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Article

Evaluation of growth performance of Brahman cross calves to local environment of Bangladesh

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Abstract: The present study was conducted using growth performance data on 624 Brahman cross (25%) calves collected from three villages adjacent to Bangladesh Agricultural University, Mymensingh, Bangladesh. Growth performance data of 289 Brahman cross (50%) calves were also collected from record sheet maintained at 12 Upazila Livestock Offices under the "Beef breed development project" of Department of Livestock Services to compare performance between 25% and 50% Brahman cross calves. Growth performance traits were considered birth weight, weight at three-, six-, nine-, twelve-month of age, average daily gain from birth to twelve-month of age. Calving difficulties (dystocia) and calf mortality were also included in the study area. The birth weight, weight at three-, six-, nine- and twelve-month average daily gain for 25% Brahman cross calves were 19.79±0.20, 52.72±1.31, 86.61±2.02, 129.90±3.08, 172.60±3.48 kg and 426.00±4.99g, respectively. The average birth weight (21.40±0.24 kg) and twelve-month weight (229.62±2.08 kg) of 50% Brahman cross calves were significantly higher ($p<0.05$) than 25% Brahman cross calves. Average daily gain was significantly higher (570.52±5.19g) in 50% Brahman cross than 25% Brahman cross calves (529.98±4.54g). Birth weight, three-, six-, nine-, twelve-month weight were positively correlated to each other. Strong correlations were found between birth weight and three-month weight (0.65), between six- and nine-month (0.65).There was no report of calving difficulties or abnormal calf birth, where the average calf mortality rate was 2.96 in the study areas. It indicates that 50% Brahman cross calves were well performed in these climatic condition. However, further study with larger sample sizes covering more different management systems would be required to draw a better conclusion in this regard.

Keywords: Brahman cross calves; growth performance; phenotypic correlations

1. Introduction

The cattle genetic resources (23.58 million, BER, 2015) of Bangladesh are mostly of indigenous type (*Bos indicus*) with substantial number of crossbreds with Sindhi, Sahiwal and Holstein-Friesian. Indigenous cattle of the country are more disease resistant and capable to thrive in harsh condition (Majid *et al.*, 1992). In spite of a high density of cattle population, but the protein requirements of the people remain under nourished. According to Department of Livestock Services (DLS, 2005), the availability of meat is 21 g/d per head against the requirements of 120 g/d per head. So, it is clear that there is a huge shortage of meat in Bangladesh for human consumption. As there is no beef type animal in the country, the farmers are frequently being involved in fattening of either local or upgraded dairy crossed bull calves for increasing the beef production in Bangladesh. Moreover, majority of our farmers are more habituated to manage their indigenous stock since being poor and following low input management system. Considering weather, agro-climatic condition, heat tolerance, disease and parasites resistance, longevity, grazing ability, calving ease, mothering ability and management, Brahman breed is considered to be the most suitable and compatible beef breed in tropical and sub-tropical regions

(Antonio *et al*., 2006). In this socio-economic condition, upgraded Brahman crossed bull may be more adaptable to our agro-climatic condition owing to improvement of indigenous cattle for beef production. Considering the above circumstances, the experiment was undertaken to evaluate the growth performance of 25% and 50% Brahman crossbred calves to local environment of Bangladesh.

2. Materials and Methods

2.1. Location of experiment

The present experiment was conducted at three different villages namely Boera, Bhabakhali and Dowhakhula under Mymensingh district, Bangladesh.

2.2. Management of the research activities

Four Brahman crossbred (graded) breeding bulls had been selected (Bull ID: ABG011, ABG012, ABG013 and ABG014) on the basis of their average daily gain, physical appearance and libido. The selected bulls have been reared at the Artificial Insemination Center, Bangladesh Agricultural University for semen collection. Collected semen of these bulls has been used to inseminate the indigenous cow to improve beef production potentialities in the respective areas. Calves produced from these crossing are considered experimental animal in this study.

