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Feedlot Performance and Profitability of Tanzania Shorthorn Zebu Finished on Local Feed Resources in Kongwa District, Tanzania

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Abstract: An experiment was conducted for 90 days to assess the effects of diets formulated based on locally available feed ingredients on growth performance, feed conversion ratio (FCR) and gross margin of cattle under feedlot condition in Kogwa district, Tanzania. Fifty bulls belonging to Tanzania shorthorn zebu breed, with the age of three to four years and average initial weight of 130 kg were used. The bulls were allotted to five treatments (T_1, T_2, T_3, T_4, T_5) in a completely randomized design. Animals on treatments T_1, T_2, T_3 and T_4 were kept under confinement, fed *Cenchrus ciliaris* hay and supplemented with concentrate diets formulated based on locally available ingredients while those on T_5 were grazed in natural pastures without being supplemented. The diet on T_1 contained maize bran as the sole energy source while T_2 comprised maize bran and rice polishing as energy sources, T_3 comprised maize bran and molasses as energy sources and T_4 had maize bran, rice polishing and molasses as energy sources. All diets contained sunflower seed cake and mineral pre-mixes as protein and mineral sources, respectively. The bulls subjected to concentrate supplementation (T_1, T_2, T_3, T_4) had higher ($P < 0.0001$) weight gain and growth rate than those on T_5. Among the bulls supplemented with concentrate diets, those on T_3 had the highest weight gain (107 kg) and growth rate (1.28 kg/d) and lower FCR (6.48), followed by those on T_1 (weight gain = 96.70 kg, growth rate = 1.07 kg/d, FCR = 6.509). Moreover, the bulls on T_3 had the highest gross margin (TZS 235,471). In conclusion, the diet on T_3 was found to be better than the other diets. Therefore, it can be used by farmers for fattening of indigenous cattle at an affordable cost and obtain large profit.

Keywords: Feed Conversion Ratio, Gross Margin, Local Feed Ingredients, Weight Gain

1. Introduction

Tanzania has 33.4 million cattle, of which 97.2% are indigenous cattle [1]. The indigenous cattle in Tanzania belong to the Tanzania Shorthorn Zebu (TSHZ) and Ankole breeds. These indigenous cattle produce about 98% of beef consumed in the country. The indigenous cattle are kept by agro-pastoralists who combine crop production and livestock keeping and pastoralists who depend solely on livestock keeping for sustenance and income of their households. Both agro-pastoralists and pastoralists practice extensive production systems, whereby ruminant livestock are herded continuously on natural pastures available on communal grazing lands during the dry and wet seasons. Beef production under agro-pastoralism and pastoralism is low and inefficient.

In beef production, feed is a critical resource that determine the growth of animals and quality of meat. In Tanzania, the main feed resources for cattle are natural pastures available in rangelands, grasslands, woodlands and bush lands. During the dry season, the natural pastures available in these rangeland resources are limited in quantity and their quality is poor. Hence, the animals grazing in the rangelands do not get enough nutrients required for maintenance and production [2]. This situation retards the growth of animals during the dry season and prolongs the time taken to reach market weight and, thus, produces tough meat [3]. Moreover, animals raised on forage system alone have poor body condition score and are emaciated [4], especially during the dry season in which the quantity and quality of natural pastures are low.

Several strategies to improve the nutrition of cattle and increase productivity have been suggested. The most common strategy is finish-feeding by supplementing grazing animals with different protein and energy concentrates [5]. Most concentrates are comprised of agro-processing by-products. Agro–processing by–products from cereal grains (maize bran and rice polishing), oilseed extraction (sunflower seed cake and cotton seed cake), sugar production (molasses), fruit and vegetable are produced in significant amount in Tanzania. These agro–processing by-products have the potential value for being used as feedstuffs for ruminants [6, 3].

