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Original Research Article

Fattening Practices, Marketing Systems and Body Weight Estimation of Beef Cattle in Arba Minch Zuria District, Gamo Zone, Southern Ethiopia

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ABSTRACT

Cattle fattening is a significant agricultural practice in Ethiopia, contributing to food security and the livelihoods of many rural households. The study was conducted to assess cattle fattening practices, marketing systems, constraints, opportunities and to predict body weight of beef cattle in Arba Minch Zuria District of Gamo Zone, Southern Ethiopia. Selected purposively for its cattle fattening potential and accessibility, the district was stratified into three agro ecological zones. Six representative kebeles were proportionally selected based on their agro ecological variation, and 162 households were systematically sampled. Utilizing formal surveys, a cross-sectional analysis employing one-way ANOVA and cross-tabulations was conducted. Mixed crop-livestock farming system was primary means of livelihood in the study area. The main purpose of fattening cattle was for income generation (100%). The fattening period was depended on body condition and target market availability. The main market place for the fattened cattle was local nearby market. Mostly eye ball estimation was used for purchasing and selling of fattened cattle. Significantly higher body condition score was observed in low land agro-ecology than highland agro-ecology. Shortage of feed and grazing land, seasonality of markets, road and transportation problems and low market price were major problems for fattened cattle. To overcome the shortage of feed resource through enhancing extension service on improved forage cultivation and conservation practice, urea treatment for crop residues and to provide agro-industrial by product for fattened cattle as source of supplementary feed resource.

Keywords: Arba Minch Zuria, body condition score, constraints, eye ball, marketing System, meat consumption.

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INTRODUCTION

Ethiopia, known for its huge livestock resources, is one of the largest livestock producers in Africa, contributing significantly to the country's agricultural economy and rural livelihood. Livestock production remains a critical economic activity, with cattle playing a vital role in both crop production systems and the national economy (IISTE, 2001; FAO, 2017). Among the various livestock sectors, beef cattle fattening has gained increasing prominence due to its potential for improving household incomes, enhancing food security, and contributing to broader agricultural development. This is particularly relevant in regions like Arba Minch Zuria District of Gamo Zone, Southern Ethiopia, where both traditional cattle farming and evolving fattening practices coexist, providing unique research opportunities (FAO and NZAGRC, 2017; World Bank, 2016). Cattle fattening is primarily conducted by smallholder farmers using indigenous knowledge and local resources (Jaleta et al., 2013). Traditional methods often involve feeding cattle on natural pastures supplemented with crop residues, but these practices face challenges such as feed scarcity and limited veterinary services (Alemayehu, 2017). However, increased urban demand for beef is prompting a shift toward more intensive fattening practices, aiming to enhance cattle productivity within shorter cycles (Shapiro et al, 2017; UNIDO, 2018).

The marketing system for beef cattle remains largely informal, characterized by direct transactions between farmers and traders at local markets. This informal structure leads to inefficiencies due to limited access to reliable market information and high transaction costs, impacting profitability for smallholder farmers (Jaleta, 2013). Despite these challenges, the growing demand for beef in urban areas like Addis Ababa presents new opportunities for farmers to engage more actively in the beef value chain (Negassa et al., 2011; Melaku et al., 2014; Tegegne et al., 2016).

Accurate body weight estimation is vital in cattle fattening as it influences market pricing and growth monitoring (Lancaster, 2022). Many farmers in Arba Minch Zuria lack access to modern weighing equipment, relying instead on visual assessments that can be inaccurate. Studies suggest that body weight estimation models based on linear measurements provide a reliable alternative, enabling better management decisions (Tadesse et al 2017).

This study aims to assess the fattening practices, marketing systems, and body weight estimation methods employed by farmers in Arba Minch Zuria District. By exploring these aspects, the research seeks to identify constraints and opportunities within the cattle fattening sector, contributing valuable insights for stakeholders involved in livestock production and marketing.

MATERIALS AND METHODS

Study Area Description

The study was conducted in the Arba Minch Zuria district of the Gamo Zone in Southern Ethiopia, situated within the Great Rift Valley. This district is bordered by Derashe district to the south, Bonke district to the west, Dita and Chencha to the north, Mirab Abaya to the northwest, the Oromiya region to the east, and Amaro district to the southeast.

Arba Minch Zuria comprises 29 kebeles and is divided into three agro-ecological zones: 13.79% highland, 51.72% mid-altitude, and 34.48% lowland. As reported by AZADO (2018), the district has a total population of 211,437 (105,303 males and 106,133 females) and 27,266 households (24,759 male-headed and 2,707 female-headed). The district's elevation ranges from 1,150 to 3,300 meters above sea level, with annual rainfall between 800 and 1,200 mm and temperatures ranging from 16 to 37 °C.

The predominant agricultural practice in the district is a mixed crop-livestock system. Major crops include wheat, maize, sorghum, teff, peas, beans, and linseed, alongside perennial crops such as enset, banana, and coffee. Cattle production is characterized by minimal management inputs, focusing on traditional and subsistence-oriented practices. According to the Arba Minch Zuria Livestock and Fishery Development Office (AZLFDO) for 2016/2017, the district's cattle population is 143,532, comprising 67,887 males and 75,645 females. Of this total, there are 2,783 crossbred cattle (1,887 males and 894 females) and 140,749 indigenous cattle (65,998 males and 74,751 females).

