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Socio-Economic Importance of Sheep Production in Central Rift Valley of Oromia Regional State, Ethiopia

Genet Dadi, Ashebir Worku

Oromia Agricultural Research Institute, Adami Tulu Agricultural Research Center, Batu, Ethiopia

Email address:
sosnadadi@gmail.com (Genet Dadi)

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Abstract: The objective of this study was to socio-economic important and marketing systems of farmers who keep indigenous sheep found in Adami Tulu JidoKombolcha and Bora districts from East Shoa zone as well as Kofele and Asasa from West Arsi zone of Oromia regional state. The study was conducted using a semi–structured questionnaire followed by a focus group discussion. A questionnaire was administered to 180 sheep producing farmers in four districts with different numbers of households in each district. The parameters studied in the survey included socioeconomic characteristics, landholding, herd structure, reproduction and production of sheep, fattening practice, marketing system of sheep, and opportunities for sheep production. The results indicated that the mean sheep flock size per household was 14.5 and differ ($P<0.05$) between the study areas. The average flock size was higher ($P<0.05$) in Asasa, with negligible differences across the other areas. The selection criteria for the majority of households were larger body conformation followed by coat color for both male and female sheep. Approximately 92% of the farmers reported that they provided permanent housing for their sheep. The major feed sources offered to sheep in all study areas included natural pasture, crop residues, crop aftermath, and non-conventional feeds. The primary reason for keeping sheep was income. Feed shortage and the prevalence of diseases were the most pertinent constraints in all areas studied. Thus, efforts must be made to improve the genetics, management, and seasonal shortage of feed and fodder.

Keywords: Arsi-Bale Sheep, Constraints, Marketing System, Opportunities

1. Introduction

Ethiopia is endowed with abundant livestock resources of varied and diversified nature reared across several agro-ecologies [46]. Farm animals are an integral part of the country's agricultural system and are reared across different agro-ecologies of the country [51]. The habitats of indigenous sheep breeds extend from arid lowlands (pastoral and agro-pastoral production systems) to humid mixed farms in the tepid cool highlands of the sheep barley system [34].

Sheep are the second numerous farm animals next cattle with about 14 traditional sheep populations in Ethiopia and nine identified sheep breeds [43] and with a population of around 30.69 million heads of sheep [18]. Conferring to the reports of Solomon et al. [41], sheep production systems in Ethiopia are categorized into five subsystems: Highland cereal–livestock system, Lowland crop–livestock system, Agro-pastoral and pastoral systems, Sub-alpine sheep-barley system and Highland perennial crop system [41].

Native sheep in Ethiopia play diverse roles, including as sources of income, meat, skin, manure, and coarse hairy fleece. Also plays as a means of risk evading (during crop failures), especially under marginal productivity under low and erratic rainfall, severe land erosion, frost, and waterlogging problems [53]. Thus, sheep reared by smallholder farmers provide support for economic stability and complementary crop production [3, 48]. Sheep rearing also plays an important role in the cultural and social livelihoods and religious values of large and diverse human populations [22]. Rearing sheep can result in the enhancement of farm family nutrition by enhancing productivity at the farm.

In Gulf countries sheep meat have a huge demands. Demand and price for sheep are also increasing locally owing

to increased urbanization and income [27]. The demand for shoats is persistent, given that the population of the country is predictable to rise to about 129 million by 2030. However, the current production is unable to fulfill the increasing demand for export abattoirs with the required export quality slaughter animals [8]. Since production is not market oriented, supply is inconsistent. Currently, export abattoirs operate at 56% of their capacity.

The East Shoa and West Arsi zones of the Oromia regional state have huge potential for sheep populations, but there is no documented information on their production and marketing systems. Thus, the present study was conducted to assess the socioeconomic importance of sheep and marketing systems in these areas.

2. Materials and Methods

2.1. Description of the Study Area

Adami Tulu Jido Kombolcha [ATJK], Kofele, Asasa and Bora Four districts were selected for the current study Adami tulu Jido kombolcha is located at (07° 55'N latitude & 39° 45' E longitude), Bora (8°39′N latitude & 39°5′E longitude), Kofele (07° 00'N latitude & 38° 45' E longitude) and Asasa (07°06′N latitude & 39°12′E longitude) were purposely selected based on their sheep production potentials. The first two districts were selected to represent the East Sshoa zone and the remaining one representing the west Arsi zone of the Oromia Regional State of Ethiopia. The study areas were described separately for each district, and a map of the study area is shown in Figure 1.