Cattle finish feeding is one of the methods for value addition of indigenous cattle breeds that can be used to improve carcass weight and meat quality for domestic and foreign markets [6, 7]. Feeding rations with high-energy content can improve beef cattle growth performance and reduce the time spent in the feedlot. Maize grains and molasses are the main supplements used to provide energy to cattle under the feedlot system [8]. However, these energy concentrates are expensive and most traditional feedlot operators cannot afford to use them for cattle fattening. Instead, traditional feedlot operators use rice polishing and maize bran as the sources of energy in fattening diets, because they are cheap compared to maize grains and molasses. The major limitation of maize bran is its high demand for use in other livestock, especially in poultry and pig diets. This limits its availability and increases the price due to competitive uses. Consequently, feedlot operators under the traditional cattle fattening system use rice polishing, either individually or in combination with sunflower seed cake. However, the diets used are unbalanced. Moreover, the types of feedstuffs and their amount used to formulate the diets vary considerably among cattle fattening operators. This leads to finished animals to have different meat qualities. Therefore, there is a need to formulate a cheap and well-balanced diet based on locally available feed resources. This study was intended to develop a good quality and cost-effective diet for cattle finish feeding based on locally available feed ingredients (i.e. maize bran, rice polishing, molasses and sunflower seed cake). Specifically, the aim of the study was to determine the appropriate inclusion levels of maize bran, rice polishing and molasses as energy sources that can be used in formulation of a balanced diet for fattening cattle at an affordable price.

2. Materials and Methods

2.1. Description of the Study Area

The study was conducted at Mtanana B village located at latitude 6°4'0" south and longitude 36°34'0" east in Kongwa district, Dodoma region, Tanzania. Kongwa district is situated at an altitude of 1067 m above sea level and receives rainfall ranging from 400 to 660 mm per annum. The rainfall pattern is bi-modal with short rains commencing from November to January and long rains falling from March to May. The annual average temperature varies from a minimum of 18°C between June and August to a maximum of 34°C between October and January. Kongwa districts is located in a semi-arid area with undulating sandy and loamy sand soils. Livestock keeping is the second major economic activity in the district.

2.2. Animals, Treatments and Experimental Design for the Experiment

The animals used in the experiment were bulls with the age of three to four years. The bulls belonged to Gogo strain of the TSHZ breed. The age of the bulls was estimated based on their dentition. The bulls were provided by livestock farmers from two villages (i.e. Mtatana A and Mtanana B) in Kongwa district. The villages were selected based on presence TSHZ cattle population, availability of feed resources and proximity of the main road for easy of transportation of the fattened cattle. In each village five farmers were purposely selected to participate in the study, depending on possession of bulls with the age of three to four years and the willingness to provide the animals for the experiment.

A total of five treatments were used in this experiment. The first four treatments involved zero grazing and supplementation of formulated diets, namely T_1, T_2, T_3 and T_4 (Table 1). The diet for treatment T_1 was made of maize bran as the sole energy sources while the diet on treatment T_2 comprised of maize bran and rice polishing as energy sources, treatment T_3 comprised of maize bran and molasses as energy sources, and treatment T_4 was composed of maize bran, rice polishing and molasses as energy sources. All diets contained sunflower seed cake as protein source and mineral pre-mixes and salt. Each supplementary diet (T_1, T_2, T_3 and T_4) was formulated to meet energy (12.5 ME MJ/kg DM) and protein (12% CP) requirements for fattening beef cattle. The fifth treatment (T_5) was a control and involved only grazing in natural pastures without supplementation (farmers practice of feeding cattle). Each treatment was assigned randomly to one group of ten bulls under completely randomized design.

Table 1. *Feed ingredients and their proportions in the experimental diets.*

Feed ingredient	Ingredient inclusion level in the diets (%)				
	T_1	T_2	T_3	T_4	T_5
Maize bran	78.0	75.0	53.0	50.0	0
Rice polishing	0.0	3.0	0.0	3.0	0
Sunflower seed cake	20.0	20.0	20.0	20.0	0
Molasses	0.0	0.0	25.0	25.0	0
Mineral Premix	1.5	1.5	1.5	1.5	0
Salt	0.5	0.5	0.5	0.5	0
Total	100	100	100	100	0

T_1= Treatment 1, T_2 = Treatment 2, T_3 = Treatment 3, T_4 = Treatment 4, and T_5 = Treatment 5.