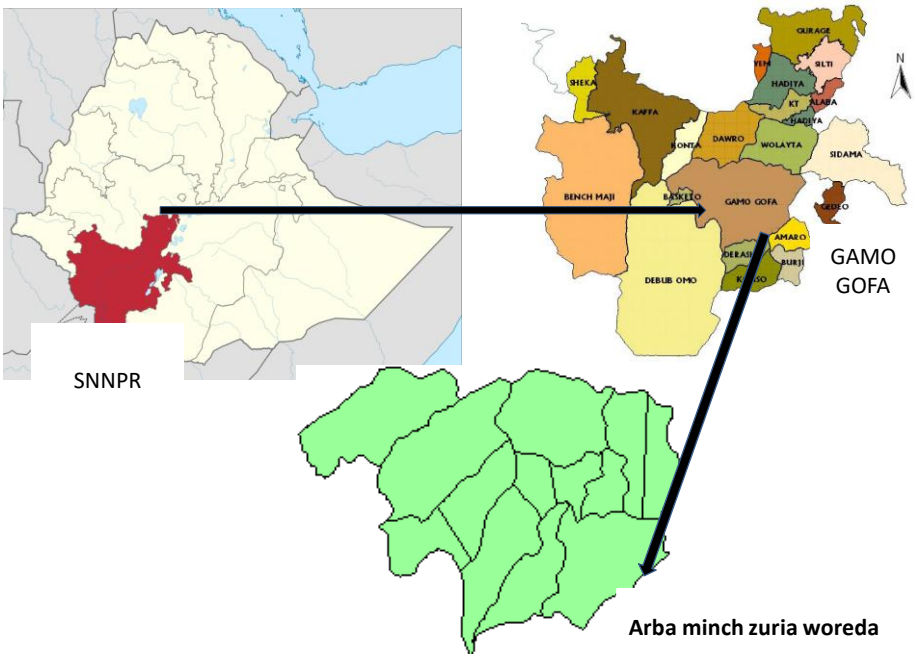

Figure 1: Map of the study area.

Sampling Procedures

A multistage sampling technique was employed to select households and kebeles for the study. Initially, the area was stratified into three agro-ecological zones: lowland, midland, and highland. In the second stage, kebeles were purposively chosen based on their cattle fattening potential and accessibility. The number of kebeles in each agroecology was determined using proportional allocation, with two kebeles from lowland, three from midland, and one from highland. Finally, individual household heads with cattle fattening practice were identified and selected using systematic random sampling technique. The sample size from each kebele was determined based on proportion to the total household in each selected kebele.

The overall sample size for household interviews was calculated using Cochran's (1977) probability proportional to size sampling technique.

$$n_o = \frac{Z^2 * (p)(q)}{d^2}$$

Where,

n_o= desired sample size when population is greater than 10,000

Z = standard normal deviation (1.96 for 95% confidence level)

P = 0.12 (proportion of population to be included in sample i.e. 12%)

q = 1-0.12 i.e. (0.88) and d = is degree of accuracy desired (0.05), 5% error term.

Based on the above formula, the total numbers of households included in this study were 162. In this regard 54, 85 and 23 households were selected from lowland, midland, and highland agro-ecologies, respectively.

Method of Data Collection

Cross-sectional type of study was conducted to collect primary data through questionnaire survey, focus group discussions, key informants' interview and field observations. Secondary data, which is used to supplement the primary data, was obtained from each Kebele farmers training center (FTC), the district livestock and fishery development office, the zonal office, and Ara Minch Agricultural Research Center. Besides, the reports of previous research findings, guidelines, manuals and other published and un-published documents were also reviewed.

Questionnaire survey: the data was collected using structured questionnaires administered by researchers and development agents. The questionnaires covered socio-economic characteristics, cattle fattening practices, herd composition, cattle sources, labor allocation, feeding, water, housing, health care, selection criteria, feeding methods, fattening duration, selling seasons, prices, costs, marketing channels, and key stakeholders. Butchers, restaurant owners, and consumers were also interviewed about beef consumption and marketing.

Key informants: the discussion with key informant were held with development agents, cooperative/enterprises working on cattle fattening, model farmers, buyer and seller of fattening cattle. The main points for the discussion were on the status of cattle fattening practices, seasoning of fattening, season effect on price cattle, main constraints and opportunities of cattle fattening practices, marketing constraints and price fluctuation, and brokers influences on marketing of fattening cattle.

Field observation: field observations were conducted to assess cattle handling, feeding, watering, housing, and the characteristics of fattening cattle, including their sex and age. At market centers, observations focused on the sex, age, body frame, and prices of fattened cattle, as well as the main actors involved in marketing as well as key market locations observed in the study district.

Body Measurement of Fattened Cattle

A total of 162 fattened cattle were measured using a tape meter to estimate body weight, with one cattle measured per household. Additionally, 60 cattle were measured at market centers. The body weight was predicted using Shaeffer's formula:

$$\text{Body weight (lb)} = G^2 \times L / 300$$

Where L is the length from the shoulder to the pin bone (in inches) and G is the heart girth (in inches). The weight in pounds was then converted to kilograms using the conversion factor of 1 lb = 0.454 kg.

