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Original article

Assessment of commercial beef cattle fattening practices and performance in East Shoa Zone

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ABSTRACT

The study was conducted in Adama, Lome and Adami-Tulu districts of East Shoa Zone of Oromia Regional State to assess commercial fattening practices, and to evaluate performance of commercial fattening. Multistage sampling procedure was employed for the survey study. The questionnaire based formal survey was conducted using semi structured questioners by interviewing a total of 45 feedlot operators purposively selected from the three districts and both quantitative and qualitative data on beef cattle fattening systems were obtained. For the monitoring work nine farms among those used for interview were selected for the purpose of monitoring animals' performance during fattening period. Eight Animals from each farm were randomly selected from the farms based on age, initial body weight and body condition. The study revealed that the major criteria for selecting animals to purchase for feedlot fattening includes breed type, physical appearance and/or frame size, age, health and initial price body condition, coat color, horn size were the top priority and major breeds used was Boran breeds with an age between 3-6 years old. The feed resources used by commercial cattle fattening include crop residues and agro-industrial by products feeds. The average total weight gain and average daily weight gain of animals recorded in 90 days of fattening was significantly higher (P<0.05) for large (97.7±1.16;

1.09±0.01) and medium (97.58±1.16; 1.09±0.01) as compared to small scale (91.04±1.169 kg; 1.01±0.01kg) commercial fattening. It is concluded that the dependence on only Borana breed may affect the efficiency of the fattening industry by creating supply shortage and also it depletes the breed population. Moreover, the Limited feed availability, high price of supplementary feed, market fluctuation of fattened cattle, disease out breaks, and water shortage are the most challenges faced by the sectors and needs to be addressed in the study area.

1. Introduction

Livestock and meat products have been among the fastest growing components of the global agriculture and food industry. The livestock sector has been contributing a considerable portion to the economy of Ethiopia, and still promising to rally round the economic development of the country. The total cattle population for the country is estimated to be about 56.71 million heads (CSA, 2015). The sector also plays a significant role in the national economy, which contributes about 47% of the agricultural GDP, 15% of the total GDP and has generated an estimated 31% of the total agricultural employment (IGAD, 2011). Live animals and livestock products such as meat, hides, and skins are the third major export accounting for 11% of the export revenue (Hurrissa, 2009).

Among the various livestock production activities, beef cattle fattening activity is one of the potential sources for employment opportunity and to increase the volume and quality of meat produced and to alleviate poverty in the country (Yitaye et al., 2007; Adugna, 2008; Kerstin and Ellengowan, 2011). Cattle fattening has gained prominence as an important business project of the livestock industry in Ethiopia to make use of cheap, plentiful farm by-products (Habitamu et al., 2008). Moreover, fattening offers opportunity to exploit the vast cattle and meet export market in the region as well as Ethiopia's domestic market (Habtamu, 2012). The fattening activity can be undertaken at any level of livestock value chain ranging from small holder farmers rearing livestock for multiple functions (Sarma and Ahmed, 2011) and small scale commercial fattening to large scale commercial fattening (Tomy, 2003; Adugna, 2008; Sinteyehu, 2010; Tsagay and Mengistu, 2013) who export live animals and supply fattened animals directly to abattoirs concocting meat for inland and international markets.

In recent years, market oriented beef production system has been gradually emerging concurrent to the increase in both domestic and export market demand for cattle meet in Ethiopia. Market oriented agricultural production system requires intensification in management or production system (Azage et al., 2011). The Government is also trying to expand the sector by motivating producers' in order to meet the growing demand. As a result, meat processing factories and export abattoirs are increasing in number and export earnings from the sector are rising (MORD, 2008; ACR, 2010). However, inadequate supplies of export quality livestock in terms of the required age and body weight for slaughter, lack of information on efficient way of feed resources utilization for quick feedlot finishing, and the biological response of indigenous cattle to feedlot fattening are remained to be a bottleneck to increase domestic per capita meat consumption and export (Yoseph et al., 2006; Tsegay and Mengistu, 2013).

As in all commercial enterprises in cattle fattening enterprises, the main purpose is to make a profit. From this point of view, evaluating the performances of cattle fattening enterprises gains importance in terms of the continuation of business efficiencies. Performance in general is a concept that quantitatively or qualitatively determines the gains at the end of a purposeful and scheduled activity. In other words, performance is the level of achievement to reach the planned output level (Erol et al., 2014).

Currently, the government encourages the emerging of commercial fattening practices and support establishments of the sector in an investment form in the study area. However, there is limited information about their utilization of available feed resources, husbandry of commercial feedlot and cattle fattening performance under commercial cattle fattening practices. Therefore, it is very important to investigate the overall activities and performance in the sector to design appropriate technologies for improvement of beef production. The current study is aimed to assess how commercial feed lot cattle fattening systems can provide sustainable and adequate

live animal supply which can meet the demand for domestic consumption and export markets and with the following specific objectives:

- ✓ To assess commercial beef cattle practice in the in East Shoa Zone
- ✓ To evaluate the performance of Beef cattle fattening under commercial feed

2. Materials and methods

2.1. Description of the study area

The study was conducted in Oromia Regional state, East Shoa Zone, Adama, Lome and Adami-Tulu-JIdo-Kombolcha Districts. Adama district is located at altitude of 1400-2700m a.s.l. and it receives uni-modal rainfall with annual amount of 600-1200mm and the average temperature varies 17°C-34°C (ESZARDO, 2015). Adami-Tulu-JIdo Kombolcha district is located at the altitude of 1650m a.s.l. it receives an annual rainfall amount of 500-760mm and its average ambient temperature varies from 12.7°C-27°C East (ESZARDO, 2015). Lome district is located at the altitude of 1604-2364 m.a.s.l. it receives rainfall with annual amount of 1065mm and the average temperature varies 18-28.7°C (ESZARDO, 2015).