2.3. Determination of Chemical Composition of Feeds

The samples of the feed ingredients (molasses, maize bran, rice polishing, sunflower seed cake), formulated diets (T_1, T_2, T_3 and T_4), natural pastures and hay were analysed for chemical composition. Dry matter, crude fiber, crude protein, ash and ether extract were analysed according to the standard proximate analysis procedures of AOAC [9]. Metabolizable energy (ME) content of feed ingredients and concentrate diet were estimated using the equation developed by MAFF [10], that is ME (MJ/kg DM) = 0.012 CP + 0.031 EE + 0.005 CF + 0.014 NFE.

2.4. Management of Experimental Animals

A feedlot barn was constructed at Mtanana – B village, Kongwa district. The barn had four pens and each pen had a size of 20 m x 20 m, which was enough to accommodate 10 bulls. The barn had feeding and resting places. Both feeding and resting places were roofed with iron sheets. A total of 50 Gogo bulls were collected from farmers' herds. The activities that were done after collecting the animals from the farmers included identification of the animals by ear tagging, screening for diseases, de-worming and spraying to control internal and external parasites, respectively. Deworming was done on arrival using Albendazole 10% W/V (Bimeda^R – oral suspension) and it was repeated in the mid of the experiment. Spraying with acaricides was done on arrival using Alphatix^R 12.5%EC (Amitraz 125 g/l) and then after every 14 days throughout the experimental period. Other diseases were treated as they occurred.

The 50 bulls were randomly divided into five groups, each with ten animals and then allocated randomly to the five treatments. The animals under T_1, T_2, T_3 and T_4 were kept under total confinement and provided with hay and the respective supplementary diet. The amount of each supplementary diet was calculated based on the dry matter intake level of 3% of the animal body weight. The ration for a day was divided into two equal portions and fed in the morning at 0800 h and in the afternoon at 1400 h. In addition to the supplementary diets, all animals were fed *Cenchrus ciliaris* hay in *ad lib* amount. The animals on T_5 were grazed in natural pastures during the day from 0800 h to 1900 h.

Before data collection, the animals were given a preliminary period of 10 days in order to accustom them to the new feeds as well as the experimental settings. During the last three days of the preliminary period, each animal was weighed and the mean weight of the three consecutive days was taken as the initial weight. Following the preliminary period, data on body weight and feed intake were collected. The experimental period lasted for 90 days. In both preliminary and data collection periods, all animals had free access to clean water.

2.5. Determination of Feed Intake, Feed Conversion Ratio and Animal Weight Gain and Growth Rate

Experimental animals were fed in groups of five animals for each group. The amount of concentrate diet and hay were weighed before being provided to the animals and also, the amount remaining after feeding were weighed before the next feeding to determine the refusals.

The amount of feed provided and the refusals from each group were measured daily. The average feed intake (AFI) in kg DM per animal per day were calculated as the total amount of feed provided minus the amount of feed refusals (kg) divided by the number of animals. Average feed conversion ratio (FCR) per animal in each treatment was calculated as AFI (kg) divided by average weight gain (kg). Body weight of individual animals was weighed at the end of the preliminary period and then every two weeks up to the end of the experiment using a weigh band. All animals were weighed in the morning before feeding. Weight gain was calculated as the difference between final weight and initial weight in kg. Average daily gain (ADG) per animal was calculated as final weight minus initial weight in kg divided by experimental period in days.

2.6. Determination of Profitability of Fattened Cattle

Profitability of cattle fattened under different treatments was determined using gross margin analysis. Gross margin (GM) was computed as the difference between the total revenue obtained and the total variable cost incurred i.e. GM = TR-TVC. Whereby GM = gross margin, TR = Total revenue, TVC = Total variable costs. In this experiment the weight of each bull at the end of the experiment was multiplied by the price of 1 kg live weight to get the selling price of each fattened bull. The selling prices of all bulls in each treatment were added to get the total revenue for each treatment. Variable costs included the costs for the purchase of bulls, feeds and veterinary drugs and water cost, transportation cost and labourer's wages. These were computed for each treatment. The cost of buying each bull was obtained by multiplying the initial weight by the price of 1 kg live weight.

