

Full Length Research Paper

Evaluation of different feeding options for growing two years old Arsi-Bulls to attain export market weight

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ABSTRACT

The study was conducted at Adami Tulu agricultural research center on 27 two years old Arsi bulls of 182kg average initial body weight during the year 2016/17. The objectives of the study were: to evaluate and identify the most economical feeding options for two years aged Arsi bulls for them to attain 300kg export market weight and to evaluate the carcass characteristics of the animals. Three feeding treatments (T1=Grazing +20% molasses+ 40% wheat bran+ 40% Noug cake, T2 =Grazing +20% maize grain+45% wheat bran+35% Noug cake and T3= Grazing + 65% wheat bran+ 35% cotton seed cakes) were evaluated. Complete Randomized Block Design was implemented to assign nine Arsi bulls to the three treatments. All the experimental bulls were supplemented with their respective feed rations at 2.5% of their body weight per day during the whole experimental period. The result of the fattening trials revealed that there is no significant difference in daily weight gain, total weight gain, final body weight and carcass characteristic of bulls received the three dietary feeds. For 195 fattening days. From the partial budget analysis it was observed that feeding on T1 to be more economical as compared to feeding on T2 and T3. Hence, for better economic return beef cattle fatteners can use dietary T1 for two years old Arsi bulls for them to attain export market weight of 250 to 300kg.

Keywords: Arsi bulls, Carcass, Feed option and export market weight.

INTRODUCTION

The livestock sub sector play vital roles as sources of food, income and foreign exchange to Ethiopian economy contributing about 12% and 33% of the total and agricultural GDP, respectively. Ethiopia holds the largest livestock population in Africa which is estimated at 59.5 million heads of cattle, 30.7million heads of sheep and 30.2 million heads of goats (CSA, 2016/17). Ethiopia provides about 45% of all domestic meat consumption with small surplus which generates export income mainly from the sale of live animals. However, the earning from exporting of live animals and processed meat is very small as compared to the potential of the country. As

cited in Negassa et al. (2011), our country's average beef yield per animal of 108.4kg is by far less than 119kg for the Sudan, 146kg for Kenya, 127kg for eastern Africa, 146kg for Africa, and 205kg for the whole world. To improve this scenario, various livestock research and development activities have been undertaken by different research institutions. Improving the growth performance of the fattening animals is one of the most important traits to obtain the required export market weight gains. Different feed options played a significant role to bring experimental animals to attain export market weight demand at different length of the fattening periods. In

In addition to the effect of dietary feeds, various fixed effects have their own role on growth performance and carcass characteristics of experimental bulls kept under a given environmental conditions. Among these factors breed and age of the experimental animals had important role on body weight gain of animals. The effort made so far regarding fattening of beef cattle at different research centers is less targeted for export market demand. To solve the underlying constraints, different demand driven research proposals were developed by different agricultural research institutions to come up with feasible and promising fattening technologies for end users. However, majority of the past research conducted on beef cattle production improvement were mainly targeted for domestic market demand. Evaluation of different feed options on different breeds and age groups has played vital role in improving body weights and the country's foreign currency earning by exporting meat and live animals (Girma *et al.*, 2015; Mieso *et al.*, 2013; Tesfaye *et al.*, 2017). In this regard effect of different feeding options for two years old Arsi bulls targeting export/local market weight demand is not yet studied. Hence, the current study was conducted to cover the following objectives and subsequently to generate promising fattening technologies for end users.

Objectives

- To evaluate the growth performance of two years old Arsi bulls fed on different feeds options for the bulls to attain export market weight of 250-300kg.
- To evaluate the carcass characteristics of two years old Arsi bulls fed on three different feeding options.
- To identify the most economical feeding options for two years old Arsi bulls to attain the targeted export market weight.

MATERIALS AND METHODS

Description of the study area

The experiment was conducted at Adami Tulu Agricultural Research Center, which is located in mid rift valley at 167km from Addis Ababa city, Ethiopia at an altitude of 1650m above sea level. The agro ecological Zone of the area is semi-arid and sub humid with acacia woodland vegetation type. The mean annual rain fall of the area is 760mm and its mean minimum and maximum temperatures are 12.6 and 27°C, respectively.

Experimental animals

For this experiment, 27 two years old Arsi bulls were purchased from Batu and Bulbula markets. The

purchased bulls were kept under quarantine in separate barn and were treated against internal and external parasites before the commencement of the fattening trial. The animals were also vaccinated to control the most important diseases of the areas.