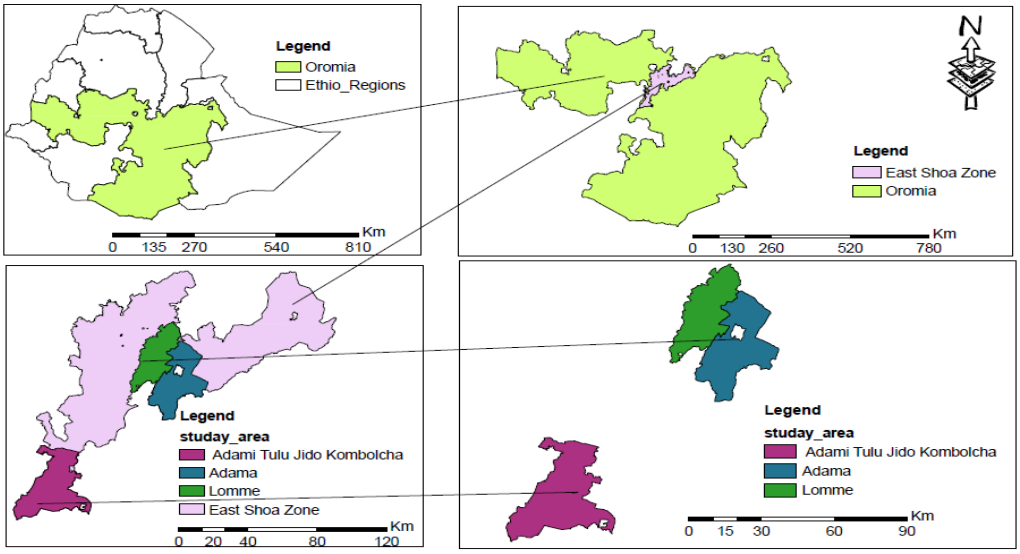

Fig. 1. Study area.

2.2. Sampling techniques

Multistage sampling procedure was employed for the survey study. Three districts were selected based on their potentiality for the commercial cattle fattening practices. Totally forty five feedlots were purposively selected based on their potential, size, accessibility and willingness of the owners to cooperate for the study. Accordingly, the representative feedlots selected from each district were twenty five from Adama, seventeen from Lome and three from Adami-Tulu-Jido Kombolcha. The commercial farms were designated as small, medium and large farm sizes based on the number of fattening animals hold by the farms and by benchmarking earlier classification criteria employed by researchers (Tomy, 2003; Adugna, 2008; Sinteyehu, 2010; Tsagay and Mengistu, 2013). In the present study, small scale commercial fattening represents those farms that hold less than 200 animals at a time. The medium scale commercial fattening holds 201-500 and large scale commercial fattening greater than 500 head of animals. The selected commercial feedlots were used for the interview and for obtaining other information. Among the feedlots used for the interview nine feedlots and from each three farms were purposely selected for monitoring of feedlots performances under the feeding management followed by the farm throughout the whole fattening period. Based on their initial body weight and age, eight fattening animals were selected from each of the feedlots identified for the monitoring study. During the monitoring animals body condition was scored and body weight was measured by using heart girth meter.

2.3. Data collected

Survey data were collected from both primary and secondary sources. The primary data was collected from producers (Commercial feed lots) by using semi-structured questionnaire. Secondary data including both published and unpublished documents available at various sources was collected and used to consolidate the information generated and personal observation was made on different animal management aspects during farm visit and monitoring to get an overview of general management activities practiced by different commercial feedlots.

2.4. Survey data collection

Semi-structured questionnaire were used to collect the data variables such as fattening cattle breed types, sex of animals, type of animals (castrated or intact), age of animals preferred by fatteners, source of animals, number of animals engaged in fattening operation per cycle, feed types and sources of feeds used, feeding strategy (frequency of feeding, order of feeding if different types of feed is offered separately), group or individual based feeding or selected group feeding, feed mixing method used, etc., watering system, fattening duration and cycle, animals selection and purchasing criteria for fattening animals purpose, health care for the fattening animals, constraints/problems/major challenges for fattening practices.

