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[1]Department of Animal Science, Bangladesh Agricultural University Mymensingh-2202, Bangladesh
[2]Bangabandhu Academy for Poverty Alleviation and Rural Development (BAPARD), Ministry of LGRD and Co-operatives, Gopalganj, Bangladesh

Research Article

Fattening practices in upgraded Holstein Friesian bulls through grass based ration at BAPARD in Gopalganj

MA Kobir[1], MMH Mustafa[1,2], MA Hashem[1], MR Islam[2] and MM Rahman[1*]

Abstract

The study was conducted to find out the study of grass based ration for cattle fattening of upgraded Holstein Frisian bulls at BAPARD cattle farm in Gopalganj. For this purpose, twelve local × Study of grass based ration for cattle fattening of upgraded Holstein Friesian bulls of average 21.39 months of age and 272.78kg live weight were divided into four equal groups. Three different rations such as: a mixed concentrate ration (T_1), mixed concentrate ration and green grass at a ratio of 1:1 on dry matter basis (T_2) and green grass only (pakchong) based ration without concentrate and green grass (T_3) were selected for this experiment. Upgraded bulls were randomly distributed into three groups for three above different rations. The results found that the average daily live weight gains of three groups was 550g, 457g and 480g respectively, which were not differed significantly ($P>0.05$). Daily DM intake was significantly higher in T_3 (9.86g/head/day) compared to T_1 and T_2 ($P<0.05$), but the digestibility found lower in T_2 than other treatments. Feed conversion ratio (FCR) was significantly higher in T_3 (9.86) but interestingly, cost of per kg live weight gain was the lowest in T_3 (209.53 BDT) compared to other two treatments ($P<0.05$). Considering the above findings, a beef ration only with green grass would be the appropriate diet for the south-west area of Bangladesh for local × Holstein Frisian upgraded bulls.

Corresponding author:

Dr. Md. Mukhlesur Rahman
Department of Animal Science, Bangladesh Agricultural University Mymensingh-2202, Bangladesh
Email: mmrahman.as@bau.edu.bd

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Introduction

Livestock plays an indispensable role in the traditional agriculture and largely subsistence economy of Bangladesh (Barman et al., 2017; Baset et al., 2003; Begam et al., 2007). The landless marginal farmers largely depend on livestock for their survival (Ahmed, 1992). The total livestock population in Bangladesh is estimated at 23.78, 1.47, 3.34, 25.77, 268.40 and 52.24 million cattle, buffaloes, sheep, goats, chicken and duck respectively (DLS, 2017). The livestock sector contributes 3 percent to the Gross Domestic Product (BBS, 2015). Livestock is one of the most important components of agriculture that contributes about 6.5% of gross domestic products (GDP) and 14.21% of total foreign exchange earnings in Bangladesh (DLS, 2017, Mustafa et al., 2020 and 2021). Livestock plays a vital role in the traditional agriculture and largely subsistence economy of Bangladesh (Barman et al., 2017; Baset et al., 2003; Rahman et al., 2002; Quddus and Rahman, 1998). The rural poor farmers largely depend on livestock (especially on small ruminants) for their survival (Ahmed, 1992). Feeds and strategy of feeding are the important factors for livestock development. The feeding practice of livestock of Bangladesh is very much traditional and conventional (Tareque, 1991; Rahman et al., 1997, 1998 and 1999). Bangladesh has a higher cattle population than any other countries of European Economic Community and distributed with a greater density (2.6 cattle and buffalo heads per hectare) compared to other Southeast Asian countries (Assaduzzaman, 1996). Beef fattening is the intensified feeding of cattle to obtain the greatest quantity of high quality meat. It can also compensate the deficiency of protein and energy of the cattle which promote weight gain. The cattle population of Bangladesh commonly suffers in malnutrition as well as beef fattening need energetic diet. Nutrient supplementation to the growing cattle enhances muscle development, meat quality and marbling. It's also a tool for livelihood improvement and income generation of rural poor. Beef fattening is an emerging sector for employment and income generation for the rural poor, especially landless, destitute and divorced women. Cattle fattening is an effective tool for poverty alleviation for the rural poor. Cattle fattening for beef production has become an important business of the small farmers in Bangladesh. One of the advantages of the cattle fattening by the rural farmers is that they use locally available cattle feed resources during the Eid festival. In recent years the women farmers of Bangladesh have been involved and sustained beef fattening program in rural areas of the country (Ahmed et al., 2010; Begum et al., 2007; Islam et al., 2012; Khan et al., 2004). Green fodder along with concentrate supplementation enhances the growth performances of cattle. Ruminant animals primarily depend on microorganisms available in the rumen to digest roughages (cell wall polysaccharides) and other feedstuffs to produce volatile fatty acids (VFA) and other organic acids. Various types of microorganisms from different species (bacteria, protozoa, fungi) are involved in the ruminal digestion process to digest the fibrous materials and other feed ingredients. There is a scarcity of green grass and rice straw might be the major feed resource for the livestock production in Bangladesh (Hashem et al., 2020 and 1999; Kamal et al., 2019; Molla et al., 2009). Straw can be used through urea treatment along with molasses that increase the