2.3. Data collection

The data were collected from 624 Brahman cross (25%) calves on the growth performance, where male and female calves were 385 and 239 in number. Besides, growth performance data of 289 Brahman cross (50%) calves were collected from (CCBDF, Chirirbandor, Pirganj, Shariakandi, Belkuchi, Chouhali, Tungipara, Kustia, Jessore, Moulovibazar, Charghat and Thakurgaon where the number of calves was 63, 22, 46, 11, 12, 19, 15, 10, 13, 16, 18 and 44, respectively) the data sheet maintained at the Upazila Livestock Office under the "Beef breed development project" of DLS to compare the performance between 25% and 50% Brahman cross calves to local environment of the country. Record on birth weight, twelve month weight and average daily gain of 25% and 50% Brahman cross calves were taken until June, 2015. Weight of each animal at different ages was measured by using a digital weighing balance. Average daily gain (birth to twelve month age) was calculated in gram (g) by using the following formula:

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

2.4. Statistical analysis

After completing the pre-tabulation task of the collected data, records of crossbred progenies were entered in Excel sheets of Microsoft office computer program. The collected data were tested for their normal distribution using Statistical Analysis System (SAS, Version 6.12) method and abnormal data were omitted from the data sheets. The sorted 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 in case of significant factors.

3. Results

3.1. Birth weight of 25% Brahman cross calves

The mean along with standard errors of birth weight of 25% Brahman cross calves at different areas are shown in Table 1. Analysis of pooled data indicated that area had significant ($p<0.05$) effect on birth weight of calves. The birth weight was higher in Bhabakhali (20.17±0.06 kg) than those of Boera (19.75±0.13 kg) and Dowhakhula (19.47±0.09).

Table 1. Mean±SE of birth weight of 25% Brahman cross calves in different study areas.

Area	Boera	Bhabakhali	Dowhakhula
Pooled	19.75^{b}±0.13 (135)	20.17^{a}±0.06 (263)	19.47^{b}±0.09 (226)
Male	20.30^{a}±0.12 (92)	20.75^{b}±0.06 (161)	19.72^{b}±0.09 (132)
Female	18.60^{a}±0.14 (43)	19.25^{b}±0.11 (102)	19.12^{b}±0.04 (94)

Figures in the parentheses indicate the number of observation; Means with uncommon superscripts within the same row differed significantly ($p<0.05$).

3.2. Weight at different ages

Table 2 showed that three month weight of male calves significantly ($p<0.01$) affected by areas and males of

Bhabakhali had higher three-month weight (55.60±0.76 kg) than the three-month weights at others areas (53.30±1.20 and 51.70±1.33 kg for Boera and Dowhakhula, respectively).

Table 2. Three-month weight (Mean±SE) of 25% Brahman cross calves in different areas.

Area	Boera	Bhabakhali	Dowhakhula
Pooled	53.08^{a}±1.02 (135)	54.79^{a}±0.74 (263)	50.29^{b}±0.77 (226)
Male	53.30^{b}±1.20 (92)	55.60^{a}±0.76 (161)	51.70^{b}±1.33 (132)
Female	52.60^{a}±2.38 (43)	53.50^{a}±4.50 (102)	48.30^{b}±0.59 (94)

Figures in the parentheses indicate the number of observation; Means with uncommon superscripts within the same row differed significantly ($p<0.01$).

Analysis indicated that area had significant ($p<0.01$) effect on six-month weight of pooled data as well as six-month weight of male and female calves (Table 3). The highest weight at six-month of male calves (91.10±0.96 kg) was observed in Bhabakhali than those of other two areas (86.40±1.55 and 84.90±1.55 kg) for Boera and Dowhakhula, respectively (Table 3).

Table 3. Mean±SE at six-month body weight of 25% Brahman calves in different study areas.

Area	Boera	Bhabakhali	Dowhakhula
Pooled	85.75^{b}±1.36 (135)	90.48^{a}±0.94 (263)	83.61^{b}±0.96 (226)
Male	86.40^{b}±1.55 (92)	91.10^{a}±0.96 (161)	84.90^{b}±1.55 (132)
Female	84.37^{a}±2.86 (43)	89.50^{b}±1.0 (102)	81.80^{a}±0.84 (94)

Figures in the parentheses indicate the number of observation; Means with uncommon superscripts within the same row differed significantly ($p<0.01$)

The Table evident that areas significantly ($p<0.01$) effected on nine-month weight of male calves as well as female calves (Table 4). Males of Bhabakhali had higher weight (136.12±1.30 kg) than the other two areas (129.80±1.98 and 126.30±1.76) for Boera and Dowhakhula, respectively (Table 4).

Table 4. Mean±SE at nine-month weight of 25% Brahman cross calves in study areas.

