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Original Article

Effect of Breeding Bulls on Growth Performance and Survivability of Brahman Crossbreds in Rural Areas of Bangladesh

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A B S T R A C T

This research aimed to determine breeding bull effect on growth performance and survivability of Brahman crossbreds (50% local-50% Brahman). Conducted study used 687 records on crossbred calves from seven Brahman bull imported from USA. The data was collected from record sheet maintained by artificial insemination field workers of respective areas, then arranged and statistically analyzed. Birth weight, weight at one, six, nine, twelve, twenty four-month and average daily gain of crossbreds progeny was significantly ($p<0.001$) affected by sire. Weights of Brahman crossbred calves ranged from 15-27, 21-43, 50-67, 83-185, 116-252, 144-311 and 266-694 kg at birth, one, three, six, nine, twelve and twenty four-month, respectively. Highest birth weight (27.12±0.59 kg) was obtained for 7BR-522, one-month (41.42±1.11 kg) for 14BR-41, three-month (67.63±5.40 kg) for 14BR-43, six-month (163.0±14.05 kg) for 14BR-43, nine-month (252.75±34.51 kg) for 14BR-43, twelve-month (282.0±12.35 kg) for 14BR-41 and twenty four month weight (641.48±38.73 kg) for 7BR-522, respectively. Average daily gain ranged from 356.33-704.87 g/d while highest was found 722.21 g/day for 7BR-527 and lowest was found 365.33 g/d for bull 14BR. Strong positive phenotypic correlations were found between weights at six and nine-month (0.9), six and twelve-month (0.78), nine and twelve-month (0.85) and twenty-four month weight with six (0.67), nine (0.73) and twelve (0.78) month weight. The average calf mortality rate estimated 2.13%. The findings of the conducted study exposed that growth performance of crossbred progeny varied with bull and their highly appreciable growth along with survival rate will helpful to enhance beef cattle farming in Bangladesh.

Introduction

Bangladesh is heavily populated country with more than165 million people, unfortunately animal protein production is insufficient to meet the demand for huge population while the demand of animal protein is increasing day by day (Adhikary *et al*., 2021). Although cattle concentration is high in per unit land area of Bangladesh their productivity is very low due to poor genetic makeup, inadequate feed supply, lack of scientific knowledge in housing and management. To fulfill large demand of animal protein Brahman crossbred cattle has been incorporated in breeding program to accelerate ongoing animal protein production. Brahman is a fast growing and high yielding beef breed which have gained unique place because of their adaptation in tropical environments like Bangladesh and attributes in crossbreeding. Brahmans have been extensively crossed with cattle in tropical genotypes to explore their advantages in hot climates and suitable for crossing as similar characteristics of our indigenous cattle. Birth weight, yearling weight, average daily gain, mature weight of Brahman crossed calves are higher compared to indigenous and other crossbred calves in Bangladesh. Traits such as growth, reproduction, disease resistance, survivability and maternal ability, these are influencing the productivity and profitability of beef cattle enterprise. Growth ability is one of the leading parameters of beef production in animals (Toušová *et al*., 2014). High growth rates and high weaning weights contribute to efficient beef production. Cattle productivity predominantly depends on their reproductive performance and the calves survived (Mukasa-mugerwa, 1989). In all cattle rearing areas calf mortality are problems of major concern and in developing regions this problem is much intense (Radostits, 2001). The

future of the livestock economy depends on the calves. Calf mortality causes heavy losses to the livestock farmer along with economy of the country. This study depicts the growth performance and calf mortality of Brahman crossbred cattle in Bangladeshi condition.

Material and methods

Source of data

This study data was collected on the growth performance of 687 Brahman crossbred (50%) calves under "Beef cattle development program" project of Department of Livestock Services (DLS). Semen from 7 (seven) 100% Brahman breeding bulls (Bull ID. 7BR-522, 7BR-524, 7BR-527, 14BR, 14BR-40, 14BR-41 and 14BR-43) were used for insemination of indigenous cows of selected areas of Bangladesh. Data on calves produced at Central Cattle Breeding and Dairy Farm, Savar (93), Chirirbandor (40), Pirganj (46), Shariakandi (28), Belkuchi (33), Chouhali (74), Tungipara (51), Kustia (40), Jessore (58), Moulovibazar (62), Charghat (68), Thakurgaon (94) district were recorded by the field assistants of the project. Growth performance records of calves were collected from the herd book kept by the artificial insemination (AI) field workers. In the project area, appointed animal recorders were working to keep various information on calves born, e.g. date of artificial insemination, date of calving, birth weight, weaning weight, yearling weight, etc. Total of 689 Brahman crossbred (50%) calves were born and out of them 2 calves were died at birth. Therefore, finally 687 crossbred calves were considered in present study. Among them 360 calves were male and rest of 327 were female.