2.5. Monitoring data

A total of nine feed lots was selected purposively and categorized into three scale of production based number of animals (Tomy, 2003; Adugna, 2008; Sinteyehu, 2010; Tsagay and Mengistu, 2013) small, medium and large scale commercial feed lot. From nine feed lot three from large, three from medium and three from small scale commercial feedlot were selected based on accessibility and willingness of owners for the study. From each feedlot eight animals were selected randomly. The age of cattle used for the fattening purposes were estimated by dentition (Vatta et al., 2006) and initial body weights of animals were taken by using heart girth meter and fitting into the formula developed by Niioka and Shiratori (2009) for Borena breed. Heart girth was measured and recorded from the smallest diameter running immediately behind the hump and the forelegs of an animal standing erect. A total of seventy two (72) animals from nine feed lot, eight animals from each farm were selected for the purpose of monitoring and evaluation study. The initial body weight of each animal involved in monitoring study was taken after adaptation period and /fifteen days after starting the concentrate feeding by using heart girt meter. Then the weights of animals involved in the monitoring study were taken at interval 30, 60 and 90 days of fattening periods. The heart girth was measured after overnight fasting and/or early in the morning before feeding. The average daily weight gain was calculated as the difference between final live weight and the initial live weight of the animals divided by the number of respective feeding days of each feeding period and body condition score by visual observation during different stages of fattening period. For body condition scoring, the same eight animals selected from each feedlot. Body condition scoring was done on a monthly basis until the end of the fattening period, using the methodology for the Zebu Cattle condition scores which range from 1-9. The body condition score are established by subdividing the three main body conditions, viz. Fat [F], medium [M] and lean [L] according to (Nicholson and Butterworth, 1986). Anatomical parts like the brisket and hump, transverse process, lumbar vertebrae, hips, ribs, hooks and pins were observed during the scoring process.

2.6. Statistical analysis

Statistical Packages for Social Sciences (SPSS 20.00) were used to analyze all survey data and General Linear Model (GLM) procedures of SAS (SAS, 2009) used for monitoring data. Mean comparisons were done by using the Least Significant Difference (LSD). The model employed was as follows:

$$Yij = \mu + Ai + Bj + A*Bij + eij \quad \text{(Model 1)}$$

Where: yij = Response variables (body weight gain and condition score)

μ = Overall mean;

$Ai = i^{th}$ feedlot size effect (large, medium and small scale),

Bj^{th} age effect

$A*Bij = ji^{th}$ interaction effects

eij = residual effect.

An index was calculated to provide overall ranking of beef cattle fattening constraints by developing rank index formula based on the method used by Musa et al. (2006).

$$\text{Rank index} = \frac{(R_n*C_1+R_{n-1}*C_2\ldots+R_1*C_n)_{a-g}}{\sum_{a-g}(R_n*C_1+R_{n-1}*C_2\ldots+R_1*C_n)}$$

Where,

R_n = Value of the least rank of constraint a (if the least rank is 7^{th}, then $R_n = 7$, $R_{n-1} = 6$, $R_1 = 1$)

C_n = Counted value of the least ranked level (in the above example, the counts of the 7^{th} rank = C_n, and C_1 = the count of the 1^{st} rank)

$(R_n*C_1+R_{n-1}*C_2\ldots+R_1*C_n)_{a-g}$=*W = weighted summation of each constraints (a, b, c..., g)

Similar formulas also used to calculate ranking index for major resources, criteria of selecting beef cattle for fattening and preference of veterinary service.

3. Results

3.1. Source, experience and major selection criteria for purchasing of beef cattle

The commercial feedlot operators purchased animals for fattening purpose from different open local market in Borena Zone According to the response of all commercial feedlot operators, young bull of Borena breed within the age of 3-6 year were used for fattening operation in the study area. The majority of the feedlot operators have experience of about 1 to 10 years in the business (Table 1) and a significant number also have experience of over 10 years.

Table 1
Experience of feedlot operators in cattle fattening activities.

Experience of feedlot operator	Frequency (N=45)	% (N=45)
Less than one year	2	4.4
One up to five year	12	26.7
Six up to ten year	17	37.8
Eleven up to fifteen year	5	11.1
Above fifteen year	9	20
Total N	45	100

N= Respondent number.

The majority of beef cattle fattening operators selected the animals purchased for fattening by considering the breed type, physical appearance and/or frame size, age, health and initial price as the top priority (Table 2). Moreover, body condition, coat color, horn size and skin conditions (stretchable upon pulling and smoothness) were also considered and used as the selection criteria to purchase beef animals.

Table 2
Selection criteria of fattening cattle as reported by feedlot operators in the study area.

		Weighted frequency										
Variable	N=45	1	2	3	4	5	6	7	8	9	Index	Rank
Breed		38	7	-	-	-	-	-	-	-	0.20	1
Frame size		15	10	6	4	3	-	-	4	-	0.15	2
Age		5	5	12	8	1	8	-	-	-	0.13	3
Price		3	4	12	8	4	2	-	-	-	0.11	4
Health		2	7	12	4	3	1	-	-	-	0.10	5
Body condition		-	4	6	12	3	1	8	-	3	0.10	6
Color		-	-	4	8	9	9	6	1	-	0.09	7
Horn size (shape)		-	-	1	2	10	4	10	11	-	0.07	8
Adaptation		-	-	2	3	7	9	3	1	-	0.06	9

3.2. Season and length of fattening period

The majority of the feedlot operators considered January to March and October to December to be the most suitable seasons to start fattening operation (Table 3).

Table 3
Suitable season to fatten commercial beef cattle.