Data Analysis

The collected data were coded and entered into Microsoft Excel (2007) and analyzed using SPSS Version 20. Results were presented in tables and figures, along with means, ranges, standard errors, and percentages. One-way ANOVA was used for continuous variables, with mean comparisons conducted using the LSD test. The statistical model employed was:

$Y_{ij} = \mu + A_i + e_{ij}$,

Where,

Y_{ij}= Response variables

μ = Overall mean

A_i = Effect of i^{th} agro-ecology (where i = low land, midland, highland)

eij = random errors

Indices for ranking major constraints in cattle fattening and marketing were calculated using the formula:

$$\text{Index} = \frac{\sum_1^3 (3) * 1st\ rank + 2 * 2nd\ rank + 1 * 3rd\ rank}{\sum_1^3 all\ ranks}$$

RESULTS AND DISCUSSION

Socio-Economic Characteristic of the Households

Sex, religion, and level of education

The socio-economic characteristics of the households are presented in Table 1. Most households engaged in fattening were male-headed (94.4%), with only 5.6% female-headed. This aligns with Seid (2012), who found that 75% of cattle fattening households in Burji district, Southern Ethiopia, were male-headed.

Approximately 58% of households identified as Protestant, while 40.7% were Orthodox Christians and 1.2% Catholic. The study found that 44.4% of households were illiterate, 27.8% had elementary education, 17.9% could read and write, 7.4% attended high school, and 2.5% held diplomas or higher. Similarly, Sisay (2015) reported that 55.6% of cattle fatteners in the Harshin district were illiterate.

Age, Family Size and Experience of the Households

A significant difference ($P<0.05$) was observed in the mean age across different agro-ecologies, with an overall mean age of 42.6 years. This suggests that most household members are in their active age group, presenting an opportunity to enhance cattle fattening in the area. Similarly, Tesfaye (2016) reported a mean age of 45.5 years in Lume district, and Seid (2012) found a mean age of 43.4 years in Burji district, Southern Ethiopia.

There was no significant difference ($P>0.05$) in average family size across different agro-ecologies, with an overall mean of 6.44 members per household. This is higher than the 5.46 reported by Tesfaye (2016) in East Shoa, Oromia, and the national average of 5.1 (CSA, 2013), but lower than Zewdie's (2010) figure of 10.5 in the highland and central rift valley of Ethiopia.

In the study area, 41.4% of households had 3-5 years of experience in cattle fattening, while 30% had 6-10 years. This indicates a strong level of expertise, presenting a valuable opportunity to expand cattle fattening practices. Similarly, Genet et al. (2017) reported that feedlot operators in East Shoa, Oromia, had 1 to 10 years of experience, with many exceeding 10 years.

Table 1. Socio-economic characteristics of households.

Variables	Agro-ecology				P-value
	Lowland (n=54)	Midland (n=85)	Highland (n=23)	Overall (N=162)	
Sex (%)					
Male	94.4	94.1	95.7	94	0.419
Female	5.6	5.9	4.3	5.6	
Religious (%)					
Orthodox Christian	27.8	45.9	52.2	40.7	0.223
Protestant	70.4	52.9	47.8	58	
Catholic	1.9	1.2	-	1.2	
Level of education (%)					
Illiterate	24.1	58.8	39.1	44.4	
Elementary school	35.2	25.9	17.4	27.8	0.916
High school	9.3	5.9	8.7	7.4	
Diploma and above	7.4	-	-	2.5	
Write and read	24	9.4	34.8	17.9	
Age	40.5^{b} ±0.73	43.3^{a}±0.82	44.7^{a} ±1.55	42.6±0.55	0.018
Family size	6.33±0.30	6.32±0.27	7.17±0.71	6.44±0.20	0.378
Fattening experience (%)					
<3 yrs	3.1	8.6	1.2	13	
3-5 yrs	14.8	21.6	4.9	41.4	0.402
6-10 yrs	12.3	11.1	6.8	30	
11-15 yrs	2.5	6.8	1.2	10.5	
>15 yrs	0.6	4.4	-	5.1	

*Means with different letters of superscripts within a row are significantly different.

Livestock and Land Holding

The average livestock holding per household was 11.54, with total cattle holdings of 10.43±1.5 in lowland, 6.76±1.16 in midland, and 8.43±0.48 in highland agro-ecologies. Significant differences ($P<0.05$) were observed for local cattle breeds across agro-ecologies, except for local bulls, while no significant differences were found for crossbred cattle. The overall mean cattle holding was 9.77 heads per household, higher than the 3.77 reported by Bezahegn (2014) in Chiro district and 4.82 by Tsigereda (2010) in Western and Eastern Hararghe zones, but lower than Seid's (2012) report of 13.7 heads in Burji district and Tesfaye's (2007) 15.5 heads in Metema district.

Table 2 shows significant differences in average landholding across agro-ecologies, with lowland households having larger holdings than those in midland and highland areas. Land use primarily included crop production (1.53 ha), perennial vegetation (0.85 ha), and grassland (0.42 ha), with midland areas having notably more perennial vegetation. The average landholding was 1.85 ha per household, lower than the 2.12 ha in Metekel zone (Solomon et al., 2014) and 2.5 ha in Dandi district (Duguma et al., 2012), but comparable to the national average of 1.77 ha per household in rural Ethiopia (CSA, 2013).

Table 2. Cattle herd size, livestock holding and land holding (ha) of the respondents.