2.7. Statistical Analysis

Data were checked for normality by using the Shapiro-Wilk test for normality in R-statistical software. Data on average feed intake (AFI), feed conversion ratio (FCR), final weight (FW), weight gain, average daily gain (ADG), variable costs, revenue and gross margin were subjected to analysis of variance (ANOVA) and analysed using the

general liner model (GLM) procedure in R – software. The statistical model included fixed effect of treatment and the initial weight of each animal was used as a covariate. The effect of treatment was tested using the F-test at p = 0.05. Tukey's test was used to determine the significance of the differences between a pair of treatment means at p = 0.05.

3. Results

3.1. Chemical Composition of the Feed Ingredients and Formulated Diets

Proximate chemical composition of feed ingredients and formulated diets used in the experiment are given in Table 2. Among the ingredients used for compounding the concentrate diets, sunflower seed cake had the highest (220.88 g/kg DM) while rice polishing had the lowest (106.45 g/kg DM) crude protein (CP) contents. Maize bran had the highest metabolizable energy (ME) (13.21 MJ/kg DM), followed by rice polishing (11.69 MJ/kg DM). The CP content of the compounded diets ranged from 108.49 to 135.72 g/kg DM, with treatment four diet (T_4) having the lowest CP content and treatment one (T_1) having the highest CP content. The ME of the compounded diets ranged from 12.03 to 12.68 MJ/kg DM. Among the diets, treatment three (T_3) had the lowest ME while treatment two (T_2) had the highest ME content. The ME content of the hay was 8.61 MJ/kg DM while that of the natural pasture in grazing area was 9.2 MJ/kg DM. The CF of the feed ingredients ranged from 74.45 to 329.34 g/kg DM, with maize bran having the lowest CF and sunflower seed cake having the highest CF. The CF in the compounded diets was highest in treatment one T_1 (117.59 g/kg DM) and lowest in T_4 (87.98 g/kg DM).

Table 2. *Chemical composition of dietary ingredients and formulated diets used in the experiment.*

Feed ingredients and formulated diets	%DM	CP g/kg DM	EE g/kg DM	CF g/kg DM	NFE g/kg DM	ME (MJ/kg DM)
Hay	92.67	55.23	9.33	327.77	429.935	8.61
NP	92.55	64.98	11.57	274.47	477.772	9.2
MB	95.58	112.16	90.21	74.45	621.408	13.21
RP	96.59	106.45	107.65	167.53	445.512	11.69
SSC	95.00	220.88	114.74	329.34	227.878	11.04
Diet T_1	97.22	135.72	94.6	117.59	530.469	12.58
Diet T_2	96.98	126.14	94.24	105.63	551.329	12.68
Diet T_3	96.08	122.17	65.93	102.97	571.597	12.03
Diet T_4	95.88	108.49	59.45	87.98	606.571	12.08

Note: NP = Natural pasture, MB = Maize bran, RP= Rice polishing, SSC = Sunflower seed cake, DM = Dry matter, CP = Crude protein, EE = Ether extract, CF = Crude fiber, NFE = Nitrogen free extract, ME = Metabolizable energy.

3.2. Feed Intake and Growth Performance of Experimental Animals

Table 3 shows the feed intake, growth performance and FCR of bulls subjected to the four dietary treatments (T_1, T_2, T_3 and T_4) and the control group (T_5). The initial weight of the bulls subjected to concentrate supplementation and of those on the control group were statistically similar (p = 0.0544). But at the end of the experiment, the bulls subjected to concentrate supplementation had higher final weight (p = 0.0001) than those on the control group. The bulls that were fed supplementary diets containing molasses (T_3 and T_4) had slightly higher feed intake than those on T_1 and T_2. The bulls subjected to concentrate supplementation had significantly higher weight gain (p < 0.0001) than those on the control group. Similarly, the average daily gains of the bulls subjected to concentrate diet supplementation were higher (p = 0.0001) than of those on the control group. Among the bulls on concentrate diet supplementation, those on T_3 had the highest weight gain and average daily weight gain, followed by those on T_1. Although FCR did not differ significantly among the bulls in different treatments, those on treatment T_3 showed the lowest FCR while those on T_4 had the highest FCR value (Table 3).