Figure 1. 100% Brahman breeding bull used in the study.

Data entry, reliability test and sorting

After completing the pre-tabulation task of the collected data, crossbred progeny records were entered in Excel sheets of Microsoft office computer program and abnormal data were omitted from the data sheets.

Statistical Analysis

Effects of bull and sex of calves on growth performance of crossbreeds were estimated. Analysis of sorted data were performed by the generalized linear model (GLM) procedure of Statistical Analysis System (SAS, 1998) computer package to obtain results of ANOVA. To compare mean Duncan's multiple range test (DMRT) method was used. The following generalized linear model was used:

$Y_{ijk} = \mu + S_i + B_j + e_{ijk}$

Where,

Y_{ijk} is a dependent variable (individual animal record for the trait)

μ is the overall mean;

S_i is the effect of sire;

B_j is the effect of sex and

e_{ijk} is the residual error.

Results and Discussion

Breeding bull effect on body weight at different ages of Brahman crossbred calves

The mean values of body weight with standard errors of Brahman crossed calves of seven Brahman bulls are presented in Table 1.

Brahman crossbred calves mean birth weight ranged from 17.52 to 27.12 kg. This result is in accordance with the findings of 24.1±1.23 kg reported by Mostari *et al.* (2017) for Brahman × BLRI cattle breed-1, 21.40±0.24 kg reported by Haque *et al.* (2016) for 50% Brahman crossbred calves. The observed mean birth weight in this experiment was lower than the 32.6, 35.5 and 30.7 kg average birth weight for Brahman cross calves reported by Dundon *et al.* (2012), Cunningham *et al.* (2005) and Antonio *et al.* (2006). Highest birth weight was found 23.14±0.32 kg for progeny of bull no. 7BR-527 and lowest 17.52±1.04 kg was estimated for progeny of bull no. 7BR-524. As best birth weight was found for bull no. 7BR-527, this sire may be the best genotype than others. This variation with others might be due to management practices, age and nutritional status of dam and also be due to sire contribution to the genotype of the calves born.

Table 1. Effect of Brahman breeding bull on body of progeny at different ages.

Bull ID	BWT±SE	WT1±SE	WT3±SE	WT6±SE	WT9±SE	WT12±SE	WT24±SE
7BR-522	27.12^{a}±0.59 (84)	38.24^{ab}±0.96 (71)	59.01^{abc}±1.84 (69)	125.86^{bc}±5.56 (51)	197.12^{b}±10.78 (41)	278.08^{a}±13.56 (39)	641.48^{a}±38.73 (21)
7BR-524	17.52^{d}±1.04 (27)	25.70^{c}±2.56 (10)	52.10^{c}±4.83 (10)	98.50^{d}±12.56 (10)	172.10^{bc}±21.83 (10)	260.40^{a}±26.78 (10)	449.44^{b}±41.84 (18)
7BR-527	23.14^{b}±0.32 (288)	36.96^{ab}±0.58 (191)	56.53^{bc}±1.19 (166)	127.56^{b}±3.44 (133)	205.94^{ab}±6.87 (101)	288.18^{a}±9.84 (74)	593.49^{a}±25.89 (47)
14BR	19.32^{cd}±1.24 (19)	38.26^{ab}±1.85 (19)	65.06^{ab}±3.71 (17)	98.41^{d}±9.64 (17)	116.53^{d}±16.74 (17)	149.0^{c}±20.54 (17)	285.0^{c}±72.46 (6)
14BR-40	22.96^{b}±0.40 (183)	35.26^{b}±0.68 (141)	57.60^{abc}±1.32 (134)	101.72^{cd}±3.43 (134)	139.58^{cd}±6.15 (126)	206.44^{b}±7.93 (114)	454.82^{b}±21.85 (66)
14BR-41	22.82^{b}±0.66 (67)	41.42^{a}±1.11 (53)	61.0^{abc}±2.10 (53)	130.15^{b}±5.46 (53)	193.16^{b}±9.14 (57)	282.0^{a}±12.35 (47)	619.43^{a}±29.18 (37)
14BR-43	21.11^{bc}±1.24 (19)	39.88^{ab}±2.86 (8)	67.63^{a}±5.40 (8)	163.0^{a}±14.05 (8)	252.75^{a}±34.51 (4)	-	-
Level of sig.	***	***	*	***	***	***	***

