11	14.29 - 17.92	15.63
Holstein-Frisian cross	27	14.50 - 27.40	17.61
Jersey cross	06	16.09 - 20.00	17.61
Sahiwal cross	17	14.04 - 17.26	16.45
Sindhi cross	04	15.46 - 18.26	16.43

The above table shows that the higher birth weight was in Brahman cross calves than that of the other available genotypes of Bangladesh. Relatively similar birth weight was obtained from crossbreds of Holstein-Frisian and Jersey, as well as crossbreds of Sahiwal and Sindhi. Also, nearly similar birth weights were observed between the calves of Red Chittagong and Pabna.

Weight at different ages

The mean weight values with standard errors at 3-, 6- and 9-months aged Brahman crossbred calves of different areas are shown in Table 3.

There were no significant effect on the weight at 3-, 6- and 9-months aged Brahman Crossbred calves when used pooled data among different areas. Table 3 also showed that weight of male calves significantly

Table 3. Mean±standard errors of weight at 3-, 6- and 9-months aged Brahman crossbred calves in different areas

Area	Boera	Bhabakhali	Dowakhola	Sig. level
Weight at 3-months of age				
Pooled	53.12±1.07 (65)	51.63±0.74 (77)	51.51±0.77 (83)	NS
Male	53.30^{b}±1.2 (48)	51.60^{b}±0.76 (75)	56.70^{a}±1.33 (32)	**
Female	52.60±2.38 (17)	53.50±4.50 (2)	48.30±0.59 (51)	NS
Weight at 6-months of age				
Pooled	85.90±1.36 (65)	85.00±0.94 (77)	85.74±0.96 (83)	NS
Male	86.40^{b}±1.55 (48)	84.90^{b}±0.96 (75)	92.10^{a}±1.55 (32)	**
Female	84.37±2.86 (17)	89.50±1.00 (2)	81.80±0.84 (51)	NS
Weight at 9-months of age				
Pooled	128.40±1.69 (65)	126.43±1.27 (77)	126.81±1.31 (83)	NS
Male	129.80^{b}±1.98 (48)	126.30^{b}±1.30 (75)	136.00^{a}±1.76 (32)	**
Female	124.00±3.0 (17)	131.00±2.00 (2)	121.10±1.28 (51)	NS

Means with different superscripts within the same row differed significantly; NS, not significant; **, $p<0.01$; Figures in the parentheses indicate the number of observation

Table 4. Mean±standard errors of weight of Brahman cross calves at 12-months ages in different study areas

Area	Boera	Bhabakhali	Dowakhola	Sig. level
Pooled	172.28±2.47 (65)	169.78±1.95 (77)	171.68±1.93 (83)	NS
Male	174.10^{b}±2.94 (48)	169.50^{b}±1.99 (75)	184.60^{a}±2.78 (32)	**
Female	166.70±4.22 (17)	180.00±2.00 (2)	163.60±1.90 (51)	NS

Means with different superscripts within the same row differed significantly; NS, not significant; **, $p<0.01$; Figures in the parentheses indicate the number of observation

($p<0.01$) affected by areas and males of Dowakhola had higher weight at 3-months than other areas *viz*., Boera and Bhabakhali. In case of male progeny, area had significant ($p<0.01$) influence on 6- and 9-months weight. The higher weight at 6- and 9-months aged male calves were observed in Dowakhola than that of other two areas. The means weight of Brahman cross calves with standard errors at 12-months of age in different areas are shown in Table 4.

Table 5. Range and mean values of yearling (12-months) weight of crossbred calves

Genotype	Number of observation	12-month weight	
		Range	Mean
Brahman	225	138.00 - 225.00	171.19
Indigenous	23	91.43 - 102.65	98.45
Red Chittagong	38	98.52 - 128.89	111.60
Pabna	11	103.63 - 115.45	115.76
Holstein Frisian cross	27	102.56- 142.13	107.05
Jersey cross	06	97.34 - 99.80	98.57
Sahiwal cross	17	89.40 - 94.78	92.28
Sindhi cross	04	104.21 - 108.28	106.25