Dietary feeds/ treatment groups used for feeding of experimental bulls

The following three different feed options were used
 T1 =Grazing +20% molasses+ 40% wheat bran+ 40% Noug cake
 T2 =Grazing +20% maize grain+45% wheat bran+35% Noug cake
 T3= Grazing + 65% wheat bran+ 35% cotton seed cakes.
 The DM, total CP and TDN content of the experimental feeds is depicted in table 1 below.

Feeding the experimental animals

In addition to hay feeding, every day all the experimental bulls were supplemented with concentrate feeds at 2.5% of their body weight throughout the fattening period. However, supplementations of bulls at 2.5% of their body weight were gradually adjusted every two weeks depending on the weight change of the bulls during the fattening period. All experimental animals were individually fed with their respective diet for the whole experimental period. The daily allocated feed was divided into two equal amounts to offer twice per day, half in the morning and half in the afternoon. Feeding of the experimental bulls was extended to 195 days until the bulls had attained on average the required export body weights of 300kg.

Average daily weight gain (ADG) of the bulls was calculated using the following formula.

$$ADG = \frac{(FWT - IWT)}{D}$$

Where:

FWT = Final body weight

IWT = Initial body weight

D = number of fattening days

Evaluation of Carcass Characteristics

At the end of the experimental period three fattened bulls were randomly selected from each treatment group and transported to be slaughtered at ELFORA abattoir at Debre-Zeit town. After the animals were slaughtered and skinned, all important internal organs such as the kidney, heart, liver, lung, spleen, empty gut, heart fat, kidney fat, mesenteric and omental fat were eviscerated and all the required carcass parameters were individually measured.

Table 1. Chemical composition of experimental diets

Type of feeds	Treatment	DM%	CP%	TDN%
Molasses	T1	20	1.16	14.4
Wheat bran	T1	40	5.52	26.80
Noug cake	T1	40	11.9	26.4
Total		100	18.58	67.6
Maize grain	T2	20	2	17
Wheat bran	T2	45	5.85	30.15
Noug cake	T2	35	10.41	23.1
Total		100	18.26	70.25
Wheat bran	T3	65	8.45	43.55
Cotton seedcake	T3	35	9.8	26.25
Total		100	18.25	69.8

Where:- DM= dry matter , CP = crude protein and TDN= total digestible nutrient

Table 2. Growth performance (Mean \pm SE) of two years old Arsi bulls fed three different rations

Parameter	NO of fattening days	Treatments		
		T1	T2	T3
Live body weight (kg)	Initial	148.33 \pm 5.63	147.89 \pm 4.96	147.89 \pm 5.13
	60	220.00 \pm 5.72	219.22 \pm 5.47	206.44 \pm 3.34
	120	266.89 \pm 7.71	259.78 \pm 7.62	257.11 \pm 4.53
	195	303.44 \pm 7.18	298.44 \pm 7.84	299.44 \pm 6.52
TWG (kg)	60	71.67 \pm 10.22	71.33 \pm 7.16	58.56 \pm 4.68
	120	118.56 \pm 11.82	111.89 \pm 7.46	109.22 \pm 3.05
	195	155.11 \pm 11.58	150.56 \pm 7.64	151.56 \pm 4.01
ADG(g)	60	1194.44 \pm 170.31	1188.89 \pm 119.41	975.93 \pm 78.08
	120	987.96 \pm 98.50	932.41 \pm 62.20	910.19 \pm 25.45
	195	795.44 \pm 59.41	772.08 \pm 39.16	777.21 \pm 20.57

Where:- ADG = average daily gain, TWG= total weight gain.

The rest hot carcass were dissected symmetrically into right and left parts with the help of modern electrical carcass cutting machine and the weight of each part of the entire carcass was measured before the carcass was put into cold chill room at -4°C for about 24 hours. After 24 hours stay, the cold carcass parts were measured again to evaluate the difference in weight change between the hot and the cold carcass of each slaughtered animal. To evaluate the chilled carcass characteristics, the right parts of each slaughtered bull were cut into five major carcass parameters.

Partial budget analysis

All costs incurred for fattening the experimental bulls using the three dietary feeds were recorded in order to calculate economic returns of fattening the bulls. The total variable costs such as animal purchase, transportation, feeds, labor and veterinary costs incurred were collected. The gross output/revenues of experimental bulls were estimated at the end of the fattening period by the help of three persons who have enough knowledge on prices of fattened animals. Fixed

costs incurred and the cost of grazing was not included in the analysis, hence this partial budget analysis indicates only gross margin of fattening bulls using three different feed options.