Figures in the parentheses indicate the number of observation; Mean with different superscripts within same column differ significantly,* (p<0.05),**(p<0.01),***(p<0.001) and NS, non-significant.

The mean body weight at one-month of Brahman crossbred calves was estimated 25.70 to 41.42 kg for seven breeding bull. Likewise, another study conducted by Mahbubul *et al.* (2020) also found similar results of 37.55 ±0.12 kg for 50% Brahman crossbred calves. The calves from bull 14BR-41 exhibited the highest one-month weight (41.42±1.11 kg) followed by 14BR-43, 14BR, 7BR-522, 7BR-527, 14BR-40 and 7BR-524.

The average three-month body weight ranged from 52.10 to 67.63 kg for crossbred calves from Brahman bull. Present study findings were supported by Hoque *et al.* (2013) who found 48.9±2.87 to 55.67±2.14 kg three-month body weight at farm level, Mahbubul *et al.* (2020) who found 58.63±0.21 kg for 50% Brahman crossbred calves, Mostari *et al.* (2017) who found 64.2±4.88 kg for Brahman × BLRI cattle breed-1, Hasan (2018) who found 58.45 kg for Brahman crossbred cattle. Progeny from bull no. 14BR-43 had highest body weight at three-month of 67.63±5.40 kg while lowest 67.63±5.40 kg was found for bull no.7BR-524.

The average Brahman crossbred calves body weight at six-month ranged from 98.41 to 163.00 kg (Table 1). Similar result was recorded by Rashid (2014) who found 104.8 kg for Mahbubul *et al.* (2020) who found 115.24±0.56 kg body weight at six-month. Slightly higher body weight of 163.43 to 186.71 kg for grade 2 Brahman crossbred calves were reported by Shejuty *et al.* (2020). Bull 14BR-43 showed best performance with 163.0±14.05 kg progeny body weight at six-month followed by 14BR-41 (130.15±5.46 kg), 7BR-527 (127.56±3.44 kg), 7BR-522 (125.86±5.56 kg), 14BR-40 (101.72±3.43 kg), 7BR-524 (98.50±12.56 kg) and 14BR (98.41±9.64 kg). Level of sire contribution to progeny, difference in feeding schedule and management practices might be possible causes of this variation.

The nine-month average body weight was 116.53 to 252.75 kg for 50% Brahman crossbred calves. This experiment result was in accordance with report of Mahbubul *et al.* (2020) who found 181.10±0.94 kg body weight at nine-month for 50% Brahman crossbred calves, Neser *et al.* (2012) also found 22.6 kg for Brangus calves and lower than the report of Shejuty *et al.* (2020) who found nine-month body weight of 318.47 to 332.43 kg for grade 2 Brahman crossbred calves.

50% Brahman crossbred calves body weight at twelve-month ranged from 149.00 to 288.18 kg (Table 1). Mahbubul *et al.* (2020) also found similar result of 258.66±1.22 kg body weight at 12-month, Sander *et al.* (2005) found 270 kg and 264 kg for Red Brahman and Grey Brahman crosses, Taslim (2014) found that weight at twelve-month 171.19 ± 1.20 kg. Shejuty *et al.* (2020) obtained higher result of 437.67 to 463.57 kg for grade 2 crossbred Brahman calves in Bangladesh. Genotype difference might be the major contributing factors for this variation.

The mean body weight at twenty-four month of Brahman crossbred (50%) calves were 285.00 to 641.48 kg (Table 1). Mahbubul *et al.* (2020) findings of 543.32±3.68 kg body weight at 24-month were in the range of above-mentioned result. Highest 641.48±38.73 kg twenty four month body weight was obtained for bull 7BR-522 whereas lowest 285.0±72.46 kg body weight was found for bull 14BR.