Variables	Agro-ecology				P-value
	Lowland (n=54) Mean ± SE	Midland (n=85) Mean ± SE	Highland (n=23) Mean ± SE	Overall mean (N=162) Mean ± SE	
Local cow	4.05^{a}±0.35	1.45^{b}±0.09	1.53^{b}±0.16	2.40±0.17	0.000
Cross cow	0.00	1.35±0.45	1.8±0.00	1.44±.36	NS
Local ox	3.71^{a}±0.67	1.76^{b}±0.06	1.58^{b}±0.12	2.21±0.18	0.000
Local bull	1.11±0.16	0.68±0.06	0.75±0.1	0.93±0.1	0.08
Cross bull	0.8±0.00	0.00	0.8±0.00	0.6±0.2	NS
Local heifer	0.98^{a}±0.07	0.56^{b}±0.03	0.63^{b}±0.08	0.77±0.04	0.000
Cross heifer	0	0.35±0.35	0.7±0.00	0.53±0.18	NS
Local calve	0.38^{a}±0.25	0.21^{b}±0.12	0.24^{b}±0.02	0.6±0.2	0.000
Cross calve	0.4±0.00	0.4 ±0.00	0.4±0.00	0.29±0.015	NS
Cattle herd size	10.43±1.50	6.76±1.16	8.43±0.48	9.77±1.45	
Goat	0.54±0.06	0.39±0.04	-	0.47±0.03	NS
Sheep	0.4^{b}±0.07	0.28^{b}±0.02	0.64^{a}±0.09	0.4±0.03	0.000
Equine	0.5^{b}±0.00	0.53^{b}±0.02	1.15^{a}±0.11	0.81±0.07	0.000
Chicken	0.08±0.013	0.09±0.012	0.11±0.023	0.09±0.008	NS
Total livestock	11.41	7.95	10.32	11.54	
Landholding (ha)					
Crop land	1.99^{a}±0.14	1.37^{b}±0.09	1.02^{b}±0.09	1.53±0.07	0.000
Grass land	0.63±0.29	0.41±0.07	0.38±0.07	0.42±0.05	0.19
Perennial vegetation	0.87^{b}±0.07	1.14^{a}±0.1	0.36^{c}±0.09	0.85±0.06	0.000
Total land holding (ha)	2.37^{a}±0.17	1.62^{b}±0.08	1.46^{b}±0.12	1.85±0.08	0.000

*Means with different letters of superscripts within a row are significantly different. NS means not significant.

Income source of households

Table 3 presents the income sources for households in the study area, with crop production, mixed production, and livestock production as the primary contributors. This differs from Shewagzaw (2016), who found livestock to be the main income source (40%) in North Gondar zone. Conversely, Estefanos et al. (2014) reported that crop and livestock production accounted for 51.7% of household income in East and West Harerge zones. This suggests that livestock production also supports crop production inputs.

Table 3. Income source of the households in the study area.

R. No.	Source	1st	2nd	3rd	Index	Rank
1	Crop production	130	22	10	0.2205	1
2	Crop-livestock production	25	110	27	0.1599	2
3	Livestock production	20	30	112	0.1152	3
4	Trade	5	30	127	0.0953	4
5	Weaving	0	1	161	0.0809	7
6	Carpentry	0	2	160	0.0814	6
7	Clay/bedding work	0	1	161	0.0809	7
8	Employed (gov't)	0	3	159	0.0819	5

Purpose of cattle fattening, practice and finishing period

The study found that all households fatten cattle mainly to generate income to cover expenses such as debts, housing improvements, education, and replacing old oxen, with none raising cattle for home consumption. This aligns with findings from Yidnekachew et al. (2016), Ayele et al. (2003), and Amistu et al. (2016), who also identified income as the key driver for cattle fattening across Ethiopia.

Cattle fattening methods were predominantly semi-intensive (72.8%), with traditional practices accounting for 27.2%. Insights from focus group discussions and key informant interviews revealed that traditional cattle fattening involves feeding older oxen after the end of traction period. Yisehak (2013) similarly noted that farmers in the Gamo Gofa zone use oxen for draft purpose and, once farming activities end, care for them for a few months before marketing them, particularly during national holidays. In contrast, semi-intensive methods primarily focus on fattening young cattle and mature oxen. Belete et al. (2010) found that smallholder farmers typically fatten mature animals (5 to 7 years old) for short durations, usually around three months. Limited landowners practiced semi-intensive farming by purchasing cattle for ploughing and then stall-feeding them. These findings align with Sintayehu et al. (2010), who reported that only a small fraction of Ethiopian beef comes from feedlots.

The duration of cattle fattening varies based on the animals' body condition and market demand. In the study area, majority of the households (37.7%) fattened their cattle for four months. In contrast, Shewangzaw (2016) found that 83.3% of farmers in western Gondar typically fattened cattle for three months. The differences may stem from farmers' limited experience in profit estimation, resource shortages, and the age and body condition of the cattle. Additionally, the Cattlemen's Beef Board and National Cattlemen's Beef Association (2009) report that beef cattle generally spend four to six months in feedlots on a grain-based diet before harvest.

Table 4. Purpose and method of fattening, finishing period of cattle fattening.

Variables	Agro-ecology				P -value
	Lowland (n=54)	Midland (n=85)	Highland (n=23)	Total (N=162)	
Purpose of fattening cattle (%)					
Income generation/profit	100	100	100	100	0.635
Other purpose	-	-	-		
Methods of fattening (%)					
Traditional system	33.3	21.2	34.8	27.2	0.992
Semi-intensive system	66.7	78.8	65.2	72.8	
Duration of fattening (%)					
Three months	14.8	1.2	-	5.6	
Four months	48.1	35.3	21.7	40.7	0.461
Five months	20.4	27.1	21.7	25.9	
Six months	16.7	22.4	30.4	19.8	
> six months	-	14	26.1	8	

Feed and feeding management, water sources and watering frequency

Table 5 outlines the feeding methods and sources used for cattle fattening. In the study area, 55.6% of farmers primarily employed stall feeding due to the convenience of providing supplementary feed and limited grazing land. This aligns with findings from Teshager et al. (2013), who noted that farmers in the Ilu Aba Bora zone of Oromia region used a stall feeding/cut-and-carry system. Similarly, Bikila and Tigist (2016) reported that 73% of households in Haramaya district utilized the cut-and-carry method for grazing.