Statistical analysis

Data of all live weights and carcass parameters were analyzed using general linear model (GLM) of Statistical Analysis System (SAS, 2002). The estimated least squares means were separated using the Duncan's Multiple Range Test at $P < 0.05$.

RESULTS AND DISCUSSION

Effects of dietary feeds on weight gains

Least-square means (LSM) of final body weight (FBW), total weight gain (TWG) and average daily weight gain (ADG) of the bulls fed on different feed rations are indicated in Table 2. There is no statistically significant difference in ADG, TWG and FBW between T1, T2 and

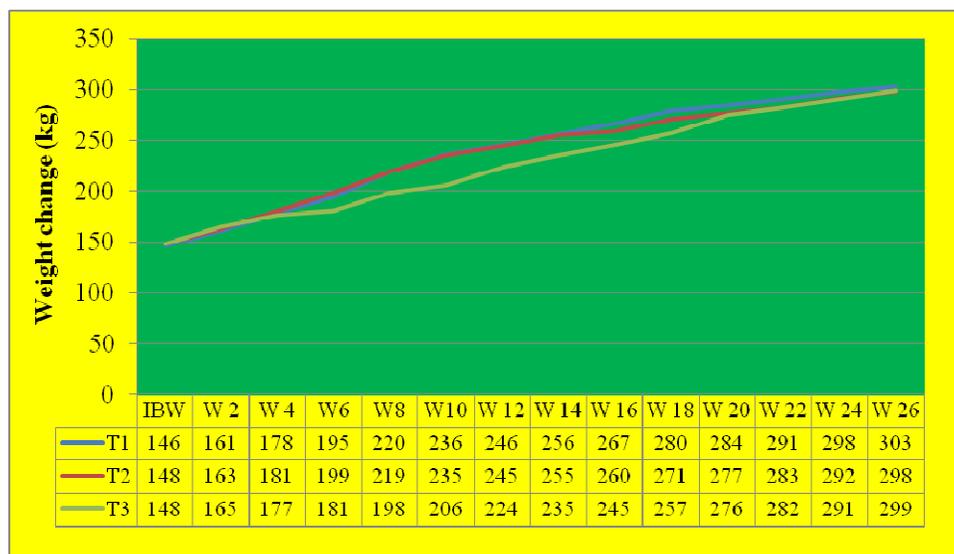


Figure 1. Body weight change of two years old Arsi bulls over the total fattening period Where:- IBW=initial body weight, W1= Week1, W2= week 2, W3= week 3, etc up to W26=week 26th

Table 3. Carcass parameters evaluation of two years-old Arsi Bulls

Parameter	Treatments		
	T1	T2	T3
SWT	290.00 ± 8.66	311.67 ± 13.02	291.67 ± 7.26
HCW	178.33 ± 3.18	189.67 ± 7.22	176.33 ± 5.90
DR %	61.54 ± 0.94	60.89 ± 0.88	60.44 ± 0.67
HQ	40.10 ± 0.66	41.90 ± 2.40	37.47 ± 1.20
FQ	47.63 ± 2.54	51.43 ± 1.43	45.83 ± 1.13
Side wt	87.67 ± 2.03	93.67 ± 3.71	83.67 ± 1.76

SWT= slaughter weight of the bulls, HCW=Hot carcass weight, DR= dressing percentage, HQ= Hind quarter, FR=Forequarter

T3. However, experimental bulls fed on T1 gained more ADG (0.795g), TWG (155.11kg) and FBW (303.44kg) than experimental animals fed on T1 and T3. This result is similar with the previous findings of Mieso *et al.* (2013), who reported that feeding of one year old Borana bulls with the same type of feed rations did not bring any significant difference among the three treatment groups.

The daily weight gain (795.44gm) of bulls fed on T1 is more or less similar with the finding of Adebabay *et al.* (2013) who reported the daily weight gain of 880gm for Fogera bulls fed with hay plus 6kg of concentrate per head per day. The two years old Arsi bulls attained more or less the required 300kg of export market weight demand at 195 fattening days which is longer than that of Borana bulls, which reached the same weight at 154 days (Girma *et al.*, 2015). On the other hand, these two years old Arsi bulls attained the required export market weight within the shortest period of time when compared with the one year old Borana bulls, which reached the required weight at 224 fattening days (Mieso *et al.*, 2013).

The trend of body weight change of the bulls over the whole fattening period is showed in figure 1.

