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EVALUATION OF THE GROWTH PERFORMANCE OF RCC GROWING BULL THROUGH THE REPLACEMENT OF CONCENTRATE WITH GREEN GRASSES

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ABSTRACT: *Valuable indigenous bovine genetic resources, like Red Chittagong cattle (RCC), have better growth potentiality. Based on the hypothesis, the study was conducted to determine the low-cost feeding system, assessing the growth performance and economic viability of RCC growing bull. Eighteen RCC bulls (n=18), aged 15-18 months, were divided into three dietary groups; control group-(T_1) having 40% concentrate supplementation, group-1 (T_2) 10% concentrate lower than T_1 and group-2 (T_3) 20% concentrate lower than T_1 in a randomized complete block design (RCBD) with two block and three replications. The average initial live weight of RCC growing bulls in each group was 112.25 kg, 117 kg, and 109 kg, respectively. The collected data were analyzed with one-way ANOVA to determine significant mean differences and mean comparisons were estimated by Duncan Multiple Range Test (DMRT) by using SPSS 22. The research result revealed that average live weight gain was significantly ($p<0.05$) higher in group 1 (0.64 kg/d) followed by the control group (0.56 kg/d) and group 2 (0.51 kg/d). Additionally, feed cost was found significantly ($p<0.05$) lower in group-2 (6660.7 BDT) compared to group-1 (8307.9 BDT) and control group (9316.1 BDT) respectively. Moreover, the feed conversion ratio was found significantly ($p<0.05$) lower in group 1 (6.1) than control group (6.7) and group 2 (7.1). Additionally, the results also exhibited that, Net return was significantly ($p<0.05$) higher in group-1 (12137.49 BDT) followed by group-2 (9676.3 BDT) and control group (8461.4 BDT). Considering the research findings, it might be concluded that a supply of green roughage with 30% concentrate mixtures could be used for profitable RCC growing bull rearing.*

KEYWORDS: Red Chittagong cattle, FCR, Feed cost, Net-return.

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INTRODUCTION

Bangladesh is an agro-based country that has mixed farming where crop, livestock and fisheries are the major components of the agricultural systems. Among those components, livestock contributed 1.90 % of total gross domestic product (GDP) and its growth rate is 3.10 % (DLS 2021-22). Currently, a total of 24.7 million cattle (DLS 2021-22) are playing a significant role in Bangladesh's economy. Although Bangladesh is able to produce more meat than the demand (147.84 g/h/d against 120 g/h/d, DLS 2021-22), there is no recognized beef breed. Sustainable indigenous beef cattle production systems, safety and nutritional quality of beef are currently critical to public opinion and preference in consumers' food choices. In Bangladesh, most of the cattle are *Bos indicus* non-descriptive type and few are improved crossbreds. Red Chittagong Cattle (RCC) is recognized as a potential type used for dual-purpose production; it has its own distinct phenotypic characteristics with physical fitness and superiority of productive performance aspects (Hossain, *et al.,* 2012; Mostari, *et al.,* 2007; and Bhuiyan, *et al.,* 2007). The RCC cattle are mostly (70-75%) concentrated in the greater Chittagong division (Simul *et al.,* 2012) with higher localization in the eastern plain land area of the Chittagong district (Hossain, *et al.,* 2012). In the Chittagong district of Bangladesh, it was found that the average birth weight of female RCC progeny was15.77 kg and that of male RCC progeny was 16.29 kg and the average live weight gain until the pre-weaning period was 0.197 kg/d (Miah *et al.,* 2023). It is well adopted in prevailing feeding and management systems and resistant to several diseases and parasitic infestation (Simul *et al.,* 2012).

Generally, the calves are weaned at 6-9 months of age, and then male calves undergo growth or fattening program for several periods varying timeframes. The RCC farmers are practiced to supply poor quality roughages like crop residues, natural resources, rice straw, green grass, and open grazing system as a source of feeds with little amount of rice polish and wheat bran, in which green grass supplementation comprises the major portion for dairy cattle (Yasmin *et al.,* 2006). Kabir *et al.* (2022) also showed that 91% of farmers supplied roadside or local grass to their animals. Consequently, farmers failed to achieve their profit margin due to proper knowledge of balancing the ration. Skunmun *et al.* (1999) reported that better animal feeding and husbandry practices are necessary in order to improve the production efficiency of RCC dairy cows but not for RCC beef cattle. It was reported that beef production with RCC male calves obtained from dairy farms is profitable (Buaphun *et al.,* 2000). But nowadays, feed costs are getting higher. The cost of beef cattle production can be further decreased through the formulation of cost-effective rations. Subsistence farmers reared RCC bull calves for beef production including family labor but lacked proper feeding management; it had a negative impact on return (Halim *et al.,* 2010). Due to increasing the price of concentrate feed, the rearing cost of a bull for meat purposes becomes higher. Thus, the research was conducted with a view to determine the cost-effective ration for rearing RCC beef cattle, at low cost in a conventional rearing system so that farmers can induce profitability by lowering feed costs.