Table 6. Mean±standard errors of average daily gain of Brahman cross calves

Area	Boera	Bhabakhali	Dowakhola	Sig. level
Pooled	417.55±52.02 (65)	409.77±46.40 (77)	416.91±46.82 (83)	NS
Male	421.20^{b}±7.89 (48)	408.90^{c}±5.43 (75)	449.94^{a}±7.46 (32)	**
Female	405.90±11.51 (17)	441.10±5.50 (2)	396.10±5.15 (51)	NS

Means with different superscripts within the same row differed significantly; NS, not significant;
**, $p<0.01$; Figures in the parentheses indicate the number of observation

The area had significant ($p<0.01$) influence on the weight at 12-months aged male progeny. Males of Dowakhola had highest weight, whereas lowest was found in Bhabakhali. The yearling weights of Brahman crossbred and other available genotypes of Bangladesh are shown in Table 5.

From this table it is evident that the yearling weight of calves was higher in Brahman cross calves than that of the other available genotypes of Bangladesh. Comparatively, almost similar yearling weight was found in Red Chittagong and Pabna, in indigenous and Jersey and in Holstein-Frisian and Sindhi cross.

Average daily gain

The mean values along with standard errors of average daily gain of Brahman crossbred calves of different areas are shown in Table 6. Area had significant ($p<0.01$) influence on average daily weight gain of male

calves and had non-significant influence on average daily gain of female progeny. The table also showed that males of Dowakhola had highest average daily weight gain and lowest one in Bhabokhali area.

The average daily weight gain of 25% Brahman crossbred calves and the calves of other available genotypes are presented in Table 7. The table also showed that average daily weight gains of calves were higher (426.00 g) in Brahman crossbred than that of the other available genotypes.

Birth weight

The birth weight in the present study (19.87 kg in Brahman crossbred and 14.81 kg in indigenous calves) was much lower than the results of Sanders *et al.* (2005) and Holloway *et al*. (2005), who found 36.63 kg birth weight from F_1 Gray Brahman calves, and 33.50 kg from Brahman and Angus crosses, respectively. This variation was probably due to the use of Brahman bulls for crossing with the dams those were

Table 7. Range and mean values of average daily weight gain (g) of crossbred calves

Genotype	Number of observation	Daily weight gain (g)	
		Range	Mean
Brahman cross	225	326.00 - 548.00	426.00
Indigenous	23	177.34 - 257.34	146.78
Red Chittagong	38	134.34 - 167.12	148.53
Pabna	11	260.75 - 280.88	270.77
Holstein-Frisian cross	27	289.40 - 359.13	303.22
Jersey cross	06	267.29 - 293.63	280.46
Sahiwal cross	17	259.39 - 298.45	284.86
Sindhi cross	04	254.32 - 267.23	260.78

Table 8. Mean±standard errors of weight (kg) at different stages of Brahman cross male and female calves

Traits	n	BWT	WT3	WT6	WT9	WT12	ADG12
pooled	225	19.9±0.02	52.0±0.09	85.5±1.2	127.1±1.5	171.2±1.9	414.7±2.3
Male	155	19.9^{a}±0.1	52.3^{a}±0.7	85.4^{a}±1.2	127.2^{a}±1.5	171.2^{a}±2.3	421.2^{a}±2.8
Female	70	18.2^{b}±0.03	47.8^{b}±0.5	79.6^{b}±1.0	117.5^{b}±1.3	158.7^{b}±1.9	399.8^{b}±2.4
Sig. Level		*	***	***	***	***	***

n, number of observation; BWT, birth weight; WT3, three-month weight; WT6, six-month weight; WT9, nine-month weight; WT12, twelve-month weight; ADG12, average daily weight gain;
Means with different superscripts between male and female within same trait differed significantly; NS, not significant; *, $p<0.05$; ***, $p<0.001$

genetically superior to native cattle. The results in 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. On the other hand, the results of Habib *et al*. (2003) and Rabeya (2009) in Red Chittagong (16.7±0.48 and 15.74 kg, respectively) as well as Hirooka and Bhuiyan (1995) in Friesian × Local grades (13.44±1.782 kg for male and 17.28±0.436 kg for female) were lower than the results of present study. The present result was also higher than that of Hoque *et al.* (1999), Udo *et al.* (1990) obtained birth weight of 17.92±3.47 and 15.6±.02 kg, respectively in Pabna local cattle. From the present results it was observed that 25% Brahman with local crossed calves were higher in average birth weight than the calculated average birth weight of local or local crossed with improved available genotypes in Bangladesh., which indicated that Brahman cattle might have better growth potentialities than others beef cattle.