Table 3. *Effect of treatment diets on growth performance, feed intake and feed conversion ratio of the experimental bulls.*

Parameter	Treatment					SEM	P value
	T_1	T_2	T_3	T_4	T_5		
Number of animals	10	10	10	10	10		
Mean initial weight (kg)	129.9	128.6	136.5	131.7	123.1	1.45	0.0544
Mean final weight (kg)	226.6^{a}	217.5^{ab}	250.5^{a}	217.1^{ab}	148.5^{b}	6.34	0.0001
Mean weight gain (kg)	96.7^{a}	88.9^{a}	107^{a}	85.4^{a}	25.4^{b}	5.27	0.0001
Average daily gain (kg/d)	1.07^{ab}	0.93^{b}	1.28^{a}	0.96^{b}	0.28^{c}	0.06	0.0001
Mean feed intake (kg/DM/day)	6.58	6.49	7.46	6.85			
FCR	6.51	7.35	6.48	7.93	-	0.33	0.3459

$^{a, b}$ Means with different superscript in the same row are significantly different (P < 0.001).

T_1 = Treatment one, T_2 = Treatment two, T_3 = Treatment three, T_4 = Treatment four, SEM = Standard error of the means.

3.3. Gross Margin of the Fattened Bulls

The results for gross margin analysis of cattle fattening using different dietary treatments are presented in Table 4. The results show that the diets in T_3 and T_4 had higher ($p = 0.0001$) feed costs which led to higher total variable costs compared to the rest of the diets. Other variable costs (water, labour and veterinary drug costs) were the same in all treatments (Table 4). There was no statistical difference ($p > 0.05$) in cost of feed per kg weight gain among the animals supplemented with different concentrate diets. Although not statistically significant, cost for weight gain for animals on T_4 was slightly higher than that of the other groups. There were no statistical differences in price of purchasing ($p = 0.6301$) and selling ($p = 0.1019$) the bulls supplemented with different concentrate diets. The average purchasing price and selling price of the experimental bulls were TZS 187,750 and TZS 660,983, respectively. The gross margin for fattening differed ($p = 0.006$) among the bulls supplemented with different concentrate diets. The gross margin for the bulls offered diet T_3 was higher (TZS 235,471.00) while that of those on T_4 was lower (TSZ 162,531.00) compared to those on T_1 and T_2. However, the gross margin for T_1 and T_3 did not differ significantly.

Table 4. *Gross margin analysis per animal for the bulls fattened under different treatments.*

Variable	Treatment				SEM	P value
	T_1	T_2	T_3	T_4		
Revenue						
Mean bull selling price (TZS)	657,140[a]	630,750[a]	726,450[a]	629,590[a]	0.648	0.1019
Variable costs						
Mean bull purchase price (TZS)	179,000[a]	179,000[a]	205,000[a]	188,000[a]	7.897	0.6301
Mean feed Costs (TZS)	216,085[b]	212,115 [b]	258,729[a]	251,828 [a]	3.327	0.0001
Mean water cost (TZS)	6,250[a]	6,250[a]	6,250[a]	6,250[a]		0.404
Mean veterinary drug cost (TZS)	6,000[a]	6,000[a]	6,000[a]	6,000[a]		0.404
Labour cost (TZS)	150,000[a]	150,000[a]	150,000[a]	150,000[a]		0.404
Mean total variable costs (TZS)	422,353[b]	418,365[b]	490,979[a]	467,078 [ab]	9.134	0.021
Mean cost of feed/kg gain (TZS)	2,374.4[a]	2,844.3[a]	2,500.0[a]	3,243.7[a]	1.5077	0.1703
Mean gross margin (TZS)	234,805[a]	212,385 [ab]	235,471[a]	162,531[b]	9.816	0.006

[a, b] Means in the same row with different superscript letters are significantly different ($P < 0.05$), SEM = standard error of the means.