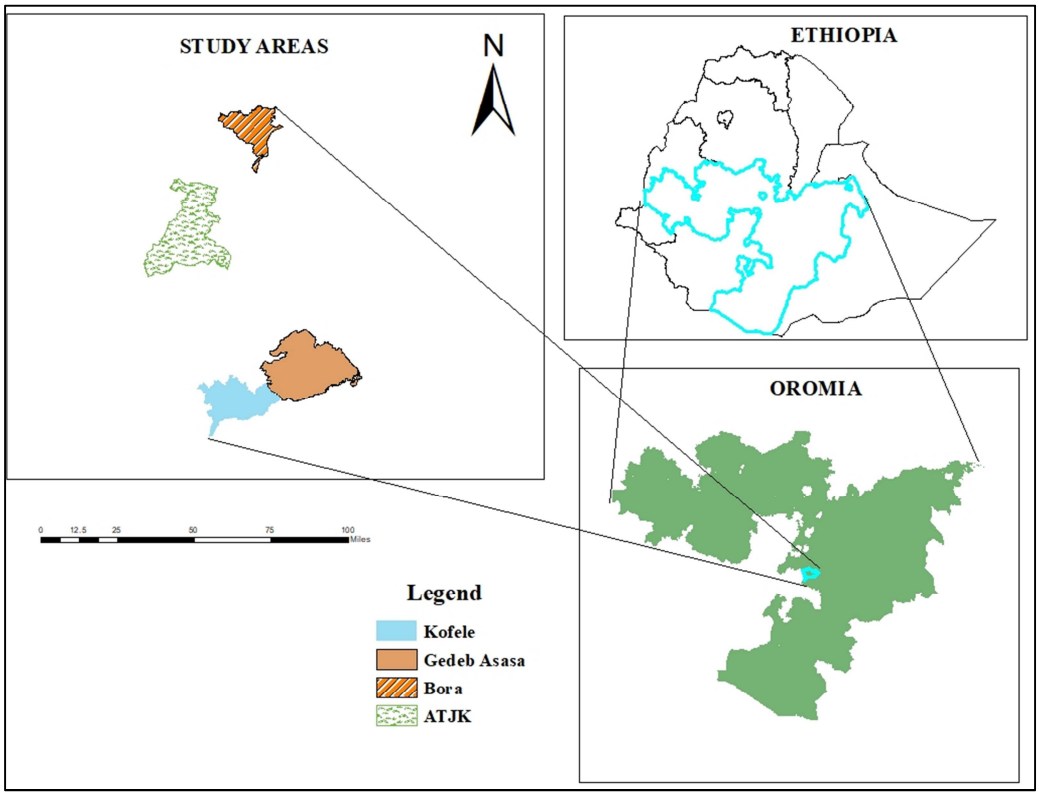

Figure 1. *Map showing the study areas.*

2.2. Sampling Procedures and Data Collection

A multi-stage purposive sampling technique was employed, in which the first districts known for sheep productivity in their respective zones were identified. This was followed by the identification of potential kebeles (the smallest administrative unit in the country) and villages. The potential for sheep production was used as the criterion for site selection. In addition to secondary data, discussions were held with zonal and district agricultural experts and development agents at the kebele level to select the sites.

A set of detailed semi-structured questionnaires was prepared to collect information on general socio-economic characteristics, landholding, herd structure, fattening practice, sheep marketing system, constraint of sheep production, and opportunities for sheep production. The general information list of the research [22] and Oromia livestock breed survey questionnaire [51] were used as a checklist in designing the questionnaire. The questionnaires were pre-tested prior to the commencement of the interview, and necessary rearrangements were made to ensure that the farmers easily understood it. In addition to information collected through individual farmer interviews, focus group discussions were held with elderly farmers, village leaders, and socially respected farmers, who are known to have better knowledge of the present and past social and economic status of the study areas, to gather detailed information on sheep production. Participants for group discussions were identified

with the assistance of the DA and kebele administrators. Accordingly, the pre-tested questionnaires were administered to 180 purposely selected respondents owning five or more sheep from the total number of households in the four districts for the present study. This was determined according to the proportionate sampling technique described by the research [6].

$$W=No*(A/B)$$

Where: - W= Number of household to be calculated from single selected districts

A= Total number of household per districts

B= Total number of household all four districts

No = the calculated sample size

Data Management and Analysis

The SPSS statistical computer software (SPSS for window, release 20.0, [45]) was used to analyze the collected data. Comparison of means was performed using one-way way ANOVA. The general learner model (GLM) of SPSS version 20 was also used to compare some socioeconomic parameters (family size, landholding, livestock holding, reproductive performance, and milk production) across the districts, and their significance differences were tested. The following one-way model was used:

$$Yij=\mu + Ds + eij$$

Where: Yij= Yth observation in ith class

M= Overall mean

Ds= Effect of districts, where i=1, 2, 3, 4

Eij=Rondom error

The chi-square test was used to test for independence between categorical variables.