digestibility of straw and very much effective for the growth and also for fattening (Baset et al., 2002; Mazed et al., 2004; Kawsar et al., 2006; Sarkar et al., 2008). Carbohydrates represent the most dominant fractions of cattle diets such as starch, cellulose, hemicellulose, pectin, arabans and xylans (Allen and Piantoni, 2014; Das et al., 2015). The digestion and utilization of carbohydrate by cattle varies according to type of carbohydrate and physiological condition of the animal (Noziere et al., 2010). Forages composed up to 40 to 100% of the cattle diet and are vital for maintaining health and productivity of animal (Prins and Kreulen, 1991). Cattle need minimum of 16% CP in their ration for their optimum growth, production, and reproduction (NRC, 1990), but in the conventional feeding system cattle gets a very low amount of CP (Khalek et al., 2004). The true protein feeds are very much expensive and so rural farmers can't supply high protein source feeds to their cattle. On the other hand urea is a NPN (non-protein nitrogen) substance which can provide 16% CP to the ruminant animals and ruminant can efficiently utilize urea. So, incorporation of urea into the ruminant's diet along with a higher carbohydrate source can provide sufficient protein and energy required for the ruminants. These urea treated feeds enhance the growth, production, and reproduction of the ruminants (Mathur and Sharma, 1985) and such type of feed materials can be used for beef fattening. Cattle fattening for beef production has become an important business of the small farmers in Bangladesh. The Department of Livestock Services (DLS) has taken beef fattening as an action program to generate income for the rural poor farmers. Detailed study is needed covering different districts of Bangladesh to recommend cattle fattening programs for the rural poor farmers as an income generating activity (DLS, 2017). Therefore, the present study was undertaken to investigate the effect of ration on beef fattening at BAPARD Cattle Farm in Kotalipara, Gopalganj, Bangladesh. In this context, the present study of beef fattening was conducted by the Livestock Department of BAPARD at Kotalipara, Gopalganj in Bangladesh. There is an acute shortage of feeds (rice straw) and fodder has been identified in this BAPARD cattle farm surrounding areas (Kotalipara) as because of low laying land that undergoes water logging up to 8-9 months. Rural people and trainees didn't like the urea mixed feed as well as fattening with synthetic steroid hormone injection. In this perspective, the research was designed with different beef cattle diets solely of mixed concentrate, green grass and a mixture of mixed concentrate and UMS. This research was carried out due to a part and research implementation with the following objectives: To determine the i) growth rate of upgraded Holstein Friesian bulls with grass based different formulated rations, ii) FCR of upgraded Holsteien Friesian bulls with grass based different formulated rations and iii) cost of meat production of upgraded Holstein Friesian bulls with grass base different formulated ration.

Materials and Methods

Body weight measurement of the bulls and experimental design with different diets

The study was conducted at BAPARD cattle farm in Kotalipara, Gopalganj, Bangladesh for a period of 4 months from September 2020 to December 2020. The animals were selected and bought from the Cattle Breeding and Dairy Farm, Bogra under DLS (Directorate of Livestock Services). Twelve F_1 local × Holsteien Friesian upgraded bulls of almost 21.39 months of age and an average body weight of 272.39 kg were selected from the breeding herd. At the beginning of the experiment the animals were weighted at morning before offering any types of feed by using Shaeffer's formula and the measurement was continued throughout the experiment at morning once weekly.

Body weight measurement of the bulls and experimental design with different diets was conducted at BAPARD Cattle Farm in Kotalipara, Gopalganj, Bangladesh for a period of 3 months from September 2020 to November 2020. The animals were selected and bought from the Cattle Breeding and Dairy Farm, Bogra under DLS (Directorate of Livestock Services). Nine F_1 Local × Holstein Friesian upgraded bull of almost 21.39 months of age and an average body weight of 272.78 kg were selected from the breeding herd. At the beginning of the experiment the animals were weighted at morning before offering any types of feed by using Shaeffer's formula and the measurement was continued throughout the experiment at morning once weekly (Figure 1).