4. Discussion

4.1. Chemical Composition of the Feed Ingredients and Formulated Diets

The concentrate diet on T_1 (with maize bran as the only energy source) had the highest CP content among the experimental diets. This could be attributed to the fact that maize bran contains higher CP compared to rice polishing and molasses. Overall, the CP values observed in different concentrate diets in this study are within the range reported by Cole and Hutcheson [11]. According to NRC [12] the CP content in fattening diet should range from 110 to 130 g/kg DM to meet protein requirement of fattened cattle. Moreover, the CP contents of the experimental diets were well above the CP of 8% which is recommended as the minimum level that can provide ammonia levels required by rumen micro-organism to support optimum rumen activity in ruminant animals [13]. This implies that the four experimental diets were able to provide adequate amount of nitrogen required by rumen micro-organism to maximally digest the fibres in the feeds and produce volatile fatty acid which facilitates microbial protein synthesis.

The higher content of ether extract (EE) observed in diets T_1 and T_2 could be attributed to higher inclusion level of maize bran (MB). The other diets, T_3 and T_4 contained the recommended level of EE (60 g/kg DM) for mature cattle diets. The metabolizable energy (ME) values of the compounded diets were in the range of 10 to 13 MJ/kg DM recommended by NRC [12] for beef cattle fattening. Thus, these diets have adequate energy content to be used for fattening of beef cattle. On the other hand, the CP and ME contents of the natural pasture that was used by the bulls on the control (grazing only group) was lower than the recommended levels for beef cattle. This resulted in animals grazed on natural pastures gaining significantly lower body weight compared to those supplemented with concentrate diets made of locally available feed materials. Studies have shown that the average CP of 50.0 g/kg DM in pastures is just enough to meet the minimum protein requirements for grazing animals [14, 15].

4.2. Feed Intake and Growth Performance of Experimental Animals

Dry matter intake (DMI) of the bulls supplemented with concentrate diets were within the range of 2.7 – 3.5% of body weight reported by Mwilawa [16]. The relatively higher feed intake observed in bulls on T_3 and T_4 is attributed to molasses content in the diets for these treatments. This is consistent with Mordenti et al. [17] who reported that inclusion of molasses in ruminant diets increases dry matter intake due to its superior palatability. Moreover, feeding molasses to ruminant livestock stimulates the digestive activity of ruminal microbiota and consequently, improving both digestibility of low quality forages and dry matter intake [18]. Molasses is tasty and binds dusty feeds, therefore, it improves palatability of a ration [19]. Molasses contains

many minerals including copper, zinc, iron and manganese that are important for optimum animal health and performance [20].

All bulls under concentrate diet supplementation had higher weight gain than those on the control group. The higher body weight gain observed in bulls subjected to concentrate diet supplementation could be due to adequate nutrients in the diets which were provided to the animals, thus the animals were able to meet their nutritional requirements for maintenance as well as for body weight gain [8]. The daily weight gain of bulls under concentrate diet supplementation in this study is higher than the daily weight gain of 0.812 kg/day reported by Mwilawa [17] for Tanzania Shorthorn zebu under similar rearing system and fed molasses based concentrate and hay. The difference could be due to the differences in ration formulation and the quality of hay. The daily weight gain of bulls on concentrate diet supplementation observed in this study is higher than that obtained by Asizua et al. [21] in Ankole cattle in Uganda but within the range reported by Gebremariam [22] in Hararghe cattle in Ethiopia under feedlot finish feeding. The results for FCR indicate that all bulls on concentrate diet supplementation had the same efficiency in converting feed to body weight gain. The results from this study show that the nutritive value of ingredients used to formulate the diets in T_1, T_2, T_3, and T_4 were optimal for sustaining high weight gain, thus, the bulls fed these diets had better feed utilization. However, the bulls on T_3 had slightly lower while those on T_4 had slightly higher FCR values compared to those on the remaining treatments, implying that animals on T_3 were more efficient while those on T_4 were less efficient in converting the feed to body tissues. Moreover, the weight gain and growth rate of animals under T_2 and T_4 were lower compared to that of the animals on T_1 and T_3. This is because diets in T_2 and T_4 contained rice polishing which has poor quality. It seems that diets containing rice polishing were utilized less efficiently compared to those containing maize bran. This concurs with the findings of Tahir et al. [23] who said that the nutritive value of rice bran is quite low compared to wheat bran and maize bran.