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MATERIALS AND METHODS

Ethical consideration

This research work was conducted mainly based on a feeding trial to determine the growth performance of Red Chittagong's growing bull. The Institutional Animal Experimentation Ethics Committee of Bangladesh Livestock Research Institute approved to conduct of this study.

Experimental site

To assess the growth performances of RCC bull for profitable rearing, a feeding trial was conducted for a period of 90 days at Pachutia Cattle Research Farm, Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka-1341 in April-June/2022. A well-conditioned face-out shed was selected to conduct the research work properly.

Selection of animals

A total of 18 growing Red Chittagong bulls, aged between 15 to 18 months, were selected as experimental animals and conducted for definite time period having initial live weights (112.25±2.20kg, 117±15.89kg & 109±15.45 kg, respectively) of three experimental groups. Selected animals were dewormed using anthelmintic drugs and allowed 15 days to adapt to the designed experimental conditions prior to the main feeding trial.

The housing of selected cattle

Selected animals were kept individually in a properly ventilated face-out housing system and provided sufficient and comfortable space and environment. A good sanitary condition and uniform management were maintained throughout the experimental period. The selected animals were sprayed once daily. Cow dung and urine were cleaned three times a day.

Experimental design

The research experiment was conducted on eighteen (n=18) RCC yearling bulls into three groups based on their initial live weight in a randomized complete block design (RCBD) with two blocks and three replications. Where concentrate feed was replaced gradually by 45 days-aged German grass. The dietary formulation for three groups is mentioned in Table 1 where the existing bull feeding practice (60:40) was considered as the control group.

Table 1: Layout of the experiment (DM basis)

Control group (T_1)	60% German grass+40% Concentrate mixtures
Group 1 (T_2)	70% German grass+30% Concentrate mixtures (10% concentrate replacement)
Group 2 (T_3)	80% German grass+20% Concentrate mixtures (20% concentrate replacement)

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Feeding Management

German grass (45 days aged in summer) was supplied as green roughage to all groups as per diet. Table 2 shows the part of concentrate mixtures used for this experiment according to different proportions to maintain the required amount of energy and protein following NRC-2016. German grass was chopped and supplied two times a day i.e. morning and afternoon. The mixed concentrate was provided also two times (morning and afternoon) in a day.

Supplied feed was kept at the manger for 24 hours for complete feeding and leftovers were measured in the morning before providing new feed. Clean drinking water was supplied *ad libitum* two times a day and kept water for a day long. Feed samples were collected fortnightly. Collected green roughage samples and mixed concentrate samples were prepared and analyzed in the Feed Biotechnology laboratory and Animal Nutrition Laboratory at BLRI (Table 2).

Table 2: Nutritional composition of supplied diet

Ingredients		**DM (%)**	**CP (%)**	**Ash (%)**	**ADF (%)**	**NDF (%)**	**ME value (MJ/Kg DM)**
German grass		16.63	12.76	11.29	38.31	67.83	9.10
Concentrate mixtures		88.95	14.92	13.49	22.15	34.67	11.47
Wheat bran	29%						
Khesari bran	20%						
Broken Maize	8%						
Sesame oil cake	9%						
Soybean meal	17%						
Broken wheat	12%						
DCP	2%						
Limestone	1%						
Vit-min premix	1%						
Common salt	1%						
Total	100%						

(N.B: DCP=Di-calcium phosphate; Vit-min= Vitamin mineral; DM= Dry matter; CP=Crude Protein, ADF=Acid Detergent Fiber, NDF= Neutral Detergent Fiber, ME= Metabolizable Energy, Kg= Kilograms)

Live weight gain and Feed conversion ratio

Throughout the trial period, the live weight of the RCC bull was measured weekly to calculate the total live weight gain (LWG). Before starting the feeding trial, initial live weights and after the ending of the trial, the final live weights of each RCC bull were measured. The live weight gain (LWG), daily live weight gain (DLW) and feed conversion ratio (FCR) were measured by following equations.