Body weight $W = \frac{L \times G^2}{300}$ ib or, $W = \frac{L \times G^2}{300 \times 2.2}$ kg

Here, L = Length of the body starting from point of the shoulder to the point of buttock in inch. G = Heart girth in inch by dividing with 2.2 to get the reading in kg (Banerjee, 1998).

Figure 1. Measuring body weight by the researcher.

Figure 2. Researcher visited red pakchong field at BAPARD

These 9 bulls were randomly distributed into 3 groups for 3 different formulated diets (treatment) and each group consists of 3 bulls (replication). Animals of group A were supplied concentrate mixture (T_1), animals of group B were supplied urea molasses straw with concentrate mixture (T_2), and animals of group C were supplied various green grass viz. sweet jumbo, napier pakchong, red pakchong (Figure 2) and local green grass (T_3) which were produced in BAPARD campus. Design of the experiment is shown in (Table 1). The proportion of feed ingredients for concentrate mixture was selected to fulfill the nutrient requirements of the experimental bulls (Table 2).

These 9 bulls were randomly distributed into 3 groups for 3 different formulated diets (treatment) and each group consists of 3 bulls (replication). Animals of group A were supplied concentrate mixture (T_1), animals of group B were supplied urea molasses straw with concentrate mixture (T_2), and animals of group C were supplied various green grass viz. sweet jumbo, napierpakchong, red pakchong and local green grass (T_3) which were produced in BAPARD campus. The proportion of feed ingredients for concentrate mixture was selected to fulfill the nutrient requirements of the experimental bulls (Table 2). Individual records of these upgraded bulls were kept with separate feeding and watering system at BAPARD cattle farm in KotaliparaUpazila, Gopalganj, Bangladesh.

Table 1. Design of experiment

Treatment	Formulated diets
T_1	Mixed concentrate only
T_2	Mixed concentrate + Green grass (1:1)
T_3	Only green grass

Table 2. Concentrate mixture for the experimental diet 1 (T_1)

Sl.	Feed Item	Percentage (%)
1	Wheat Bran	30%
2	Crushed maize	20%
3	Rice Polish	30%
4	Mustard Cake / Soybean	15%
5	DCP	2%
6	Molasses	1%
7	Lime Stone	1%
8	Salt	1%
9	Premix (D.B.)	0.10%

Quarantine and Deworming of the upgraded bulls: All upgraded bulls kept under quarantine for 14 days period prior to fattening and then dewormed with anthelmentics before the starting of feeding experiment. One (1) antiworm (Bol. Endex) bolas was applied for 41-70 kg body wt. to all of the upgraded bulls and sufficient amount of water was supplied during this period for better effectiveness of that drug.

Feeding and digestibility trial: The formulated diets were fed *ad libitum* and calculated the total DM intake of the diets of the respective dietary components was maintained throughout the feeding period. The animals were fed twice daily once at 7.00 h and again at 15.00 h. Clean and fresh water was offered twice daily to all animals. The same amount of mineral supplements (di-calcium phosphate and salt) was supplied to all treatment groups to minimize mineral deficiencies. Daily feed offered to and refused by an individual animal were recorded and the animals were weighed every seven days for a total period of 120 days including a seven days digestibility trial after sixty days of growth trial. The digestibility of the diets was calculated by the following formula:

$$\% \text{ digestibility} = \frac{\text{Intake} - \text{excreted}}{\text{Intake}} \times 100$$

Analysis of Cost of Feeding: Cost of feeding was analyzed considering the present market price of feed ingredients and cost of diets shown in Table 3.

Table 3. Price of the Ingredient of the Experimental Diets

Feed ingredients	Price (TK/kg)	Price (Dollar/kg)
Wheat bran	32.00	0.40
Crushed corn	24.50	0.31
Rice polish	16.00	0.20
Green grass	10.00	0.13
Rice straw	11.00	0.14
Mustard plant	10.00	0.13
Urea	30.00	0.38
Molasses	28.00	0.35

Statistical Analysis

The obtained information was collected, stored and coded accordingly using Microsoft Excel-2013 to WASP-1.0 (Web Agri. Stat Package) by ICAR (Central Coastal Agricultural Research Institute) for analysis. Then the data were analyzed through Completely Randomized Design (CRD). Significant mean values were tested with DMRT (Duncan's Multiple Range Test).