Table 1. *Number of households selected per four Districts.*

Agro ecological zones	Selected Districts	Total number of household possessing Sheep	Proportion number of household selected per district
Highland	Kofele	23,100	56
	Asasa	24,651	60
Midland	ATJK	17,601	43
	Bora	8,213	21
Total	4 districts	73,565	180

3. Results

3.1. Demographic Characteristics of the Households

The results belong to family size, gender of the respondents, and education are presented in Table 2. The findings indicate that the family size differed across the studied locations, with higher numbers of respondents residing at Kofele, while the reverse was true for those residing in Bora. Most respondents were males. The educational status of the respondents also indicated that most of them were illiterate at ATJK and Bora while the respondents at Kofele and Asasa were barely literate (primary level education).

Table 2. *Family size (LSM ± SE), Sex & education (%) of the households.*

Descriptor	Districts				
	ATJK (N=43)	Bora (N=21)	Kofele (N=56)	Asasa (N=60)	Overall (N=180)
Family size	7.36± 3.85^{b}	6.16 ± 2.57^{c}	11.44 ± 5.11^{a}	8.82 ± 3.76^{b}	8.44 ± 4.36
Sex					
Male	64.4	80.0	82.2	95.6	80.6
Female	35.6	20.0	17.8	4.4	19.4
X^2 *Value*					14.1*
Education					
Illiterate	37.8	51.1	20.0	8.9	29.4
Primary school	17.8	28.9	22.2	37.8	26.7
Elementary school	35.6	17.8	33.3	33.3	30.0
Secondary school	6.7	2.2	11.1	17.8	9.4
Preparatory school	0.0	0.0	8.9	2.2	2.8
Higher Education	2.2	0.0	4.4	0.0	1.7
X^2 *Value*					41.49*

* & ^{abc} Rows with different superscripts are significantly different at (P<0.05), ATJK= Adami tulu Jido kombolcha District.

3.2. Livestock Holdings Per Households

The average number of livestock reared per household in the study area is presented in Table 3. The findings showed that the number of cattle was higher (P<0.05) at Kofele, whereas the reverse was true across Asasa and ATJK. The findings showed that the number of sheep was higher (P<0.05) at Bora, Kofele, and Asasa, whereas the reverse was true across ATJK. The number of goats was lower in Kofele and Asasa (P<0.05) than in the other locations. The number

of sheep reared at ATJK was lower (P<0.05) than at the other locations. The populations of chickens and horses varied across the studied locations.

Table 3. *Average (LSM ± SD) numbers of livestock reared per households in the study area.*

Livestock	Sps ATJK	Bora	Kofele	Asasa	Overall	P-value
Cattle	6.38 ± 5.71[b]	9.31 ± 9.18[b]	15.4±11.18[a]	6.64±3.63[b]	9.43±71	0.000
Sheep	10.4±7.11[b]	16.3±13.9[a]	16.1±12.08[a]	15.3±8.02[a]	14.5±10.84	0.030
Goats	3.31±5.64[a]	2.78±3.97[a]	0.31±1.22[b]	0.93±1.75[b]	1.83±3.79	0.000
Chicken	5.18±7.47[b]	8.38±8.19[a]	5.67±4.91[ab]	6.38±5.36[ab]	6.40±6.68	0.011
Horse	0.04±0.29[c]	0.07±0.25[c]	2.22±1.39[a]	1.38±1.23[b]	0.93±1.32	0.000
Donkey	1.53±1.60	1.71±1.48	1.96±1.41	1.42±1.12	1.66±1.42	0.306

[abc] Rows with different superscripts within the specified Species are significantly different (P<0.05), N=45 across each location; ATJK= Adami tulu Jido kombolcha District

3.3. Farming Experience and Land Holding Per House Hold

The farming experience of the study area was significantly different (Table 4), with farmers in the Kofele and Asasa districts having a higher experience of sheep rearing. The total land area showed a significant (P<0.05) difference among the four districts. The highest (4.68 hect) and lowest (1.97 hect) were found in the Bora and ATJK districts, respectively. The entire land-use pattern (cropland, fallow land, and grazing land) across the study districts showed statistically significant differences (P<0.05).