Natural pasture was the primary feed source for fattening cattle in the study area, followed by crop residue. This finding aligns with Solomon (2004), who noted that livestock in the Bale highlands primarily rely on natural pasture, crop residues, and aftermaths. Similarly, Alemayehu and Sisay (2003) reported that Ethiopian livestock feed on natural pastures, crop residues, agro-industrial by-products, and cultivated forage crops. The primary crop residues used for fattening cattle were maize/sorghum straw (63.6%), barley/wheat straw (21%), and teff straw (15.4%). Notably, no farmers in either highland or lowland agro-ecologies used teff or barley/wheat straw for fattening, likely due to the absence of these crops in their respective regions. This aligns with Alemayehu (2004), who noted that at lower altitudes, maize, sorghum, and millet stovers are more prevalent, while teff is cultivated at intermediate altitudes and barley replaces wheat at higher elevations, where pulses are also widely grown.

Supplementary Feed Resource for Fattening Cattle

Table 5 details the major supplementary feeds provided to fattened cattle in the study area, where households primarily use concentrates and root tubers to enhance the animals' body condition. The main feeds included sweet potato (58%), maize/sorghum (47.5%), haricot bean (42.6%), inset root (40.7%), barley (10.6%), cassava (17.2%), pumpkin (15.5%), formulated feed (3.7%). These findings align with Takele and Habtamu (2009), who reported similar supplementary feeds in the Wolayta zone, including various green and dry crops and improved forages like desho grass (Pennisetum pedicellatum), napier grass (Pennisetum purpureum) and concentrate feed especially wheat brans. Shewangizaw et al. (2014) also noted the use of diverse feeds, such as false banana and sugar cane, in central southern regions. However, this study contrasts with Tesfaye (2016), who found that agro-industrial by-products were the most common supplements in the Lume district of East Shoa zone.

The primary sources included river (46.3%), tap water (35.8%), deep well (7.4%), spring (6.8%), pond (0.6%), and lake (3.1%). In highland agro-ecologies, water was mainly sourced from rivers (78.3%) and tap water (21.7%). Water provision was primarily through transportation (56.8%) or bringing cattle to watering areas (43.2%).

Table 5. Feed and water resources, feeding management and watering frequency.

Variables	Agro-ecology				P-value
	Lowland (n=54)	Midland (n=85)	Highland (n=23)	Overall (N=162)	
Feed resource (%)					
Grass/natural pasture	29.6	47.1	82.6	46.3	
Crop residue	31.5	24.7	4.3	24.1	
Crop residue sources (%)					NS
Teff straw	5.6	25.9	-	15.4	
Barley/ wheat straw	-	16.5	87	21	
Maize and sorghum	94.4	57.6	13	63.6	
Other feed resources**	38.9	28.2	13	29.6	
Supplementary feed sources (%)					
Roasted haricot bean	17.3	56.5	2.9	42.6	
Roasted maize	22.8	22.2	0.6	47.5	
Barley	-	-	10.5	10.5	NS
Sweet potato	25.3	26.5	2.5	58	

Ration from market	3.7	-	-	3.7	
Cassava	9.9	5.6	-	15.4	
Pumpkin	4.3	8	3.1	15.4	
Inset root	-	31.5	9.3	40.7	
Salt	33.3	34.6	10.5	78.4	
Feeding method (%)					
Tethering	1.9	2.4	17.4	4.3	NS
Stall feeding	48.1	68.2	26.1	55.6	
Mixed feeding	50	29.4	56.5	40.1	

***Other feed resource = (inset, bamboo tree leaf and other home waste), NS= not significant*

Housing Managements to Fattening Cattle

In the study area, 48% of households fatten cattle in specially constructed houses, while 77.8% in lowland agro-ecologies use open kraals. No households in the midland or highland areas used open kraals to shelter their animals, opting instead to protect them from extreme weather conditions with more secure or enclosed housing systems. This aligns with Sisay (2015), who identified various housing types in Harshin district, including living rooms (30%), homestead sheds (50%), and barns (20%). Shitahun (2009) reported similar practices in Bure district, with 56% of animals housed in family rooms and 32% in separate structures. Housing systems varied by agro-ecology and environmental conditions; highland and midland designs resembled human dwellings for protection against harsh conditions, theft, and predators, while lowland areas primarily used fenced kraals. Dereje et al. (2014) and Zewdie (2010) noted that mature cattle are often kept in open enclosures at night to prevent crop damage and protect against predators. Additionally, 54.3% of households kept fattening cattle separately, while 45.7% mixed them with other cattle, using partitions to facilitate feeding, hygiene, and reduce competition. This supports Tesfaye (2016), who emphasized that proper housing protects animals from extreme weather and aids in providing supplements.

Table 6. Housing system of fattening cattle.