Weight at different ages

The weight at 3-months (52.0 kg) of Brahman crossbred calves in this study was higher than that reported by Afroz *et al.* (2011), Rabeya *et al.* (2009), Aruna pal *et al.* (2004) and Gaur *et al.* (2003) which were 29.26 kg for Red Chittagong, 30.53 kg for Red Chittagong, 59.38 kg for Karan Fries and 54.25 kg for crossbred cattle, respectively. The average weight at 6-months aged Brahman crossbred calves (85.5 kg) in the present study were higher than the reports of Afroz *et al.* (2011), Rabeya *et al.* (2009) and Gaur *et al.* (2003), which were 42.60 kg for Red Chittagong, 45.72 kg for Red Chittagong and 85.8 kg for crossbred, respectively at the same age. The weight at 9-months of age (127.10 kg) was also higher than that of the results of Afroz *et al.* (2011), Rabeya *et al.* (2009) and Gaur *et al.* (2003), who reported 116.85, 108.09 and 123.56 kg for crossbred, respectively at the same age. In the present study maximum average yearling (12-months) weight (171.19 kg) was observed in Brahman crossbred calves and minimum 92.28 kg in Sahiwal cross (Table 8). The higher birth weight in Brahman crossbred calves may be reflected to the higher yearling weight in Brahman cross cattle. The current result is much higher than that of Habib (2011) and Rabeya *et al.* (2009) in Red Chittagong breed (male- 70.6±0.70 and 76.2±4.0 kg; female- 64.6±6.6 and 73.2±3.3 kg, respectively). The variation of weight at different ages between present study and other studies might be reflected due to different genotypes of cattle and different management practices. Accordingly, with some exception, it is observed that higher birth weight resulted greater yearling weight.

Average daily gain

The mean daily weight gain of Brahman crossbred calves was 426.00 g in the present study, which was much higher than that of Habib *et al.* (2003) who reported average daily gain of 168 g in the same breed. Their result was noticeably lower than the present findings. Perhaps, it happened due to genotype and environmental variations, and it evidently proved that Brahman crossbred calves are better than the calves from indigenous and non-descriptive cattle of Bangladesh.

Sex: In our results significant ($p<0.05$) differences on birth weight between sexes were found. The mean birth weight of Brahman cross calves were 19.9±0.10 and 18.2±0.0 kg, respectively for male and female. This result is consonance with the results of Bakir *et al.* (2004). Significant effect of sex on birth weights of local and crossbred calves were reported by Afroz *et al.* (2011), Kabir and Islam (2009), Rabeya *et al.* (2009) and Alam *et al.* (2007) which were in agreement with the present findings. The variations of birth weight within and between different genotypes may be due to different dam size, dam performance,

environmental support, sample size, feeding and management, etc. The higher birth weight of males than the females could be attributed to the greater rate of skeletal growth of male calves compared to the female. The effect of sex was found significant on 3-, 6-, 9-, 12-months aged calves ($p<0.001$). Farmers usually provide inadequate balanced feed, milk to their calves and had tendency to give priority to male calves than females. For this reason, lower weight may be found in female calves.

Conclusion

The performances of Brahman crossbred cattle were better than the other zebu or humped cattle. It can be pointed out that the birth weight, yearling weight and average daily weight gain of Brahman crossbred calves were higher than that of indigenous and other crossbred calves in the country. With some exception, higher birth weight tended to greater in average daily weight gain and yearling weight, although management system of calves might have affected on these traits. The crossing of indigenous cows with Brahman crossbred breeding bulls may create an opportunity to improve indigenous cattle for beef purposes in Bangladesh as the Brahman crossbred cattle has superior breed potentiality. However, to explore the genetic potentiality of Brahman crossbred cattle in Bangladesh, further in depth study is needed.

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