Table 4. *Farming experience and land holding per households in four districts.*

Descriptors	Districts				Overall (N=180)	P-value
	ATJK (N=43)	Bora (N=21)	Kofele (N=56)	Asasa (N=60)		
Farming experience	10.58 ±1.51[b]	13.18 ±1.66[b]	18.07 ±1.42[a]	16.00 ±1.62[a]	14.46 ±0.80	0.005
Land Holding (hect)						
Total land	1.97±0.24[c]	4.68±0.52[a]	3.69±0.31[b]	2.40±0.20[c]	3.18±0.19	0.000
Total crop land	1.81±0.22[b]	4.12±0.47[a]	1.99±0.16[b]	1.82±0.16[b]	2.43±0.16	0.000
Total fallow land	0.03±0.02[b]	0.08±0.04[b]	0.15±0.07[a]	0.24±0.07[a]	0.13±0.03	0.040
Total grazing land	0.13±0.04[b]	0.42±0.15[b]	1.53±0.18[a]	0.45±0.12[b]	0.63±0.8	0.000

[abc] Rows with different superscripts are significantly different at (P<0.05), ATJK= Adami tulu Jido kombolcha District.

3.4. Milk Production Performance

In the current study, a greater percentage of respondents from ATJK, Kofele, and Asasa reported practice of sheep milking and consumption (Table 5). This result also indicates that the consumption of sheep milk is bettered in the mixed farming and pastoral areas of the country. Consequently, it is of practical significance to research and promote the nutritional content and suitability of sheep milk in other sheep-producing areas of Ethiopia. Most of the respondents used sheep milk for household consumption, except Bora district, which did not practice sheep milking and consumption of sheep milk. The milk consumption, milking frequency, and average lactation length (days) of sheep at each study site are summarized in Table 5.

Table 5. *Milk production performances (LSM ± SE) of studied sheep breed.*

Parameter	Districts				Overall mean
	ATJK	Bora	Kofele	Asasa	
Production of milk in rainy season	0.63 ±0.13	0.00	0.62 ±.0.05	0.54 ±0.06	0.59 ±0.04
Production of milk in dry season	0.25 ±0.00	0.00	0.32 ±0.02	0.29 ±0.03	0.31 ±0.02
Lactation length in rainy season	3.00 ±0.00	0.00	2.87 ±0.81	2.79 ±1.06	2.84 ±0.90
Lactation length in dry season	3.00 ±0.00	0.00	2.00 ±0.91	2.28 ±0.83	2.16 ±0.88
Frequency of milking in rainy season	1.00 ±0.00	0.00	1.06 ±0.25	1.04 ±0.21	1.05 ±0.23
Frequency of milking in dry season	1.00 ±0.00	0.00	1.04 ±0.20	1.06 ±0.24	1.04 ±0.21

ATJK= Adami tull Jido kombolcha, Rows with different superscripts within milk production performance are significantly different (P<0.05)

3.5. Reproductive Performances

The findings pertaining to the reproductive performance of the ewes and rams is presented in Table 6. The findings showed that the age of ewes and rams at first service did not vary across the studied locations. The findings also show that lambing interval of the ewes varied (P<0.05) across the studied locations, with the lowest at Bora and the highest at Kofele. The age at first lambing and the average occurrence of multiple births per lifetime did not vary across the study areas.

Table 6. *Reproductive performances (LSM ± SE) of studied sheep breed.*

Parameter	Districts				Overall mean
	ATJK	Bora	Kofele	Asasa	
AFS female (months)	8.00±2.23	7.89±2.14	7.87±1.90	8.04±2.08	7.95±2.08
AFS male (months)	7.44±1.75^{ab}	8.02±2.1^{a}	7.18±1.24^{b}	7.82±1.85^{ab}	7.62±1.78
Age at first lambing (month)	13.6±11.87	13.0±2.02	13.4±1.79	13.2±1.9	13.3±1.90
Lambing interval (month)	7.87±0.23^{b}	7.89±0.14^{b}	8.49±0.17^{a}	8.09±0.14^{ab}	8.08±0.07
Average occurrence of multiple birth per life time	3.47±0.17	3.36±0.14	3.42±0.16	3.53±0.18	3.44±0.08