Variables	Agro-ecology				P-value?
	Lowland (n=54)	Midland (n=85)	Highland (n=23)	Overall (N=162)	
Confined at night (%)					
Main house without partition	-	7.1	4.3	4.3	
Adjoin house (partition in the house)	-	23.5	60.9	21	
Separate constructed house	22.2	69.4	34.8	8.8	
Grazing area (open kraals)	77.8	-	-	26	
Confine fattening cattle (%)					
Alone	76	44.7	39.1	54.3	
Mixed with other cattle	24	55.3	60.9	45.7	

Cattle Diseases

According to farmers and veterinarians, the primary cattle diseases in the study area are trypanosomiasis (1st), internal parasites (2nd), brucellosis (3rd) and others. Trypanosomiasis is notably more prevalent in lowland and midland regions than in highland areas, significantly affecting cattle productivity, farmer income, and mortality rates. This increased incidence is linked to a higher prevalence of tsetse flies in these environments. These findings are consistent with

reports from Seid (2012) and FARM-Africa (2006), which also identified trypanosomiasis as the most common disease in the Segen Zone of southern Ethiopia.

Table 7. Disease of cattle with index m.

R. No.	Major diseases	1st	2nd	3rd	Index	Rank
1	Trypanosomiasis	132	18	12	0.249	**1**
2	Internal parasite	56	12	94	0.160	**2**
3	Brucellosis	20	31	111	0.131	**3**
4	External parasite	-	67	95	0.128	**4**
5	Anthrax	12	35	115	0.124	**5**
6	Blackleg	9	27	126	0.116	**6**
7	Foot and mouth disease	-	3	159	0.092	**7**

Source of Fattening Cattle and Number of Fattened Cattle per Fattening Period

The primary source of cattle for fattening in the study area was market purchases (73.5%)(Table 8). This finding aligns with Sisay (2015), who noted similar practices in Harshin district. In highland areas, a higher percentage of respondents used their own herds for fattening compared to lowland and midland regions. The main sources of funding for cattle purchases included crop sales (36.4%), personal savings (19.8%), and microfinance (11.1%). Most households (73.5%) fattened only one animal per period, while 19.8% fattened one to two animals. This is consistent with Tesfaye (2016), who reported that traditional farmers typically fatten 1-3 cattle annually. Fattening generally occurs post-plowing season, mainly involving mature oxen. The primary reasons for limiting fattening to one animal include capital shortages, feed availability, and lack of experience, as supported by LIVES (2012), which highlighted the traditional use of oxen for draught power before being fattened for market during holidays.

Table 8. Average number of fattening cattle per household.

Variable	Agro-ecology				P-value
	Lowland (n=54)	Midland (n=85)	Highland (n=23)	Overall (N=162)	
Source of fattening cattle (%)					0.769
Purchase from market	77.8	80	39.1	73.5	
Own herd	20.3	18.8	60.9	25.3	
NGO	1.9	1.2	-	1.2	
Source of money (%)					
Personal saving	35.2	13	8.7	19.8	
Money lender	1.9	-	-	0.6	0.35
Family/ friends	1.9	9.4	-	5.6	
Microfinance	18.5	7	8.7	11.2	
Crop sell	22.2	49.4	21.7	6.4	
Other source	20.4	21.2	60.9	26.5	
Number per fattening (%)					
Only 1 head	48	88.2	78.3	73.5	
1-2	33.3	10.6	21.7	19	0.742

3-5	5.6	1.2	-	2.5
6-10	7.4	-	-	2.5
>10	7.4	-	-	2.5

Marketing System and Market Actors of Beef Cattle

Market channels and main actors

The main cattle markets in the study district include Zigit Baqole (Garibbo), Genta Meyiche (Shoshine), Kola Shelle, and Chano Mile. Chano and Shelle serve as secondary markets due to the entry of cattle from various districts and a higher number of traders. Cattle are primarily sourced from local producers and border districts like Male, Konso, Garda, Buriji, konso, Gidole, Gumayide, and Mirab abaya districts

Marketing channels flow in two main directions. From producers to traders, then to butchers and consumers, or from producers to small traders, then to larger traders for export. The marketing system lacks standardization, with livestock, crops, and other products sold together in crowded spaces without proper infrastructure such as pens or watering facilities.

Four major market days are established: Gariboo on Saturdays, Shoshine on Tuesdays, Shelle on Wednesdays and Saturdays, and Chano on Mondays. Respondents reported that selling at Shelle and Chano markets yields higher profits due to their proximity to city centers, greater trader involvement, and better transportation access.

Market price, price estimation methods, causes of price variation, and price fixing factors

Price estimation of fattened cattle

Most households (85.2%) estimated the price of fattened cattle using visual assessment at the market place, while 14.8% based their sales on balancing expenses and profits. The study area lacks weighing scales, relying solely on visual estimation tied to the animals' body condition. This aligns with Malede and Yilkal (2013), who noted that livestock trading typically employs "eye-ball" pricing, with weighing being uncommon. Similarly, Alemayehu (2004) highlighted that livestock marketing is not weight-based, which negatively impacts producers' pricing. Shewangizaw et al. (2014) also reported that farmers do not use scientific measurements for weighing animals during transactions.

Market price of fattened cattle

The average purchasing and selling prices of fattened cattle are shown in Table 8, with significant differences ($P<0.05$) noted among agro-ecologies. Price variations are attributed to factors such as finishing quality, seasonality, capital, body condition, and breed. The minimum and maximum purchasing prices were 4,500 ETB and 8,000 ETB, respectively, while selling prices ranged from 7,600 ETB to 15,000 ETB. The mean purchasing price in the study area was 6,507 ETB, higher than Sisay's (2015) report of 5,000 ETB in Harshin district. The mean selling price was 10,197.1 ETB, lower than Shewangzaw's (2016) figure of 15,000 ETB in Gondar town and Jafer et al.'s (2016) range of 10,000-18,000 ETB during Meskel season in East Badawacho district. However, it was higher than Sisay's (2015) report of 9,500 ETB in Harshin district……. The price

variation reported by different authors here is only to show variations in numbers however the study location is different for all.