Equation 1: Total LWG= FLW-ILW;

Equation 2: DLW=Total LWG/Total days of the experiment

Equation 3: FCR= Total DMI (kg)/ Total LWG (kg).

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Whereas,

FLW= Final live weight

ILW= Initial live weight

LWG= Live weight gain

DMI= Dry matter intake

GR= Gross return

TC= Total cost

Economic Analysis

The economic analysis was carried out considering the feed cost (BDT/Per kg) including concentrate ingredients (Wheat bran-41.00; Khesari bran-31.00; Broken wheat-26.00; Crushed maize-20.00; Sesame oil cake-33.00; Soybean oil cake-35.00; DCP-47.00; Limestone-8.50; Vit-min premix-235.00 and Salt-20.00), fodder cost (2.5 BDT. per kg), labor cost (500.00 BDT./d), deworming cost (45.00 BDT/bull), and miscellaneous cost (Grass cutting scissors, Manger cleaning brush, Rope, Belcha, Whose pipe etc.) as input costs. The total profit was calculated from selling meat (Average local market price 680.00 BDT/kg) with dressing percentage 55% (Ali. M.M. *et al.*, 2013) and cow dung. Net return (profit) was calculated by subtracting total cost from gross return.

Data recording and Statistical analysis

The collected data was arranged into MS Excel for sorting, cleaning and identifying the outliers and analyzed with descriptive statistics (General linear model multivariate one-way ANOVA) and Duncan Multiple Range Test (DMRT) to compare the mean of difference of dietary group by using IBM software SPSS 22. The results were presented as "Mean±Standard deviation" and the differences at $p<0.05$ were considered statistically significant and $p>0.05$ were considered as non-significant.

RESULTS AND DISCUSSION

Feed intake, Average daily gain and Feed conversion ratio

The research results revealed that there was no significant difference ($p>0.05$) in dry matter intake among all treatment groups (Table 3). Although, the control group (T_1) and group 2 (T_3) showed similar dry matter (DM) intake (%LW/day) for RCC bull (2.78 kg), whereas treatment group 1 (T_2) exhibited lower DM intake (2.67 kg). Rashid *et al.* (2015) stated in their studies that, cattle intake of 2.69% DM under the dietary management of 50% concentrate+50% urea molasses straw-based diet group, which supported the current research results. Additionally, Zahradkova *et al.* (2010) also agreed with the current study and reported that there was no significant difference in dry matter intake per day of several groups of different dietary treatments having similar live weights.

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Table 3: Feed Intake and growth performances of selected RCC bull

Parameter	Treatment *(Mean±SD)*			p-value
	(T_1)	(T_2)	(T_3)	
Total DM Intake (Kg/bull/day)	3.81^{a}±0.40	3.86^{a}±0.63	3.66^{a}±1.04	0.061
DM Intake (% LW /day)	2.78^{a}±0.08	2.67^{a}±0.2	2.78^{a}±0.13	0.713
Initial live weight (Kg/bull)	112.2^{a}±2.20	117^{a}±15.89	109^{a}±15.45	0.113
Final live weight (Kg/bull)	162.7^{b}±7.41	174.7^{a}±6.07	155.2^{c}±16.74	0.051
Live weight gain for 90 days (Kg/bull)	50.5^{b}±4.65	57.7^{a}±4.34	46.2^{b}±2.50	0.004
Avg. daily live weight gain (Kg/bull)	0.56^{b}±0.05	0.64^{a}±0.04	0.51^{b}±0.02	0.003
Feed Conversion Ratio (DMI/LWG)	6.7^{b}±0.47	6.1^{a}±1.01	7.1^{c}±2.06	0.042

^{a,b,c} *Mean in the same row with different superscripts differ significantly (p<0.05); Highly Significant (p<0.01), Non significance (p>0.05)*

Significantly (p<0.05) higher average daily live weight gain was found in group 1 (0.64kg) compared to the control group (0.56kg) and group 2 (0.51kg) (Table 3). Roy *et al.* (2013) reported 0.447 kg average daily gain (ADG) for RCC which was lower than that of the present study due to different feeding strategies. It can be narrated that ADG may increase by feeding quality green roughage with minimum concentrate mixture. Table 4 showed that better growth potential was found in group 1 (T_2). The optimum amount of green grass enhances nutrient digestibility and total volatile fatty acid (VFA) concentration which may help to increase average daily gain. Malole *et al.* (2014) also revealed a significant differences in ADG between the two feeding groups. Urea-Molasses-Straw (UMS), a closely mixed feed of the three ingredients at a ratio of 3:15:82 on a dry matter basis, and supplemented concentrate mixture at a range of 10 to 30% of the diet were used to fatten the local cattle, having live weight 90 to 170 kg showed an average daily gain of 0.418 to 0.800 kg/head according to Chowdhury and Huque (1998).