ATJK= Adami tull Jido kombolcha AFS= age at first service; Rows with different superscripts within reproductive performance are significantly different (P<0.05)

3.6. Sheep Marketing Systems in the Area

The reasons for selling sheep (Table 7) were the need for cash income, due to old age, crop failure, fattening, and difficulty in management, in descending order in Kofele and Asasa districts. Crop failure is the primary reason for selling sheep, followed by the need for cash income. Old age is difficult to manage and fattening in the ATJK district. The respondents in the study areas mentioned three reasons for buying sheep from the market and farmers at the farm gate (Table 7). Buying for replacement was the main reason, ranked number one in all districts studied. The district market is the main source of sheep purchased by farmers, followed by farms.

Table 7. *Reason of selling, buying and Market place of sheep by the respondents.*

Particulars	ATJK (N=43)		Bora (N=21)		Kofele (N=56)		Asasa (N=60)		Overall (N=180)	
	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank
Reason of selling										
Need of cash income	39.53	1	19.05	3	35.71	1	38.33	1	35.56	1
Due to old age	11.63	3	42.86	1	23.21	2	28.33	2	24.44	3
Crop failure	25.58	2	23.81	2	17.86	3	18.33	3	20.56	2
Fattened	9.30	5	4.76	5	14.29	4	11.67	4	11.11	5
Difficult in management	13.95	4	9.52	4	8.93	5	3.33	5	8.33	4
Reason of buying										
Replacement	90.70	1	47.62	1	91.07	1	95.00	1	87.22	1
Household consumption	9.30	2	38.10	2	8.93	2	5.00	2	11.11	2
Trading	0.00		14.29	3	0.00		0.00		1.67	3
Market place of sheep										
Farm gate	20.93	2	14.29	2	69.64	1	61.67	1	48.89	2
District market	60.47	1	52.38	1	12.50	2	15.00	2	29.44	1
Both	18.60	3	33.33	3	17.86	3	23.33	3	21.67	3

3.7. Marketable Age of Sheep and Sex

The results (Table 8) showed that the majority of the respondents sold sheep falling into two age groups: 6 months to 1 year and breeding rams in the case of males. In the case of females, they were focused on 6 months to 1 year and barren ewes. The results show that the minimum percentage of castration was sold in the Kofele and Asasa districts, which may be less practice of castration of sheep in the areas.

Table 8. *Preference of household for sale of sheep by sex and age group.*

Sex	Age group	ATJK (N=43)		Bora (N=21)		Kofele (N=56)		Asasa (N=60)		Overall (N=180)	
		%	Rank	%	Rank	%	Rank	%	Rank	%	Rank
Male	Less than 6 month	11.11	3	12.22	2	8.89	4	10.00	3	18.63	3
	6month – 1 year	18.89	1	22.22	1	24.44	1	25.00	1	39.95	1
	Breeding Ram	16.67	2	12.22	2	16.67	2	16.11	2	27.21	2
	Castrated	10.00	4	11.11	3	8.33	3	2.78	4	14.22	4
Female	Less than 6 month	10.00	4	8.89	4	7.87	4	10.00	3	15.46	4
	6month – 1 year	16.67	2	18.89	1	22.78	1	21.11	1	33.49	1
	Breeding Ewe	11.67	3	11.11	3	13.89	3	15.56	2	22.01	3
	Barren Ewe	18.89	1	17.22	2	17.22	2	15.56	2	29.04	2

3.8. Castration, Fattening Practice and Periods of Fattening Sheep

The findings pertaining to the castration and fattening of the rams in the studied locations are presented in Table 9. The results showed that castration was practiced only in Bora pigs. The findings also show that supplementary feed for rams is provided only at ATJK and Kofele. However, in most cases, rams were not provided with supplementary feed. The results also indicate that ATJK and Bora are castrated using

modern techniques. Most rams here are not fattened, and even if they are, fattening is carried out coinciding with religious festivities. Results regarding the season of sheep marketing (Table 9) indicated that during major cultural and religious holidays, especially after long fasting by Orthodox Christian believers (during this fasting period, consumption of animal products is strictly banned), there is a sharp increase in demand for meat.