Area	Boera	Bhabakhali	Dowhakhula
Pooled	130.89^{a}±1.69 (132)	134.68^{a}±1.27 (263)	124.14^{b}±1.31 (226)
Male	129.80^{b}±1.98 (92)	136.12^{a}±1.30 (161)	126.30^{b}±1.76 (132)
Female	124.01^{a}±1.38 (43)	132.43^{b}±2.00 (102)	121.10^{a}±1.28 (94)

Figures in the parentheses indicate the number of observation; Means with uncommon superscripts within the same row differed significantly ($p<0.01$).

Results showed that area had significant ($p<0.01$) influence on twelve-month weight of male and female calves (Table 5). Males of Bhabakhali had higher twelve-month weight (184.60±1.99 kg) than those of Boera (174.10±2.94 kg) and Dowhakhula (169.50±2.78 kg) regions (Table 5).

Table 5. Twelve-month weights (Mean±SE) of 25% Brahman cross calves in study areas.

Area	Boera	Bhabakhali	Dowhakhula
Pooled	171.74^{b}±2.47 (135)	179.03^{a}±1.95 (263)	167.05^{b}±1.93 (226)
Male	174.10^{b}±2.94 (92)	184.60^{a}±1.99 (161)	169.50^{b}±2.78 (132)
Female	166.70^{a}±4.22 (43)	170.23^{a}±2.0 (102)	163.60^{b}±1.90 (94)

Figures in the parentheses indicate the number of observation; Means with uncommon superscripts within the same row differed significantly ($p<0.01$).

3.3. Average daily gain

The mean along with standard errors of average daily gain of 25% Brahman cross calves of different areas were significantly affected ($p<0.01$). Results also showed that males of Bhabakhali had highest average daily gain (449.94±25.43 g/d) and lowest (408.90±27.46 g/d) in Dowhakhula area (Table 6).

Table 6. Mean±SE of average daily gain (g) up to twelve-month age of 25% Brahman cross calves.

Area	Boera	Bhabakhali	Dowhakhula
Pooled	416.35^{b}±22.13 (135)	446.51^{a}±16.40 (263)	403.58^{b}±16.82 (226)
Male	421.24^{b}±27.89 (92)	449.94^{a}±25.43 (161)	408.90^{c}±27.46 (132)
Female	405.90^{b}±31.51 (43)	441.10^{a}±24.50 (102)	396.10^{c}±25.15 (94)

Figures in the parentheses indicate the number of observation; Means with uncommon superscripts within the same row differed significantly ($p<0.01$).

3.4. Growth performances of 25% Brahman cross calves

Growth performances (birth weight, three-, six-, nine-, twelve- month weight and average daily gain) of Brahman cross male calves (ignoring area and bull effect) were higher than those of female calves (Table 7).

Table 7. Mean±SE of weight (kg) at different age of 25% Brahman cross male and female calves.

Trait	BWT	WT3	WT6	WT9	WT12	ADG12
Pooled	19.79±20	52.72±1.31	86.61±2.02	129.90±3.08	172.60±3.48	428.81±19.20
Male	20.25^{a}±0.29	53.53^{a}±1.13	87.46^{a}±1.86	130.74^{a}±2.87	176.06^{a}±4.46	426.69^{a}±12.15
Female	18.99^{b}±0.19	51.46^{b}±1.60	85.22^{b}±2.26	125.84^{b}±3.39	166.84^{b}±1.91	414.36^{b}±13.66

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 gain; Means with uncommon superscripts between male and female within same trait of the column differed significantly.

3.5. Growth performances of 50% Brahman cross calves

Mean along with their standard error of birth weight, twelve-month weight and average daily gain of 50% Brahman cross calves are shown in Table 8. The average birth weight of total calves was (21.40±0.24 kg) where sex has a large effect on birth weight of calves. The average birth weight of male was (22.50±0.36 kg) which is higher than females birth weight (20.24±0.29 kg) which shows male calves were heavier than females, and weak calves tended to be lighter than healthy calves. The mean twelve-month weight of Brahman crossbred calves was (229.62±2.08 kg) and male calves had slightly higher twelve-month weight than that of female calves (male 245.13±2.88 vs. female 213.10±2.29 kg). The overall mean of average daily gain of crossbred calves was (570.52±5.19 g/d) and it was influenced by sex. Average daily gain of male was (610.12±7.11 g/d) and in female it was (528.38±5.77 g/d).