Season	Frequency (N=45)	% (N=45)
July-September	-	4.4
October-December	16	35.6
January-March	22	48.9
April-June	5	11.1
Total N	45	100

N= Number of respondent.

The length of fattening periods across the farm scale were significantly ($p<0.05$), lower in medium followed by small scale production, whereas the frequency of cattle fattening per year and number of animal fatten per cycle was significantly ($p<0.001$) higher for large, followed by medium and small scale commercial cattle fattening, respectively.

Table 4
Length of fattening period, season, and frequency of fattening per year, number of animals fattened per cycle between scales of production.

	Mean ±SD			
Variables	**Large**	**Medium**	**Small**	**P-value**
Fattening duration (months)	4±0.38	3.69±0.48	4.18±0.39	P<0.011**
Number of cattle fatten per cycle	1104.6±1042	437.38±65.7	234.82±117.58	P<0.001***
Frequency of fattening per year	3.2±0.77	2.46 ±0.66	2.18±0.64	P<0.001***

***= significant at (P<0.001 **= significant at (P<0.05); NS= not significant.

3.3. Major feed resources used by commercial feedlot

Large scale commercial cattle fatteners preferred Noug seed cake, cotton seed cake and faba bean bran as protein sources and wheat bran and maize as energy sources (Table 5). The medium scale operators prefer to use cotton seed cake and lentil bran as protein feed sources while wheat bran, ground sorghum and ground maize energy sources. Whereas small scale commercial cattle fattener preferred cotton seed cake and faba bean bran as protein feed and ground maize and wheat bran were utilized as energy sources.

Table 5
Major feed resource used for cattle fattening by the respondents in scale of fattening.

	Farm size	Weighted frequency						
Variable	**Small scale N=18**	**1**	**2**	**3**	**4**	**5**	**Index**	**Rank**
Cotton seed cake		7	1	7	-	-	0.32	1
Wheat bran		-	8	5	5	-	0.28	2
Lentil bran		-	-	6	8	3	0.18	3
Maize flour		1	2	4	0	2	0.13	4
Faba bean bran		-	-	-	9	2	0.09	5
	Medium scale N=12							
Wheat bran		6	3	3	-	-	0.35	1
Cotton seed cake		6	2	1	3	-	0.32	2
Sorghum flour		-	-	3	3	1	0.11	4
Maize flour		-	1	4	-	1	0.12	3
Lentil bran		-	-	4	2	-	0.1	5
	Large scale N=15							
Noug cake		4	2	3	3	2	0.26	1
Wheat bran		-	8	7	-	-	0.25	2
Cotton seed cake		-	-	2	5	6	0.24	3
Maize flour		1	5	4	3	2	0.12	5
Faba bean bran		-	-	3	5	6	0.13	4

N= Number of respondents.

3.4. Feeding system of beef cattle fattening

All the commercial feedlot operators' uses confined feeding system. Almost all feedlot operators offered roughage first on feeding trough and followed by concentrate feeding twice per day. The amount of feed offered to beef cattle per day per animal was presented in (Table 6). The amount of the concentrate mix and roughage feeds offered per animals per day was significantly higher (p<0.001) in large scale farms followed by medium small scale farms.

Table 6
Amount of feed offer to fattening beef cattle per day by districts and scales of production.

	Mean ±SD			
Variables	**Large**	**Medium**	**Small**	**P-value**
Concentrate (kg)	8.47±2.07(15)	7.6±1.45(13)	6.18±1.42 (17)	P<0.001
Roughage (kg)	2.17±0.70(15)	2.08±0.53(13)	1.76±0.56(17)	P.>0.154

N= Number of respondents; SD= Standard deviation; ***= significant at (P<0.001); **= significant at (P<0.05); NS= not significant.

3.5. Housing system

The experience of housing system of commercial feedlots in the study area was presented in Table 8. Open overhead shelter with enclosures was observed to be the predominant type of housing system across all the commercial cattle fattening system in study area. While few of the medium and small scale fattening system used no shed, but open enclosure housing system.

Table 7
Housing system of fattening animals in the study area.

	Farm size					
	Small scale		Medium scale		Large scale	
Type of housing system	**N=17**	**(%)**	**N=13**	**(%)**	**N=15**	**(%)**
Open overhead shelter with and enclosure	13	76.5	10	76.9	15	100
Open without overhead shelter but enclosure	4	23.5	3	23.1	-	-
Total	17	100	13	100	15	100

3.6. Source of water

The source of water used by feedlot operators in study area was presented in Table 9. The majority (88.9%) of feedlot operators uses pipe water and animals drink *ad libtum* but few of them were using river and ground water sources for fattening animal.

Table 8
Source of water in the study area.

	Scale of production					
	Small scale		Medium scale		Large scale	
Source of water	**N=17**	**(%)**	**N=13**	**(%)**	**N=15**	**(%)**
Pipe	15	88.24	10	76.92	13	86.67
River	2	11.76	3	23.08	-	-
Ground water	-	-	-	-	2	13.33
Total	17	100	13	100	15	100

3.7. Common health problems and health service availability to feedlot fattening operation

The present study indicates that the major diseases constraining feedlot operation in the order of their importance include lumpy skin disease, Foot and Mouth disease, bovine respiratory disease, and digestive system

disorder (Table 9*)*. The lumpy skin disease was more frequent in small scale feedlots than the others. Comparatively, the metabolic disorder was more a problem in medium scale farms.