Average Daily Gain

Pooled data on average daily gain were significantly affected by bulls where calves were produced with the maximum average daily gain from bull 14BR-41 (722.21±26.26 g) followed by bull 14BR-41, 7BR-522 and 7BR-524 and the lowest found by bull 14BR (356.33±54.79 g), respectively. Male and female calves average daily gain was also significantly affected ($p<0.001$) by bulls. The apical average daily gain for male calves originated from bull 14BR-41 (783.89±47.26 g) followed by bull 7BR-524, 7BR-527 and 7BR-522 and for female found from bull 7BR-527 (727.12±31.73 g/d) followed by bull 7BR-522, 14BR-41 and 7BR-524.

Average daily gains (g/d) with standard error of Brahman crossbreds are presented graphically in figure 2.

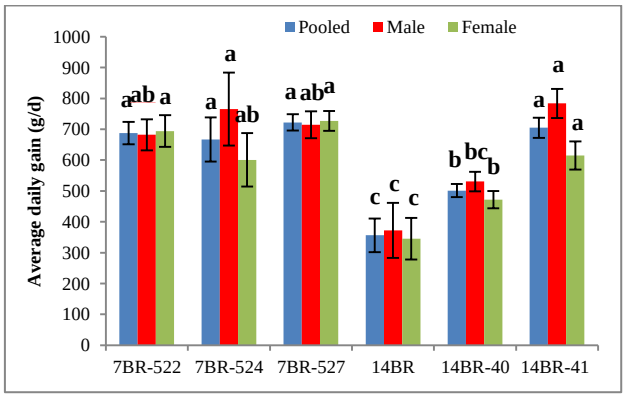

Figure 2. Average daily gain (g/d) of progeny from seven Brahman breeding bulls.

Sire effect is one of the important factors which may affect the average daily gain of progeny. Bull had significant ($p<0.001$) effect on progeny average daily gain. Previous studies conducted by Shejuty *et al.* (2020), Haque *et al.* (2011) and Papry *et al.* (2020) also found that sire significantly affected the average daily gain of progeny. Islam *et al.* (2013) found 0.36±0.03 to 0.43±0.01 kg average daily gain at farm for crossbred calves. Highest growth rate of 722.21 g/day was obtained for progeny produced from bull no. 7BR-527 while growth rate for male was 714.6 g/day and growth rate for female was 727.12 g/day. Second highest pooled growth rate of 704.87 g/day was found for bull no. 14BR-41 whereas for male and female it was 783.89 g/day and 615.07 g/day. Lowest pooled average daily gain of 356.33 g/day was estimated for bull no. 14BR produced progeny along with 372.21 g/day for male offspring and 345.21 g/day for female offspring. In case of bull no. 7BR-522 and 7BR-527 female calves had higher growth rate compared to male calves this may be due to female calves was comparatively older than male at the time of data recording.

Calf mortality

Mortality of Brahman crossbred calves originated from seven breeding bulls are shown in Table 2. The calf mortality of bull 14BR (10.53%) was greater than those of bull 14BR-40 (2.19%), 7BR-522 (1.18%) and 7BR-527 (1.03%), respectively. Our result showed average calf mortality rate 2.13%. Due to small sample size of bull no. 14BR possibly mortality rate became higher.

The success of any breeding program and profit of cattle fattening as well as dairy farm largely depend on number of calves survived. In generally, mortality rate over 5% is considered too high (Alemu and Teshome, 1987) and net profit may be reduced by 38% when mortality rate is 20% (Mekonnen, 1998). In a previous study conducted by Cundiff *et al.* (1998) found that calf losses from Brahman-sired occurred within 3 d of birth. Use of Brahman sire on indigenous dams might be a cause of calving difficulty due

to heavy birth weight that causes calf loss. Overall calf mortality was 2.13% up to 12 months of age. This mortality rate was much lower compared to 5.26% for different beef cattle crossbred (Mostari *et al*., 2017), 9.7% for F1 Fogera crosses cattle in Ethiopia (Amuamuta *et al*., 2006), 14.5% up to 12-month of age for Local zebu × Holstein crossbred calves in Ethiopia (Ferede *et al*., 2014), 24.5% reported by Kebamo *et al*. (2019) for Boran calves in Ethiopia. This improvement possibly due to increased farmers consciousness toward colostrum intake, better housing and feeding and other managemental activities during and immediately after calving. Calf mortality rate vary with sex, birth weight, management, individual disease resistance, colostrum feeding, season.