Results and Discussion

Effect of different formulated diets on the performances of Holstein Friesian upgraded bull

The effects of different formulated diets on the performances of upgraded Holstein Friesian bulls were shown in (Table 4). Average age was 22, 20 and 22 months respectively in T_1, T_2 and T_3 treatment groups. The age of the HF crossbred bulls was relatively closer and there were no significant differences among the treatment groups. Initial body weight was 239, 236 and 204 kg in T_1, T_2 and T_3, respectively and the values were significantly differed in three treatment groups. Final body weigh was 289, 277 and 253 kg in T_1, T_2 and T_3 treatment groups after 3 months of experimental period. The final body weight was also found significantly different in T_1, T_2 and T_3 ($p>0.05$). The average daily live weight gains of three groups were 550g, 457g and 480g respectively. A higher body weight gain was found in T_1 (550g) and a lower body

weight gain was found in T_2 (457g) and the differences were not significant at different treatment groups. Comparatively lower feed intake was found in T_1 (5.07 kg/head/day) than in T_2 (7.99 kg/head/day) and T_3 (8.70 kg/head/day) respectively. The digestibility of the three formulated diets was 83.18, 68.40 and 79.88% for T_1, T_2 and T_3 respectively. A higher digestibility of DM was found in concentrate based diet (T_1) but there was no statistical difference in the digestibility of T_2 (mixture of concentrate and UMS) and T_3 (green grass based diet). A lowest daily excreta was found at T_1 (0.83) compare to T_2 (2.3) and T_3 (2.25) in Kg dry matter respectively there was higher statistical difference in the excreta of T_1 and both of T_2 and T_3.

Table 4. Effect of different formulated diets on the performances of Holstein Friesian upgraded bull

Parameters	Treatment			Level of significance
	T_1	T_2	T_3	
Age of Animal (Month)	22.33	19.67	22.17	NS
Initial body weight (kg)	239	236	204	*
Final body weight (kg)	288.67	277	252.67	*
Body weight gain (kg/day)	0.55	0.46	0.48	NS
Feed intake (kg/head/day)	5.07	7.99	8.70	*
Daily excreta (kg/head/day)	0.81	2.3	2.25	**
Digestibility (%)	83	78	69	*
FCR (kg feed/live wt. gain)	6.93	9.24	9.86	*
Cost of beef cattle production (BDT/kg live-wt.)	275.20	216.55	209.53	*

FCR = feed conversion ratio, BDT= Bangladeshi Taka, Figures followed by same letter (s) within a row do not differ statistically, NS means not significant; *means significant at 5% level of probability.

The most effective FCR was found in T_1 (6.93) compared to T_2 (9.24) and T_3 (9.86). Concentrate based diet (T_1) showed a significant difference ($p>0.05$) with T_2 and T_3 but, there was no statistical difference between T_2 and T_3. The feed cost of producing one kg live weight was calculated to be 275.20, 216.55 and 209.53 BDT respectively for the three diets. The cost of producing beef cattle was significantly different $p>0.05$ in T_3 (green grass based diet) compared to T_1 and T_2. Considering the FCR and cost of producing per kg live weight, a beef diet of green grass is the comparatively appropriate diet for the floodplains area for F_1 Local x Holstein-Friesian crossbred bulls. However the difference, is not significant ($p>0.05$). Forage to concentrate ratio (F:C) may alter dry matter intake (DMI) in ruminants since DMI is associated with the amount of neutral detergent fiber (NDF) in diet, the digestibility of NDF, the proportion of NDF that is slowly digested, lignin contents and the passage rate of the undigested feed residues from the digestive tract (Oba and Allen, 1999). In addition to NDF, the other cell wall components being the dominant part (55 to 60%) of the forage materials and having variable fractional passage rate may also limit DMI by occupying gut fill (Wilkins, 2009). Forages represent the most dominant parts of cattle diets that are the source of starch, cellulose, hemicellulose, pectin, arabans and xylans (Das et al., 2015; Rahman et al., 1998). Forages comprise up to 40 to 100% of the cattle diet and are vital for maintaining health and productivity of animal (Prins and Kreulen, 1991). The higher the fiber content of the forage materials, the lower is the digestibility and the nutritive value (Baset et al., 2002; Mazed et al., 2004; Refat and Yu, 2016). However, fiber plays an important role in rumen development and voluntary feed intake (Khan et al., 2011).