Animals on the control group (grazing only) had the lowest mean weight gain and average daily weight gain. This could be due to poor quality of the natural pastures in which the animals were grazed. According to Natongo et al. [7] natural pastures in the dry season are of low quality and scarcely available, thus cannot even meet the maintenance requirements of animals. This situation results into animals losing weight and become emaciated. Olafadehan et al. [24] showed that the performance of ruminant animals reared on the native pasture is seriously impaired because of the low quality caused by the fibrous and lignified nature of the pasture which, in turn, limits intake, digestibility and utilization. Furthermore, the animals on the control group were trekked every day from homestead to the grazing area for a distance of about eight km back and forth. The trekking consumed a lot of energy that could otherwise being used for growth.

4.3. Gross Margin of the Fattened Bulls

The results on gross margin analysis indicate significant difference in gross margin (GM) among treatments. Among the supplemented animals, those on treatment four (T_4) had significantly lower GM than those on T_1 and T_3. This is due to the fact that animals on T_4 had the lowest while those of T_1 and T_3 had the highest final body weight. Animals are usually sold based on body weight, hence, those with higher body weight fetch high price. Therefore, animals on T_4 were sold at lower price as they had lower final weight compared to those on the other treatments. The cost of diet was higher in T_3 compared to others treatments. This could be due to the high costs of the ingredients that were used in ration formulation (i.e. molasses). Molasses is abundantly available near sugar possessing industries and thus, feedlots located far away from sugar processing industries get molasses at higher costs duet to transportation cost.

Although there were no significant differences in cost of feed per kilogram weight gain among the treatments, T_1 had slightly lower cost of feed per kg weight gain. In addition to lower cost, T_1, had relatively higher nutritive value compared to other diets. Therefore, diet T_1 can be used as a finishing feed to yield a unit weight of meat at comparatively lower cost compared to the other diets. Diet T_3 had slightly higher feed cost per kilogram weight gain, but animas fed this diet had higher feed intake and lower feed conversion ratio. This resulted in animals on treatment T_3 having higher weight gain and consequently sold at higher price, hence, higher gross margin compared to those on the other diets.

The total feed cost and price of purchasing the bulls in this study accounted for 54% and 42% of the TVC, respectively. This implies that feed and purchasing price of bulls are the most important variable costs to consider if profit maximization from feedlot finishing is to be achieved. Other studies on fattening businesses have shown the importance of close monitoring of the price set-up of feeds and fatteners for a profitable, efficient and sustainable beef industry [25].

For the grazing cattle, the total variable costs are usually lower than that of cattle on concentrate supplementation [26]. However, the price of beef from grass-finished cattle is often lower compared with the beef from concentrate-fed animals because of low production cost of the former. Also, the difference in beef price is due to the observed difference in tenderness, colour, juiciness and flavour [27]. High energy fed cattle produce more tender and better flavoured meat than grass-finished cattle and thus, fetch higher price per kg [27]. Thus, animals should be finished using concentrate diets in order to get more profit from the feedlot business. The results from this study have demonstrated the economic benefits of using concentrate made from locally available feed resources i.e. maize bran, rice polish, and molasses as the source of energy and sunflower seedcake as a source of protein in beef cattle fattening.

5. Conclusions

Based on the findings of the present study on feedlot performance of zebu cattle finished on local feed resources in central, Tanzania, it can be concluded that; bulls supplemented with concentrate diets grow faster and gain more weight, hence, attain slaughter weight at shorter time compared to those under grazing only. Locally available feeding materials i.e. maize bran, rice polishing and molasses as sources of energy and sunflower seed cake as a source of protein can be formulated to form balanced diets that can support higher growth performance and better feed conversion ratio of indigenous beef cattle under feedlot system. The diet on treatment T_3 was found to be better than the other diets in terms of animal growth performance and gross margin. Therefore, it can be used by farmers for finish feeding of indigenous cattle at an affordable cost and obtain large profit.

Conflict of Interest

The authors declare that they have no conflict of interest.

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