Increased live weight was found at the early stage of trial periods at an increasing rate, but in the later stage, it increased at a decreasing rate (Fig. 1). A higher energy-protein diet of nutrition could increase daily gain, but after the deposition of fat, the growth rate decreased. The results of the current study showed that replacing 10% concentrate with green roughage resulted in better growth performances. Therefore, the RCC bull showed better growth potential with low-cost feeding management. Additionally, Feed conversion ratio (FCR) in the present study was significantly affected by different dietary treatment groups which was similar to the results reported by Rashid *et al.* (2015). The current research revealed significantly (p<0.05) lower feed conversion ratio (DMI/LWG) in group 1 (T_2) compared to the control group (T_1) and group-2 (T_3) (Table 4). Huque and Sultana (2007) reported the FCR of local cattle with a UMS diet range of 6.58 to 8.22 which supported the current research. Additionally, Pordomingo *et al.* (2020) found 7.93 FCR in an 18-month Angus bull, which was almost similar to current research results. Moreover, the findings of the present study revealed that RCC as local cattle showed better feed efficiency and growth performances which were similar to previous scientific reports.

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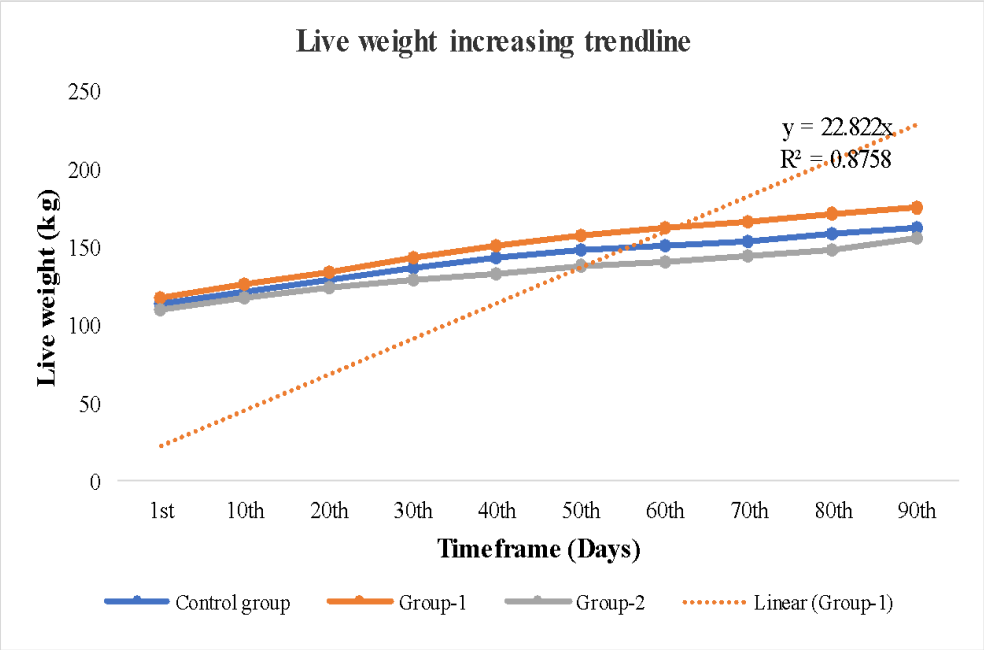

Figure 1: Live weight increasing trend line

Cost analysis of Red Chittagong bull rearing

The result of current research showed significant ($p<0.05$) differences in feed cost (BDT) among different dietary groups. Group 2 (T_3) had significantly lower feed cost per bull compared to the control group (T_1) and group-1 (T_2) for the trial period (Table 4). In the present study, feed cost varies due to concentrate supplementation. Sultana *et al*. (2024) stated that feed cost also varied from region to region based on locally available feed ingredients who found higher feed cost at Ishwardi and lower at Charfassion. Other costs like roughage cost, labor cost, deworming cost, and miscellaneous costs were similar among the different dietary groups.