Table 9
Major diseases observed in commercial feedlot in the study area.

	Scale of production		
Variables	**Small scale (%)**	**Medium scale (%)**	**Large scale (%)**
Lumpy skin diseases	14(82.4)	7(53.9)	5(33.3)
Foot mouth disease	2(11.7)	3(23.1)	2(13.3)
Bovine respiratory disease	0	1(7.7)	0
Digestive system disorder	0	2(15.4)	1(6.7)
Multiple response	1(5.9)	0	7(46.7)
Total N	17(100)	13(100)	7(100)

Multiple response= Lumpy Skin Disease Foot Mouth Disease, Bovine System Respiratory Disease, Digestive System., nutrition deficiency.

Feedlot operators in the study area use both private and government animal health services. The majority of the respondents prefer to use private veterinary practitioner than the government veterinary services rendered at the study areas (Table 10).

Table 10
Health services available to commercial feedlot in the study area.

	Farm size	Weighted frequency					
Variable	**Small scale N=18**	**1**	**2**	**3**	**4**	**Index**	**Rank**
Government clinic		9	2	2	1	0.38	2
Private clinic		-	-	-	1	0.01	4
Private pharmacy		1	5	-	-	0.15	3
Private Vet practitioner		7	9	1	-	0.46	1
	Medium scale N=12						
Government clinic		4	3	2	1	0.35	2
Private clinic		0	1	-	-	0.04	4
Private pharmacy		2	2	-	-	0.16	3
Private Vet practitioner		6	4	1	-	0.45	1
	Large scale N=15				-		
Government clinic		5	3	2	-	0.31	2
Private clinic		-	-	1	-	0.02	4
Private pharmacy		3	3	-	-	0.19	3
Private Vet practitioner		7	8	-	-	0.48	1

N= Number of respondents.

3.8. Major constraints of beef cattle fattening

The major constraints of commercial cattle fattening in the study area was ranked and presented in Table 11. Feed scarcity, marketing problem, water scarcity, animal health problems, and lack of appropriate stock for fattening were identified as the major problems that are hindering the performances of the fattening operations as a whole. According to the respondent's lack of feed, marketing problems, water scarcity and animal health problems were the primary constraints to run the fattening operations in all the scale of production.

3.9. Performance of fattening cattle under commercial feedlot management

The average initial weight of beef cattle purchased for fattening was almost similar for the different farm sizes; with animals purchased by small scale farms weighing a little ($P < 0.001$) lower as compared to the medium (Table 12). Animals with age ranging 5-6 weighed significantly higher as compared to those aged 3-4 years. The final weight was lower for small scale fattening farms than the medium.

Table 11

Major constraints of beef cattle fattening ranked in the order of their importance.

Variable	Scale of production	Weighted frequency							Index	Rank
	Small scale N=18	1	2	3	4	5	6	7		
Feed		5	4	3	-	-	-	-	0.28	1
Market		6	3	1	-	-	-	-	0.17	2
Animal health		-	5	-	6	-	-	-	0.14	4
Lack of animal supply		-	-	-	4	3	-	-	0.16	3
Management know how		-	-	-	3	-	1	2	0.08	6
Water		1	1	-	3	-	-	-	0.11	5
Absence of promotional activities		-	-	-	-		4	-	0.06	7
	Medium N=12									
Feed		5	4	3	-	-	-	-	0.22	1
Market		6	3	1	-	-	-	-	0.18	3
Animal health		-	5	-	6	-	-	-	0.20	2
Lack of animal supply		-	-	-	4	3	-	-	0.13	4
Management know how		-	-	-	3	-	1	2	0.11	5
Water		1	1	-	3	-	-		0.09	6
Absence of promotional activities		-	-	-	-	-	4	-	0.07	7
	Large scale N=15									
Feed		10	3	2	-	-	-	-	0.42	1
Market		6	-	-	-	-	-	-	0.17	2
Animal health		-	3	2	-	-	-	-	0.14	3
Lack of animal supply		-	-	3	1	-	-	-	0.11	4
Management know how		-	-	-	-	2	-	-	0.06	6
Water		-	-	3	-	-	-	-	0.08	5
Absence of promotional activities		-	-	-	-	1	-	-	0.03	7

N= Number of respondents.