Mustafa et al. (2021) conducted a 4 month period study of same type Initial body weight of their experiment was little bit different at three diet treated groups and final body weight was also different ($p>0.05$) in T_1, T_2 and T_3. The average daily live weight gains of three groups were 350g, 330g and 340g respectively. A little higher body weight gain was found in T_1 but the differences were not significant at different treatment groups. Comparatively lower feed intake was found in T_1 (5.6 kg/head/day) than in T_2 (9.5 kg/head/day) and T_3 (9.8 kg/head/day) respectively. The digestibility of the three formulated diets was 85, 75 and 74% for T_1, T_2 and T_3 respectively. A higher digestibility of DM was found in concentrate based diet (T_1) but there was no statistical difference in the digestibility of T_2 (mixture of concentrate and UMS) and T_3 (green grass based diet).

Ruminant animals depend on plant source feeds that are digested anaerobically in their rumen through microbial enzymes. Volatile fatty acid (VFA) and other organic acids are the primary energy sources in rumen fermentation. Microbial fermentation in the rumen also produces waste products such as methane (CH_4) and carbon dioxide (CO_2) (Kim et al., 2012; Rahman et al., 2013). Rahman et al. (2013) examined the VFA (acetate, propionate and butyrate) production pattern of different types of feed ingredients and found that a comparatively higher propionate was produced from energy and protein feeds than forages. On the contrary, acetate production was comparatively higher in forages (63.16%) than energy (60.19%) and protein rich (60.79%) feeds. Higher acetate: propionate ratio was found in forages compared to energy and protein feeds might be due to presence of structural carbohydrates (cellulose, hemi- cellulose) in forages. Forages contain more acid detergent fiber (ADF) and neutral detergent fiber (NDF) that helps to increase A:P ratio during anaerobic fermentation, and the molar proportion of different fatty acid production depends on the structural composition of the feed ingredients. Readily degradable carbohydrates produced relatively higher propionate as compared to acetate, and cell wall containing fibrous carbohydrate (cellulose) produced more acetate than propionate. Rahman et al. (2012) formulated a ration with selected feed ingredients to optimize production by reducing CH_4 emissions from ruminant.

Table 5. Relationship between the calculated variables on different formulated diets

Parameter	Correlation coefficient, r	Regression equation
Feed intake and daily gain	0.73	Y= - 0.025+0.109
Feed intake and age	0.76	Y=1.34+0.17
Age and digestibility	0.83	Y=8.84+3.20

Correlation coefficient between average feed intake and average daily gain

Correlation coefficient, r = 0.73

Y= -0.025 + 0.109

Correlation coefficient between average feed intake and average daily gain is 0.73 implies that there is strong positive relationship between the variables/characteristics. Again, the estimated regression equation of average daily gain on average feed intake is Y= -0.025+0.109 indicates that if there will not be given any feed then on an average the daily body weight will be lost by 0.025 kg and regression coefficient, b = 0.109 implies that if average feed intake will be changed by one unit then average body weight will be changed by the rate 0.109.

Correlation coefficient between average feed intake and average age

Correlation coefficient, r = 0.76

Y= 1.34 + 0.17

Coefficient between average feed intake and average age is 0.76 implies that there is strong positive relationship between the variables/characteristics. Again, the estimated regression equation of average age feed intake on average age is Y=1.34+0.17 indicates that if there will increase the age then on an average the daily feed intake will be increased by 1.34 kg.

Correlation coefficient between average age and average digestibility

Correlation coefficient, r = 0.83

Y= 8.84 + 3.20

Correlation coefficient between average age and average digestibility is 0.83 implies that there is strong positive. Again, the estimated regression equation of average digestibility on average age is Y=8.84+3.20 indicates that if there will increase the age my 3.20 month then the average the digestibility of given feed will be increased by 8.84 % of the calculated digestibility.

Conclusion

From the findings, cost of per unit beef production was the lowest in green grass based feed formulation. Although the DM intake was higher and digestibility was lower in grass based diet, it seems to be profitable for rural poor who were engaged in beef fattening. Concentrate feed ingredients were expensive for the rural poor. FCR of concentrate feed was higher than mixed and green grass diet. Therefore, it is concluded that green grass-based beef fattening was found suitable in this rural area for graded beef cattle in Bangladesh.

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