Table 2. Calf mortality up to twelve-months of age for different breeding bull.

	Breeding bull							
	7BR-522	7BR-524	7BR-527	14BR	14BR-40	14BR-41	14BR-43	Total
Calf born	85	27	289	19	183	67	19	689
Calf died	1	0	3	2	4	0	0	10
Mortality (%)	1.18	0	1.03	10.53	2.19	0	0	2.13

Phenotypic correlation of growth traits at different ages

Phenotypic correlations of growth traits for Brahman crossbred calves at different ages are concise in Table 3. Birth weight, one-, three-, six-, nine-, twelve-, twenty four-month weight all of these are positively correlated to each other. However, strong and positive correlations were observed between six- and nine-month weights (0.90), between weights at nine- and twelve-month (0.85). Moreover, six-month weight also had strong positive correlation with twelve-month weight and twenty four-month weight had strong correlations with six-, nine- and twelve-month weight (Table 3).

Table 3. Phenotypic correlations among body weight of Brahman crossbred calves at different ages.

Growth trait	1-month weight	3-month weight	6-month weight	9-month weight	12-month weight	24-month weight
Birth weight	0.38	0.25	0.32	0.33	0.45	0.42
1-month weight	-	0.58	0.36	0.26	0.32	0.5
3-month weight	-	-	0.53	0.39	0.32	0.4
6-month weight	-	-	-	0.90	0.78	0.67
9-month weight	-	-	-	-	0.85	0.73
12-month weight	-	-	-	-	-	0.78

Positive correlation was found for all growth parameters investigated in the study. Correlation between birth weight and 1-month weight found in current study was higher than 0.32 (Mahbubul *et al*., 2020) for 50% Brahman crossbred calves, 0.08 (Shejuty *et al.*, 2020) for grade-2 Brahman crossbred calves. Mahbubul *et al*. (2020) reported lower correlation value of 0.19 between birth weight and 3-month weight than present study findings (0.25). In contrary higher correlation value of 0.65 was reported by Haque *et al.* (2016) for same traits. Positive correlation value of 0.32 were found between birth and 6-month weight in the present experiment which was comparatively lower than 0.74 (Papry *et al*., 2020) and 0.52 (Haque *et al*. 2016) for Brahman crossbred calves. Phenotypic correlation between birth and 9-month body weight (0.33) was higher than Mahbubul *et al*. (2020) reports of 0.17 while lower than Papry *et al*. (2020) reports of 0.75. Correlation between birth and 12-month body weight of Brahman crossbred calves was 0.45 which was much higher than 0.23 reported by Mahbubul *et al*. (2020) and much lower than 0.71 reported by Papry *et al*. (2020). Correlation between birth and 24-month body weight for Brahman crossbred calves was found 0.42. This finding was comparatively higher than 0.35 (Mahbubul *et al*., 2020).

Moderate positive correlation was seen between 1-month and 3-month (0.58), 1-month and 24-month (0.50), 3-month and 6-month (0.53) and 3-month and 24-month (0.40). Strong positive correlation was found for 6-month and 9-month (0.90), 6-month and 12-month (0.78), 9-month and 12-month (0.85), 9-month and 24-month (0.73) and 12-month and 24-month (0.78). Comparatively lower phenotypic correlation was noticed for 1-month and 9-month (0.26), 1-month and 12-month (0.32) and 3-month and 12-month (0.32).

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Conclusions

This study conclude that Brahman bull has the capacity to produce calves with heavy body weight with higher growth rate when crossed with indigenous cattle. Strong positive correlation indicates selection for one trait will help to improve others. Low calf mortality rate of Brahman crossbred cattle at farmers house is a good sign of sustainability of this population. So, this crossbred cattle (50% local-50% Brahman) population may be a valuable asset to improve farmers condition and ultimately fulfil increasing meat demand of Bangladesh.

Conflict of Interests

The authors declared no potential conflicts of interest with publishing of this article.

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