Table 12

Least square means of live weight gain of fattening animals under commercial feedlot**.**

Factors	Levels	Variables					
		IBW(kg)	FBW(kg)	Total gain(kg)	ADG(kg)	BCI	BCF
Age	I	245.11^{b}±2.60	344.00^{b}±2.82	98.89^{a}±0.95	1.10^{a}±0.01	4.33^{a}±0.08	7.25^{a}±0.11
	II	292.72^{a}±2.60	384.69^{a}±2.82	91.97^{b}±0.95	1.02^{b}±0.01	4.33^{a}±0.01	7.06^{b}±0.11
	p-value	P<0.0001	p<0.0001	P<0.0001	P<0.0001	P>1	P>0.23
	SL	***	***	***	***	NS	NS
FS	L	270^{a}±3.18	368.46^{a}±3.45	97.67^{a}±1.16	1.09^{a}±0.01	4.5^{a}±0.09	7.42^{a}±0.14
	M	275.00^{a}±3.18	372.58^{a}±3.45	97.58^{a}±1.16	1.09^{a}±0.01	4.29^{ab}±0.09	7.13^{ab}±0.14
	S	260.96^{b}±3.18	35200^{b}±3.45	91.04^{b}±1.16	1.01^{b}±0.01	4.17^{b}±0.09	6.92^{b}±0.14
	p-value	P<0.0004	P<0.0004	p<0.0001	P<0.0001	P<0.05	P<0.05
	SL	***	***	***	***	*	*
Age*FS	I L	242^{c}±4.42	$342.58d^{e}$±4.81	100.58^{a}±1.58	1.118^{ab}±0.02	4.58^{a}±0.13	7.5^{a}±0.2
	IM	252^{c}±4.42	355.4^{cd}±4.81	103.41^{a}±1.58	1.15^{a}±0.02	4.33^{ab}±0.13	7.6^{a}±0.2
	IS	241.33^{c}±4.42	334^{e}±4.81	$92.67b^{c}$±1.58	1.03^{c}±0.02	4.17^{b}±0.13	7.08^{ab}±0.2
	IIL	299.58^{a}±4.42	394.33^{a}±4.81	94.75^{b}±1.58	1.05^{bc}±0.02	4.5^{ab}±0.13	7.33^{ab}±0.2
	IIM	298^{ab}±4.42	389.75^{ab}±4.81	$91.75b^{c}$±1.58	1.02^{c}±0.02	4.33^{ab}±0.13	7.08^{ab}±0.2
	IIS	280.58^{b}±4.42	$370b^{c}$±4.81	89.41^{c}±1.58	0.99^{c}±0.02	4.17^{b}±0.13	6.75^{b}±0.2
	p-value	P>0.1188	P>0.1441	P>0.0296	P>0.0324	P>0.824	P>0.8158
	SL	NS	NS	*	*	NS	NS

N= Number of animals; SL=level of significance;*= significant at (P<0.05);**= significant at (P<0.01);***= significant at (P<.0001); I=3-4 years; II=5-6years. FS=Farm Size, IBW=Initial Body Weight, FBW=Final Body Weight, ADG=Average Daily Gain, IBCS=Initial Body Condition Score and FBCS=Final Body Condition Score, FS=farm size, IL=Large farm 3-4 year.

The total and average daily weight gain was significantly (P<0.001) higher for large and medium than the small scale commercial fattening farms. In terms of the age of the animal, age range of 5-6 recorded higher final weight, but lower total and daily weight as compared to age range of 3 -4.The average condition score recorded during late fattening period were shown 7.42±0.14, 7.13±0.14 and 6.92±0.14 for large and small medium scale and small scale commercial cattle fattening respectively (Table 12). The body condition score result show that animals in large scale farms laid down more fat compared to the medium and the small scale fattening farms.

4. Discussion

4.1. Source, experience and major selection criteria of beef cattle

The commercial feedlot operators purchased animals for fattening purpose from different open local market. As information gathered from feedlot owners, they bought mainly Borena cattle for fattening practices. This indicated that they prefer Boran breed type of animals and this is because Borena breeds were well performed on fattening than the other breed types. This also showed that they lack of information about other breeds of animals that could suit for feedlot fattening. For example, it is noted that the Ogaden (Getechew et al., 2008; Tsagay and Mengistu, 2013) and Kerayu (Mohammed et al., 2008) cattle breeds have a good feedlot fattening performance. Better preference of bulls at the age of 3-6 years suggested that animals after grown to these ages are more suitable to fatten and produce high yield and quality beef production to the standard required by the export market niche for Ethiopian cattle breed. According to the response of all commercial feed lot operators, young bull of Borena breed within the age of 3-6 year were used for fattening operation in the study area. Sinteyehu (2010) reported that most cattle fattened in feedlots are in the range of 50 to 60 month-old Boran bulls targeted to the higher value export market.

Malede and Yilikal (2013) also noted that intact male animals between four and six years of age and weigh at least 280 kg are preferred by the purchasing agents of the abattoirs which are based on the end market requirements. Intact male gains faster and convert feed more effectively than castrated animal (Field, 1971). The majorities (64.5%) of the feedlot operators have experience of about 1 to 10 years in the business (Table 1) and about 20% have experience of over 10 years. The long experience of feedlot operators indicated their success in the business and it is an opportunity for other investors to involve in fattening business to obtain advises and assistance from the experienced owners. The experience they gained helped the operators to utilize appropriate environment that include suitable agro-ecology, access to market and available feed resources in the area. The majority of beef cattle fattening operators were purchased animals for fattening by considering breed type, physical appearance or frame size, age, health and initial price as the top priority (Table 2). In addition, body condition, coat color, horn size and skin conditions (stretchable upon pulling and smoothness) were also considered and used as the selection criteria to purchase beef animals.