Table 8. Mean±SE of birth and twelve-month weight and average daily gain of total Brahman graded (50%) calves.

Parameter	Pooled	Male	Female
BWT (kg)	21.40±0.24 (289)	22.50^{a}±0.36 (149)	20.24^{b}±0.29 (140)
WT12 (kg)	229.62^{b}±2.08 (289)	245.13^{a}±2.88 (149)	213.10^{c}±2.29 (140)
ADG (g/d)	570.52^{b}±5.19 (289)	610.12^{a}±7.11 (149)	528.38^{c}±5.77 (140)

Figures in the parentheses indicate the number of observation; BWT, birth weight; WT12, twelve-month weight; and ADG, average daily gain; means with different superscripts in the same raw differed significantly ($p<0.001$).

3.6. Comparison of growth traits between 25% and 50% Brahman calves

Comparison among growth traits between 25% and 50% Brahman calves are shown in Table 9. The pooled data average of birth weight of Brahman calves was (19.73±0.12 kg). The average birth weight of 50% Brahman cross calves was (21.40±0.24 kg) which was higher than the birth weight (18.59±0.08 kg) of 25% Brahman cross calves which shows 50% Brahman calves were heavier than 25% Brahman. The mean twelve-month weight of Brahman crossbred calves was (217.55±1.38 kg) and 50% Brahman calves had slightly higher twelve-month weight than that of 25% Brahman cross calves (50% Brahman, 229.62±2.08 vs. 25% Brahman, 209.29±1.74 kg). The overall mean of average daily gain of Brahman cross calves was 546.46±3.50 g/d). Average daily gain of 25 % Brahman cross calves was (529.98±4.54 g/d) and 50% Brahman cross calves was (570.52±5.19 g/d).

Table 9. Comparison among growth traits between 25% and 50% Brahman cross calves.

Growth trait	Brahman calves		
	Pooled (913)	**25% (624)**	**50% (289)**
BWT (kg)	19.73±0.12	18.59^{b}±0.08	21.40^{a}±0.24
WT12(kg)	217.55^{b}±1.38	209.29^{c}±1.74	229.62^{a}±2.08
ADG (g/d)	546.46^{b}±3.50	529.98^{c}±4.54	570.52^{a}±5.19

Figures in the parentheses indicate the number of observation; BWT, birth weight; WT12, twelve-month weight; ADG, average daily gain; means with different superscripts between 50% and 25% Brahman calves in the same row differed significantly ($p<0.001$).

3.7. Calving difficulties and calf mortality

There was no report of calving difficulties (dystocia) or abnormal calf born in study areas. The calf mortality (Table 10) was found in Boera (3.13%) was slightly higher than those of Bhabakhali (2.71%) and Dowhakhola (3.06%). The average calf mortality rate was found as 2.96%.

Table 10. Calf mortality up to twelve-month of age at different study areas.

Area	Boera	Bhabakhali	Dowhakhula	Total
Calf born	192	332	259	833
Calf died	6	9	8	23
Mortality (%)	3.13	2.71	3.06	2.96

3.8. Correlation among growth of different ages of calves

Phenotypic correlations among the body weight traits of Brahman cross calves at different ages are summarized in Table 11. Birth weight, three-, six-, nine-, twelve-month weight and average daily gain all are positively correlated to each other. Strong correlations were found between birth weight and weight at three-month (0.65), between weights at six- and nine-month (0.65).

Table 11. Phenotypic correlations among body weight of 25% Brahman cross calves at different ages.

Growth trait	WT3	WT6	WT9	WT12
BWT	0.65	0.52	0.63	0.48
WT3		0.60	0.62	0.45
WT6			0.65	0.45
WT9				0.43

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

4. Discussion

4.1. Birth weight of calves

The mean birth weight of 25% and 50% Brahman male and female calves were 20.25±0.29, 18.99±0.19 and 22.50±0.36, 20.24±0.29 kg, respectively. The value of birth weight of the present study were comparable to the value (23.3kg) observed by Crockett *et al.* (1978) for beef cattle. Holloway *et al.* (2005) observed 33.50 kg birth weight of Brahman and Angus crosses, which was much higher than the value of the present findings. This variation was probably due to use of Brahman bulls for crossing with the dams those were genetically superior to indigenous cattle and genetic proportion of Brahman sires. Birth weight of male calves was 2.25 kg higher than female calves (1.25 kg) which are similar to the values (2.1 kg and 2.00 kg) observed by Vargas *et al.* (1999) and Keith *et al*. (2010), respectively.