Effects of dietary feeds on carcass components

The result of carcass evaluation of the two years-old Arsi bulls fed on the three different feed rations is indicated in Table 3. There is no significant difference in measurements of carcass parameters among the three dietary treatments. This may be because of the breed and age similarity of the bulls. Moreover, the bulls had received the same percentage of total CP and TDN which may have the same effect on carcass characteristics of the bulls. This finding is similar with what is reported by Mieso *et al.* (2013) for one year old Borana bulls, by Girma *et al.* (2015) for two years old Borana bulls and by Tesfaye *et al.* (2017) for two years old Kereyu bulls. The bone, fat and muscle ratios of the bulls in the three treatments are indicated in figure 2.

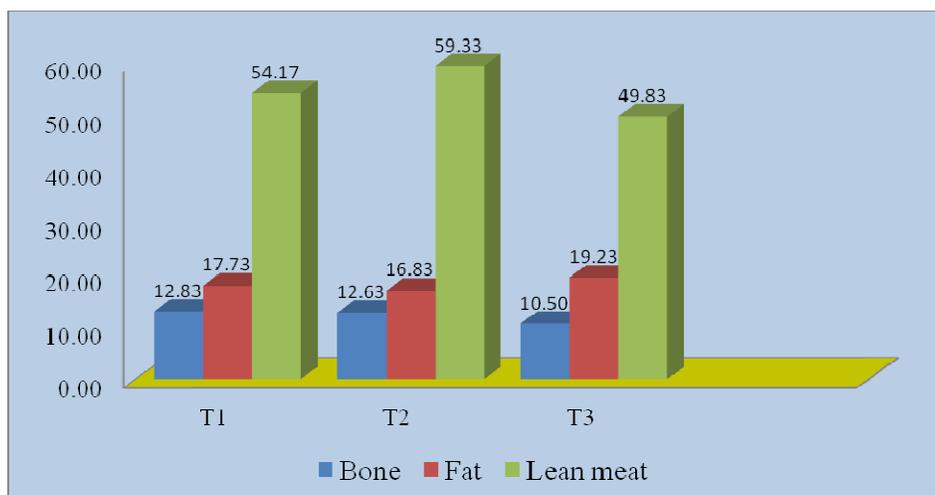


Figure 2. Muscle, fat and bone proportions of the bulls

Table 4. Forequarter Carcass parameters evaluation of two years-old Arsi Bulls

Variable	Treatments		
	T1	T2	T3
Forequarter	47.63 ± 2.54	51.43 ± 1.43	45.83 ± 1.13
Hump	2.20 ± 0.21	2.60 ± 0.26	3.00 ± 0.51
Rib-eye roll	6.23 ± 0.38	6.67 ± 0.33	5.67 ± 0.42
Brisket	2.60 ± 0.38	3.10 ± 0.40	2.17 ± 0.35
Clod (cloud)	4.93 ± 0.38	4.93 ± 0.19	4.77 ± 0.43
Chuck tender	0.83 ± 0.03	0.97 ± 0.09	0.80 ± 0.06
Chuck roll	3.67 ± 0.42	3.80 ± 0.15	2.87 ± 0.32
Fore-shank	1.43 ± 0.09	1.67 ± 0.12	1.60 ± 0.20
Neck	12.53 ± 1.15	13.67 ± 1.62	12.10 ± 0.76
Bones	7.00 ± 0.30 ^a	7.00 ± 0.31 ^a	5.87 ± 0.13 ^b
Fat trim	9.60 ± 0.15 ^{ba}	7.87 ± 0.94 ^b	10.83 ± 1.02 ^a
Lean trim	29.17 ± 1.88 ^{ba}	34.00 ± 1.00 ^a	28.00 ± 1.53 ^b

^{abc} =Treatments with different superscripts are significantly different @ p<0.05

The forequarter cuts (Table 4) of the carcasses were also not statistically different ($p>0.05$). This shows that the feed options used to fatten the bulls have similar effects on carcass characteristics of the animals. But the overall bone, fat trim and Lean trim showed statistical significant difference. This was in agreement with reports of Mieso *et al.* (2013); Girma *et al.* (2015)

Most of the hind quarter different cuts of the carcass were also not statistically significant at $p<0.05$ (Table 5 below). This shows that the feed options used to fatten the bulls have similar effect on carcass characteristics of the animals. But the Flank steak Hard-shin Tri-tip Lean trim showed statistical difference.