Causes of price variation of fattened cattle

The causes of price variation for fattened cattle are detailed in Table 8. Most households (93.2%) attributed price fluctuations to seasonality. Key informants noted that prices drop during Orthodox Christian fasting periods when meat consumption decreases, and at the start of the rainy season, excess supply from farmers leads to lower prices as they sell cattle to cover costs for seeds and fertilizers. Conversely, prices rise after the rainy season due to increased demand for feed, replacements, and traction. Respondents identified fasting seasons (84.1%) and dry/wet seasons (15.9%) as primary factors influencing price changes. These findings align with Getachew et al. (2017), who highlighted seasonality and fasting as key market fluctuation factors, and Shewangzaw (2016), who noted that farmers often market cattle during major holidays. The survey indicated higher prices from June to September (55.6%), September to December (23.5%), and January to April (21%), likely due to holidays like Meskel and Christmas. Takele and Habtamu (2009) also observed that cattle fattening peaks from June to September, driven by feed availability and holiday demand. Overall, livestock prices are influenced by various factors related to market conditions and animal quality, as noted by Hailemariam et al. (2009).

Factors affecting the price of fattened cattle

Table 9 presents the determinants of fattened cattle prices. The study found that prices are influenced primarily by festive periods (60.5%), body condition (28.9%), age (4.9%), sex (3.7%), and color (2.4%). Farmers target holidays to maximize prices, aligning with Tesfaye (2016), who reported that 72.5% of fatteners sold cattle during Easter due to increased consumer demand. Similarly, Shewangzaw (2016) and Amistu et al. (2016) noted that prices are largely determined by body conformation, weight, and individual preferences, with male cattle generally fetching higher prices than females. While demand typically drives prices up, imbalances between supply and demand can lead to price declines during religious and cultural festivals.

Table 9: Market price estimation of Fattened cattle in the study area.

Variables	Agro-ecology				P-value
	Lowland (n=54)	Midland (n=85)	Highland (n=23)	Overall (N=162)	
Price estimation ways (%)					
Eye ball estimation	68.5	92.9	95.7	85.2	**0.06**
Other**	31.5	7.1	4.3	14.8	
Market Price (birr)					
Purchasing price	7034.8^{a}±117.7	6755.5^{b}±187.9	6145.6^{b}±123.2	6507±91.0	0.000
Selling price	10746.3^{a}±195.1	9980.3^{b}±141.5	9708.7^{b}±195.3	10197.1±99.7	0.001
Is there price change across months (%)					0.09
Yes	98.1	88.2	100	93.2	
No	1.9	11.8	-	6.8	

Price variation across seasons (%)					
Fasting	90.6	76	95.7	84.1	0.49
Dry/wet season	9.4	24	4.3	15.9	
Price variation across months (%)					
June to Sept	40.7	65.9	52.2	55.6	
Oct to Jan	31.5	18.8	21.7	23.5	
Feb to Apr	27.8	15.3	26.1	21	
Price fixing factors (%)					
Color	-	1.2	14	2.4	
Age	7.4	3.5	4.3	4.9	
Sex	5.6	1.2	8.7	3.7	
Body condition	31.4	30.6	13	28.9	
Time of festivals	55.6	63.5	60.8	60.5	

a,b Means with different letters of superscripts within a row are significantly different. **Other = based on comparing cost vs. profit and other criteria

Body Weight Estimation and Body Condition of Fattening Cattle

Table 10 presents body weight measurements and condition scores for fattened cattle. Significant differences ($P<0.05$) were observed, with lowland cattle showing higher body weights than those in midland and highland areas, likely due to larger breeds like Boran and better management practices. The overall mean body weight was 222 kg on farms and 300.3 kg at marketplaces, both lower than the findings of Hassan et al. (2017), who reported mean weights of over 324 kg in Northern Ethiopia. The minimum and maximum weights recorded were 128.86 kg and 340.90 kg, respectively.

The study's mean farm weight is lower than Goe et al.'s (2001) report of 281 kg in highland Ethiopia but comparable to Tesfaye's (2016) market place estimates of 248.4 kg and 303.8 kg in Lume district. The findings also align with Shitahun (2009), who noted pre- and post-fattening weights of 275 kg and 341.24 kg, respectively, while being higher than Tesfaye et al.'s (2005) report of initial weights around 173 kg.

Additionally, significant variations in body condition scores were noted, with lowland cattle scoring higher than those in highland areas. The scores ranged from 6 to 8, indicating a medium to good body condition, consistent with Hassan et al. (2017), who found that most oxen at abattoirs had good body conditions.

Table 10. Body weight measurement and body condition score of fattened cattle.