The average birth weight of 50% Brahman cross calves was (21.40±0.24 kg) higher than the calves of 25% Brahman cross (18.59±0.08). It was proved that sex had significant ($p<0.001$) effects on birth weight of 50% Brahman cross calves. From the above discussion it is clear that the average birth weight of 50% Brahman with local crossed calves were higher than the birth weight of 25% Brahman with local cows. This might be due to cumulative effects of better growth potential genes of pure Brahman cattle than crossbred Brahman.

4.2. Weight at different ages

The mean three-month weight of 25% Brahman male and female calves was 53.53±1.13 and 51.46±1.60 kg, respectively. The weight of Brahman cross calves was higher than that reported by Aruna *et al.* (2004), Gaur *et al.* (2003) which were 59.38 kg for Karan Fries and 54.25 kg for crossbred, respectively.

The six-month weight of 25% Brahman cross male and female calves was 87.46±1.86 and 85.22±2.26 kg, respectively. The weight of this study was found much lower than the findings reported by Chen *et al.* (2012) of Piedmontese and Nanyang as 194 kg, while the six-month weight of this study was found higher than that reported by Gaur *et al*. (2003) and Carew *et al.* (1986) which were 85.8 kg for crossbred and 71.4 kg for crossbred, respectively.

The nine month weight of 25% Brahman male and female cross calves was 130.74±2.87 and 125.84±3.39 kg, respectively which was found much lower than the findings reported by Chen *et al*. (2012) of Piedmontese and Nanyang as 293 kg, Neser *et al.* (2012) of Brangus as 227.6 kg, respectively, while the nine-month weight of this study was found higher than that reported by Gaur *et al.* (2003) and Carew *et al.* (1986) which were 125.56 and 123.0 kg for crossbred, respectively.

The mean twelve-month weight of 50% Brahman cross calves was 229.62±2.08 kg, which was higher than that of 25% Brahman cross calves. This result was lower than that of 248 kg by Holloway *et al.* (2005) in Brahman and Angus cross.

4.3. Average daily gain

The mean average daily weight gain of 25% Brahman cross calves was 426.69±12.15g for male and 414.36±13.66g for female, respectively which is significantly ($p<0.01$) affected by area and sex on average daily gain up to one year of age. The mean average daily weight gain of 50% Brahman cross calves was 570.52±5.19 g which is significantly ($p<0.001$) affected by sex. This result was similar to Antonio *et al.* (2006) who reported mean average daily gain of calves to be 429 g in summer season. Keith *et al*. (2010) and Colditz *et al*. (1972) reported higher average daily weight gain than that of the present study (849 g and 670 g). These are probably due to genotype and environmental variations, feeding system and evidently proved that 50% Brahman crossed calves are better than the calves from 25% Brahman cross types of Bangladesh.

4.4. Calving difficulties and calf mortality

There were no reports of calving difficulties (dystocia) or abnormal calf born in study areas. Mortality rate (2.96) was found in the study areas which were higher than that of Brahman-sired cows 2.4% in Simmental observed by Morrison *et al.* (1989).

4.5. Phenotypic correlations

Strong phenotypic correlations were found between birth weight and weight at three-month (0.65), between weights at six- and nine-month (0.65) which indicated that selection based of body weight at one stage of growth will also improve the body weight at other stages.

5. Conclusions

The weight at different stages of growth of 25% Brahman cross calves at Bhabakhali were higher than that of other two areas, which indicating that farmers of Bhabakhali may provide better feeding and management to their calves. The variations of results between progeny of different bulls might be due to variation in genetic potentialities of different breeding bulls, as well as individual differences for feeding and management. Strong phenotypic correlations were found between birth weight and weight at three-month. The birth weight, twelve-month weight and average daily gain of 50% Brahman crossed calves were higher than that of 25% Brahman cross calves in Bangladesh. As the Brahman crossed cattle are a new introduction to Bangladesh, further in depth study is needed to explore more information from breed development approaches.

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Conflict of interest

None to declare.

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