The choice of animals based on those criteria could be to meet the preference of the end user and the finishing ability of the animal. It is reported that body size (frame size) as an individual trait is said to be very important since it is related to potential growth at every stage of the development process (Webster, 1986) and affect the whole production system, due to its influence on aspects such as the food conversion efficiency, the time taken to meet a specific market finishing degree, or the final quality of the product obtained (Romera et al., 1998).

4.2. Season and length of fattening period

It is known that the main goal of all commercial enterprises in cattle fattening is to maximize their profit. Thus, to achieve this goal all feedlot operators prefer suitable time to start cattle fattening activities. The majority of the feedlot operators were considered January to March and October to December to be the most suitable seasons to start fattening operation (Table 3). In addition, they were also reported that preference for some months of the year to fatten animals is related to market demand picks. Moreover, fattening operators target to finish their animals and sale at the month of March was for religious holiday of Easter festival in Ethiopia and for export market during Muslim holidays, particularly Eid Al-Adha, and Eid Al-Fetir (Haji). It was also reported that those finish their animals at the month December was for Ethiopian charismas holy day. According to the information obtained from respondents' cattle fattening operation is a time bound activity based on the availability of resource such as feed and labor, and market demand locally as well as at an export market niche.

Frequency of cattle fattening per year and number of animal fatten per cycle was significantly ($p<0.001$) higher for large, followed by medium and small scale commercial cattle fattening respectively).

This indicated that large scale feedlot operators have the largest size of the finished beef cattle exported to Middle East market whereas the length of fattening periods across the farm scale were significantly ($p<0.05$), lower in medium followed by small scale production. The current study is in line with the finding reported by Hutcheson (2008) for Boran bull that has been fed for about four months finished and would produce a desirable carcass and neither over finished nor under finished they had enough fat covering to improve the flavor of the meat and possibly will be marbled adequately. Similarly, Tsegay and Mengistu (2013) noted that most feed lot operators fed their animals for three up to four months.

4.3. Major feed resources and feeding system commercial feedlot

All commercial feedlots operators (Table 5) depend on purchased feed resources for fattening, because of shortage of land for feed production. The current study is in accordance with that reported by Adugna (2008) and Tsagay and Mengistu (2013). The type of roughage and concentrate feeds utilized depend on accessibility, importance for fattening such as the feed nutrient content and palatability, and based on ability to be purchased by the farms due to their cost and availability. Use of agro-industrial feed by-product as a major concentrate source and teff straw as a principal roughage by all scale of commercial feedlot operators is an attribute of the availability of the feed resource in the area and cost advantage from using this feeds. All the commercial feedlot feed animals in confined feeding system. The practice of offering roughage first and concentrate next and rationing the concentrate offer into morning and afternoon meal is a normal practice and may reduce the risk of digestive disorder. Same amount of roughage offer by all scale of farms imply that the fattening operators uniformly utilize the limited amount of roughage feeds, which is in agreement with earlier reports (Tsegay and Mengistu, 2013). The type of feed offered is according to the ingredients availability and price, and stage of fattening. This finding is similar with the criteria noted by Alex (2015) for selecting feed ingredients are easily available in their locality, most preferred by the animals and cheap and easier to transport.

4.4. Housing system

Cattle should be protected from extreme hot or cold conditions. Hence, proper housing and equipment are important in successful fattening operation. The experience of housing system of commercial feedlots in the study area was presented in Table 7. Open overhead shelter with enclosure was the predominant type of housing in large (100%), medium (intermediate) (75%) and small (72.2%) scale commercial cattle fattening operations studied. But, open without overhead shelter housing system was used by few medium (intermediate) and small scale fattening operators. The environment where the commercial fattening of the present study was located in hot particularly during some seasons of the year. Hence, it is important to provide shed where the animals will get access to be protected from excessive heat. According to Koknaroglu (2005) providing an overhead shelter in open lots improved ADG of beef cattle in warm and hot environments via increased dry matter intake and feed conversion efficiency, Table 71 Housing system of fattening animals in the study area.

4.5. Common health problems and health service availability to feedlot fattening operation

Animal diseases are still a major constraint to livestock productivity there by affecting economic growth and the effort made to attain food security Yimenu (2014). The occurrence of various diseases across the fattening farms could be one of the problems that can jeopardize the business if sufficient attention is not given. As the survey result the most feedlot operators lumpy skin disease are the major concern and this result is disagreed with the finding of (Gezahign and Samson, 2014) 83.9 % the disease of most concern was foot Mouth Disease and 16.1 % the most disease concern was Lumpy Skin Disease. While the other disease in few percent for example disease comes from nutritional deficiency is the blindness some the reason of this all feedlots use dry feed only not fed their like green feed. Efficient and reliable animal health services constituent an essential pre-requisite to the cattle fattening. Leonard and Cornelius (1984) old reference stated that animal health care services can be evaluated based on accessibility and service delivery efficiency. Feedlot operators in the study area were used both private and government animal health services. The majority of the respondents were preferred use private veterinary practitioner as first rank than the government veterinary services rendered at the study areas (Table 10). The preference of feedlot farms for private veterinary practitioner could be due to the accessibility and better service although the government veterinary and clinic is low price. According to (Yemenu, 2014) the most feed lot

operators (71%) of them used private veterinarians (private veterinary practitioner) which is in line with the present study.