Variable	Agro-ecology				P-value
	Lowland (n=54)	Midland (n=85)	Highland (n=23)	Overall (N=162)	
	Mean ± SE	Mean± SE	Mean ± SE	Mean ± SE	
Body weight estimation on farm					
Length (inch)	39.8^{a}±0.58	37.8^{b} ± 0.27	37.9^{b} ± 0.4	38.5±0.6	0.001
Heart girth (inch)	61.3^{a} ± 0.62	59. 7^{b} ±0.64	57.3^{b} ± 1.38	59 ± 0.45	0.001
Body weight (kg)	248.3^{a} ± 6.7	216.8^{b} ±5.3	210.2^{b} ± 11.5	226.3 ± 3.8	0.000
Body weight estimation on market	**n=20**	**n=32**	**n=8**	**N=60**	
	Mean ± SE	Mean± SE	Mean ± SE	Mean ± SE	
Length (inch)	42.9^{a}±0.73	41.2^{a}±0.70	40.1^{ba}±0.39	41.1±0.45	0.044
Heart girth (inch)	74.3^{a}±0.81	69.3^{b}±1.37	68.9^{b}±1.29	70.9±0.83	0.031
Body weight (kg)	330.8^{a}±8.8	289.9^{b}±9.9	268.3^{b}±11.3	300.3±6.7	0.002
Body condition score	7.14^{a} ± 0.10	6.91^{ab} ± 0.08	6.6^{b} ± 0.13	6.6 ± 0.06	0.010

a,b Means with different letters of superscripts within a row are significantly different

Constraints and Opportunities of Cattle Fattening

Constraints of fattening beef cattle

The study identifies significant constraints to beef cattle fattening, primarily the shortage of feed and grazing land, followed by marketing challenges and drought. These issues are consistent with Tsegay et al. (2016), who noted similar obstacles in Eastern Shewa, including a lack of improved forage seeds and inadequate feed conservation methods. Additional challenges highlighted by Amare et al. (2017) in Melo Koza and Belete et al. (2010) in Fogera include disease management, insufficient veterinary services, low technology adoption, limited access to capital, and a scarcity of improved cattle breeds. These findings emphasize the urgent need for targeted interventions to enhance feed production, improve animal health services, facilitate market access, and provide financial support, which could significantly increase the productivity and profitability of beef cattle fattening in the area.

Table 11. Constraint of cattle fattening in the study area.

R. No	Constraints	1st	2nd	3rd	Index	Rank
1	Labour shortage	-	30	132	0.058	10
2	Lack of credit access	-	52	110	0.065	9
3	Lack of appropriate breed of animals	32	56	84	0.089	8
4	Water shortage	50	42	70	0.092	7
5	Inadequate/lack of inputs	66	44	52	0.103	6
6	Disease and parasite	70	55	37	0.109	5
7	Drought	77	50	35	0.111	4
8	Inadequate extension support	88	32	42	0.113	3
9	Marketing problems	80	60	22	0.116	2
10	Feed and grazing land shortage	150	10	2	0.144	1

Challenges of cattle marketing systems

Beef cattle fatteners in the study area face significant marketing challenges. Key issues include market seasonality, leading to fluctuating demand and prices, with peaks during holidays. Poor road infrastructure and limited transportation options hinder the timely movement of cattle to markets. Additionally, low market prices during oversupply periods erode profit margins, while the lack of timely market information complicates decision-making for fatteners. Many struggle to access better-priced incentive markets, and intermediaries often take a substantial share of profits, further reducing returns. Excessive taxes and fees also diminish net earnings. These findings align with Amistu et al. (2016), who identified road conditions and seasonal price variations as major constraints, and Tesfaye (2016), who noted similar challenges in the Lume district of Oromia. To address these issues, interventions should focus on improving road infrastructure, enhancing market information systems, facilitating access to higher-value markets, and regulating brokers' activities.

Table 12. Marketing problems present on index method.

R.N	Marketing problem	1st	2nd	3rd	Index	Rank
1	Excessive tax	56	60	46	0.126	7
2	Brokers/dealers	70	57	35	0.136	6
3	Lack of access to incentive markets	80	42	40	0.138	5
4	Lack of market and price information	90	30	42	0.141	4
5	Low market price	95	45	22	0.150	3
6	Road and transportation problems	100	36	26	0.151	2
7	Seasonality of markets	110	35	17	0.158	1

Opportunities of cattle fattening in the study area

The opportunities for cattle fattening in the study area are substantial, driven by various socio-economic factors and market dynamics. Key opportunities include rising meat demand due to population growth, urbanization, and increasing income levels, which create a favorable market for beef. The local cattle population is well-adapted to harsh conditions, and many farmers are already utilizing available supplementary feed, indicating potential for improved productivity. Additionally, engaging jobless youth and landless farmers in cattle fattening can address unemployment while boosting production. The establishment of agro-processing plants and industrial parks enhances market access for fattened cattle. Moreover, the cultural significance of meat consumption in Ethiopia supports sector growth. Research shows that as populations become wealthier and more urbanized, demand for meat will continue to rise, making this an ideal time for investment in the cattle fattening industry. These trends align with findings from Yitaye et al. (2007) and Hall et al. (2004), emphasizing the favorable conditions for beef cattle production in Ethiopia.

CONCLUSION

The study comprehensively assessed cattle fattening practices and the marketing system in the study area, revealing significant insights into the challenges and opportunities within the sector. Key constraints identified include feed shortages, poor infrastructure, market seasonality, and limited access to veterinary services, which hinder profitability and productivity. Conversely,

substantial opportunities exist due to rising meat demand driven by population growth and urbanization, the availability of well-adapted local cattle, and potential engagement of unemployed youth in fattening activities. Additionally, the study demonstrated that body weight prediction of fattened cattle can be effectively achieved using heart girth and length measurements, further enhancing management practices. Addressing identified constraints while exploiting available opportunities could significantly boost the productivity and profitability of beef cattle production in the region.

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