Although slight variation were observed among bulls fed different rations for flank steak, tri-tip, hard shin and lean-trim, there were no significant difference for other cuts. These results are similar with report of Girma *et al.*

(2015). Study by Tesfaye and Tesfa (2007) on Kereyu bulls and Lemma *et al.* (2007) on Borana bulls also indicated that there was no significant difference among the above listed carcass parameters for Kereyu and Borana bull respectively.

Economic return on fattening of two years old Arsi bulls

The result of partial budget analysis of fattening of two years aged Arsi bulls fed on three different feeds ration for about 195 days for export market weight gain is indicated in table 6. Its result showed that experimental bulls fed with T1 had higher gross margin per animal (3507.15) than bulls fed on T2 (2662.54) and T3

Table 5. Hindquarter carcass parameters evaluation of the Bulls

Variable	Treatments		
	T1	T2	T3
hindquarter	40.10 ± 0.66	41.90 ± 2.40	37.47 ± 1.20
False lean	0.53 ± 0.03	0.63 ± 0.03	0.50 ± 0.06
Flank steak	2.00 ± 0.00 ^a	1.77 ± 0.15 ^{ba}	1.43 ± 0.12 ^b
Sirloin	4.83 ± 0.13	5.10 ± 0.49	4.40 ± 0.06
Tri tip	2.43 ± 0.03 ^b	2.97 ± 0.18 ^a	2.83 ± 0.15 ^{ba}
Ball tip	2.40 ± 0.15	2.13 ± 0.48	1.57 ± 0.09
Tender loin	1.23 ± 0.07	1.20 ± 0.10	1.17 ± 0.07
Strip-loin	3.83 ± 0.18	3.47 ± 0.72	3.07 ± 0.47
Silver-side	5.40 ± 0.23	5.87 ± 0.34	5.50 ± 0.44
Top-side	4.93 ± 0.09	4.80 ± 0.12	4.63 ± 0.18
Thick flank	1.73 ± 0.03	1.97 ± 0.12	1.90 ± 0.06
Soft shin	1.17 ± 0.03	1.17 ± 0.03	1.10 ± 0.06
Hard shin	1.10 ± 0.00 ^{ba}	1.27 ± 0.09 ^a	1.03 ± 0.03 ^b
Bones	5.83 ± 0.48	5.63 ± 0.48	4.63 ± 0.24
Fat-trim	8.13 ± 0.93	8.97 ± 0.43	8.40 ± 0.70
Lean-trim	25.00 ± 0.58 ^a	25.33 ± 1.30 ^a	21.83 ± 0.60 ^b
Oxtail	0.33 ± 0.03	0.33 ± 0.07	0.30 ± 0.00

NB: Treatments with different superscripts are significantly different @ $p < 0.05$

Table 6. Partial budget analysis of two years old Arsi Bulls fed on different feed options

List of Items	T1	T2	T3
Number of bulls	9	9	9
Purchasing price/ bull	2596.67	2600	2622.22
Transportation/ animal	50.00	50.00	50.00
Cost of concentrate/ animal	7886.74	8156.76	8842.19
Labor cost per animal	706.03	706.03	706.03
Veterinary cost/animal	71.00	71.00	71.00
Total cost per animal	11310.44	11583.79	12291.44
Gross return per animal	14817.58	14246.33	14890.55
Gross margin per animal	3507.15	2662.54	2599.11

(2599.11). Feeding of bulls with T3 (2599.11) is less profitable as compare to T1 and T2. This is because of the high cost of cotton seed cake used in T3. But the cost of molasses used in T1 and the cost of maize grain used in T2 is relatively low as compare to other feed items used in T3. Hence, fattening of two years old Arsi bulls for 195 days by using three different feeding rations for export/local market weight gain is profitable for all the three feeding rations in general.

CONCLUSION AND RECOMMENDATION

There is no statistically significant difference in daily weight gain (DWG), total weight gain (TWG) and final body weight (FBW) and most carcass characteristics of the two years old Arsi bulls which had received the three different feed options for 195 fattening days. This may be because of the similarity of the bulls both in breed and

ages. Moreover the same percentage of total CP and TDN were provided for all the experimental animals. On average the experimental bulls which had received dietary T1, T2 and T3 had attained 303.44kg, 298.44kg and 299.44kg body weight respectively at the end of the fattening period. Therefore, cattle fatteners can use one of the three feed options depending on the availability and accessibility of the feeds for fattening two years old Arsi bulls for export market/local as the animals could attain the required weight of 250-300kg within 195 days of feeding.

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