4.6. Major constraints of beef cattle fattening

The major constraints of commercial cattle fattening in the study area was ranked and presented in Table 11. According to the respondent's response feed scarcity, marketing problem, water scarcity, animal health problems, and lack of appropriate stock for fattening were identified as the major problems that are hindering the performances of the fattening operations in all scale of production. According to the respondents, productivity and fattening activity of livestock were affected by shortage of feed, market, animal health problems, water shortage, lack of animal supply, management skill, and housing system. The present finding is in line with the finding of Bezhign (2014) who noted poor nutritive value of available feeds, its limited availability and high price of supplementary feed associated with poor management practices and seasonality of market price for fattened cattle as a major constraint to cattle fattening business in Chiro area of Western Hararghe small holder cattle fattening operation and similar constraints were also listed by Tsagaye and Mengistu (2013).

4.7. Performance of fattening cattle under commercial feedlot management

The average initial weight of beef cattle purchased for fattening was almost similar for the different farm sizes; with animals purchased by small scale farms weighing a little ($P < 0.001$) lower as compared to the medium (Table 12). Animals with age ranging 5-6 weighed significantly higher as compared to those aged 3-4 years. The average initial weight of beef cattle at entry to the fattening schedule in different commercial feedlot was 254.3±4.55 with a range of 226±4.55 to 330 ±4.55 kg. The higher initial body weight recorded for the medium scale farms is an advantage for producer to achieve desired market weight of beef cattle. The initial live weight recorded in the three commercial feedlot in the present study, was higher than reported by Mohammed et al. (2014) for Baggara bulls used for feedlot experiments which lies in the range 165 and 185kg, and also higher than was reported by Girma et al. (2015) for Borana bulls which recorded 182kg average initial body weight but lower than reported by Bezhign (2014) for Hararghe high land cattle which lies between 415.41±4.8 and 333.9±7.4 for traditional fattening and small scale fattening operation, respectively and also the final weight was lower for small scale fattening farms than the medium. The total and average daily weight gain was significantly ($P<0.001$) higher for large and medium than the small scale commercial fattening farms. In terms of the age of the animal, age range of 5-6 recorded higher final weight, but lower total and daily weight as compared to age range of 3 -4.

The average daily weight gain of about 1 kg recorded for all size of the commercial feedlot is a good rate of gain by the standard of experimental reports for Zebu cattle. For example, Eltarhir et al. (2000a) reported a daily weight gain of up to 1.13 kg for feedlot finished indigenous Western Baggara bulls in Sudan. This finding was little higher than ADG recorded for Borena cattle (0.889 kg per day) under station conditions in Tanzania (Mwilawa, 2012). The higher average weight gain for large and medium compared to small farm size can be attributed to sufficient nutrients contained in diets (feeds), which were able to meet body maintenance requirements and gain. The average condition score recorded during late fattening period were shown 7.42±0.14, 7.13±0.14 and 6.92±0.14 for large and small medium scale and small scale commercial cattle fattening respectively (Table 13). The body condition score result show that animals in large scale farms laid down more fat compared to the medium and the small scale fattening farms. The mean body condition score obtained for the present study was comparable with the condition score of 7.67±0.12 and 7.69±0.11 for fattened Hararghe highland oxen measured on farm during the main rainy season which was managed under experienced and less experienced farmers group for fattening cattle, respectively (Fikadu, 1999). The mean values of condition scores for this study was lower than condition score values of 7.82±0.49 and 7.462±0.62 for Hraraghe highland oxen fattened under traditional system and small scale cattle fattening system, respectively (Bezhign, 2014).

5. Conclusion and recommendation

Generally, East Shoa Zone was the area where most commercial feed lot (cattle fattening) were practices and suitable area. The present study result indicated that the commercial feedlots operators of study area were preferred to fatten Borena bulls immediately purchased from open market of Borena Zone in the season of October to December and January to March by considering these months as suitable time to start fattening operation. The management practices regarding utilization of existing feed, feeding system, housing system and

health care of animals varies across large, medium and small scale commercial fattening and Limited feed availability and high price of supplementary feed, market fluctuation of fattened cattle, water shortage, and disease out breaks were the most challenges that faced the cattle fattening in the study area. The average daily weight gain of about 1 kg recorded for all size of the commercial feedlot is a good rate of gain and average daily gain within age also vary younger age fattened cattle have better gain than mature finished Cattle. Based on the finding of the study, the following recommendations are set for environmental friendly commercial cattle fattening operation business in the study area.

- ✓ Currently, the major breed involved in the fattening operation in the Eastern Shoa Zone districts is Borena breed. However, exploiting this breed without any intervention on breeding strategies endangers the breed. Therefore; the government should design proper livestock policy to optimize the population of animals used for beef and replacement stock at its original area. Moreover, use of breeds that have good feedlot performance like the Borena should be encouraged.
- ✓ Animal health is also the major constraints of beef cattle productions in the study area. Therefore the government should design community based livestock health policy in the districts to maximize the profit of the producers and export healthy and highly demanded beef cattle at international market. Because, producing safe products are a forefront strategy to protect the health of consumers and maintain export market trust.
- ✓ Investment on meat processing and beef cattle production sectors should be encouraged.

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