Table 4: Rearing cost of selected RCC bull for 90 days

Parameter	Treatment *(Mean±SD)*			p-value
	T_1	T_2	T_3	
Feed Cost (BDT. /h)	9316.1^{a}±38.6	8307.9^{ab}±10.2	6660.7^{b}±19.0	0.006
Labor Cost (BDT. /h)	2812.5^{a}±0.00	2812.5^{a}±0.00	2812.5^{a}±0.00	0.451
Deworming cost (BDT/h)	45^{a}±0.00	45^{a}±0.00	45^{a}±0.00	0.562
Miscellaneous cost (BDT. /h)	500^{a}±0.00	500^{a}±0.00	500^{a}±0.00	0.347
Total cost (BDT/h)	12673.6^{a}±38.69	11665.4^{ab}±31.23	10018.2^{b}±44.04	0.002

^{a,b,c} *Mean in the same row with different superscripts differ significantly ($p<0.05$); Highly Significant ($p<0.01$), Non significance ($p>0.05$)*

Therefore, the feed cost was increased by increasing the amount of concentrate in the feed. Rashid *et al.* (2015) showed that feed cost was reduced per kg LWG by replacing a 50% concentrate diet with urea-molasses straw (UMS) which indirectly supported the findings of

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this study that lower feed cost can reduce production cost. Besides this, the current study was also consistent with the following previous studies. Parvez *et al.* (2001) also stated that daily feed costs are reduced with a decreased amount of energy and protein in the diet. Ghaffari *et al.* (2023) reported that higher feed cost was found in the dry feed treatment group (58.2%). However, based on this discussion it can be suggested that reducing concentrates supplementation by quality green roughages can reduce feed costs and also increase profitability.

Return Analysis of Red Chittagong bull rearing

The current results also (Table 5) revealed that net return was significantly ($p<0.05$) higher in group 1 (T_2). Due to optimum green roughage and concentrate supplementation with lower feed cost (Table 4) at RCC bull rearing, the net return was increased. Significantly ($p<0.05$) higher net return was found in group 1 (T_2) compared to the control group and group 2 (T_3), respectively for 90 days RCC bull rearing program (Table 5).

Table 5: Returns of rearing selected RCC bull

Parameter	Treatment *(Mean±SD)*			p-value
	(T_1)	**(T_2)**	**(T_3)**	
Return from selling dressed meat (BDT./bull)	18980.5^{b}±37.5	21598.5^{a}±26.6	17297.5^{b}±35.0	0.000
Return from selling cow dung (BDT./bull)	2154.6±22.1	2204.4±29.4	2397.1±27.5	0.129
Gross return from meat and cow dung (BDT./bull)	21135.1^{b}±77.3	23802.9^{a}±52.5	19694.5^{b}±62.8	0.007
Net return (BDT./bull)	8461.4^{b}±24.2	12137.4^{a}±44.8	9676.3^{ab}±42.5	0.005

^{a,b,c} *Mean in the same row with different superscripts differ significantly ($p<0.05$); Highly Significant ($p<0.01$), Non significance ($p>0.05$).*

Feed costs are increasing day by day. Feeding is the foundation of livestock rearing system which accounted about 65-70% of total cost. The profitability of cattle farming can be enhanced by reducing concentrate feeding and increasing green roughage supplementation. Ghaffari *et al.* (2023) found a higher net return from the CONVL fed group than the dry feed treatment group that agreed with the current study result (i.e. -maximum net return from RCC bull rearing with 10% concentrate replacement by green roughage).

CONCLUSIONS

Considering this research findings, it can be concluded that by replacing 10% concentrate (i.e. 70% German grass + 30% Concentrate mixtures) in Red Chittagong growing bull rearing, showed better growth performances and lower feed conversion ratio with lower production cost. In Bangladesh, 10% concentrate replacement by green roughage (German-70%) with concentrate mixture (30%) supplementation for beef cattle rearing may be more convenient and profitable to farmers.

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AUTHORS CONTRIBUTION

SMJ Hossain supervised the experiment, review literature, data curation and review the final draft of manuscript. M Miah performing the field trials, sample collection, lab work, analyzed the data and writing the manuscript sincerely. SF Shejuty performing the lab work and writing of draft manuscript, MA Kabir design and supervised the experiment and review literature, and review the draft manuscript and D Das performing the lab work and review of manuscript. All authors have read and agreed to the published version of the manuscript.

CONFLICT OF INTEREST

There were no conflicts of interest to disclose.

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