Table 9. *Castration, fattening practices and Periods (%) of sheep in the study area.*

Parameters	ATJK	Bora	Kofele	Asasa	Overall	X^2 *Value*
Castration practice						*25.34**
Yes	42.2	53.3	26.7	6.7	32.2	
No	57.8	46.7	73.3	93.3	67.8	
Castration method						6.34ns
Modern	47.4	66.7	33.3	33.3	57.7	
Traditional	36.8	29.2	58.3	66.7	39.7	
Both	15.8	4.2	8.3	-	8.6	
Supplementary feed for castrated sheep						*8.41**
Yes	52.6	20.8	66.7	33.3	41.4	
No	47.4	79.2	33.3	66.7	58.6	
Practice Fattening						*20.41**
Yes	28.9	28.9	66.7	55.6	45.0	
No	71.1	71.1	33.3	44.4	55.0	
Periods of fattening						*21.01**
Any time	40.0	0.00	20.0	28.0	22.9	
New year	13.3	0.00	3.3	4.00	4.8	
Religious holy days	46.7	100	76.7	58.0	72.3	

ATJK= Adami tull Jido kombolcha district,* = Significant at (P< 0.05), ns= Not significant

4. Discussion

4.1. Demographic and Socio-Economic Characteristics of the Households

The findings pertaining to the demography and socio economy of the respondents show that the family size was greater among the respondents of Kofele which is in accordance with the findings [30] around Dire Dawa and [15] in low land areas of South Omo Zone. This may also be ascribed to the landholdings of the respondents; studies [35] have indicated that landholdings and family size may be correlated.

Most respondents were male, which is in accordance with the findings [12]. Workneh and Rownalds [50] also reported that the majority of the households (94%) in Oromia region were male headed while the rest 6% were female headed. In Ethiopia (as in other tropical countries), most household heads are males [53]. The education levels of the respondents varied from illiterate to barely literate (primary/elementary levels of education), which makes it difficult for them to take up the intricacies of modern animal husbandry [52]. This also will result in poor recording of any livestock related activities. Hence, livestock extension agents/development agents need to devise methods by which modern livestock husbandry is imparted to rearers so that livestock development in general and sheep husbandry can be improved. Livestock improvement is correlated with the overall economic improvement of respondents [16].

4.2. Livestock Holdings Per Households in the Study Area

The livestock demography of the locations as presented in Table 3 indicates that the sheep population predominated in the study areas, followed by the cattle population. These findings are in close accordance with those [12], who reported that sheep are the dominant livestock among smallholder farmers in the mid-and highlands of Ethiopia. The number of sheep followed that of cattle, which may be because among the agrarian communities, bovines play multifarious roles, such as agricultural operations, milk, and manure [33]. The higher the number of children between the ages of 6 and 14 in households, the larger the stock of owned animals, ceteris paribus [13]. Land area can affect livestock ownership through its effect on the availability of animal feed from land and the wealth effect. The study further indicates that the respondents also reared many other species of livestock which may be ascribed to distribution of risks associated with rearing a single species of livestock [31].

4.3. Land Holding Per House Hold

The average landholding was 3.18-hectare (ha) Table 4). Approximately 3.8% of respondents were landless. There was no significant difference between the ATJK and Asasa districts in terms of the mean landholding. The mean landholding of the Bora district was significantly (P<0.05) higher than those of Kofele, ATJK, and Asasa, which were assigned for crop production. This value was slightly higher than the 1.93 ha reported by the author [12] for Gomma District and that of the Bahir Dar and Mecha Woredas (2.7 ha) reported by the author [7], and smaller than that of Metama

(6.17) [39]. It was also smaller than the total landholding in Alaba of SNNPR [48] and Bale highlands of Oromia [47]. The farmers in the study area allocated a larger proportion of their land to cereal crops, which is the main crop. This allocation of very little land for livestock feed/grazing may be due to the high production of food crops in the arias. Fallow land, which can also be a source of grazing, constitutes only approximately 0.13 ha.

4.4. Milk Production Performance

Sheep milk plays a significant role in the health and nutrition of young and elderly individuals. It is also known for its valuable and healing effects on people with cow milk allergies. These nutritional, health, and therapeutic benefits highlight the potential value of sheep milk and its specialty products [29]. It is more valuable over cow or human milk having better digestibility, alkalinity, buffering capacity, and certain therapeutic values in medicine and human nutrition, as a result the need of sheep milk as infant diet is growing rapidly worldwide [17] and it fetch higher price than cow milk. According to these authors, sheep milk is very similar in composition to breast milk. The current result show that boiled sheep milk alone or with coffee is principally given to children and sick household members as a medicine, and if there is extra, other household members will access it. From the reports of the interviewed participants, the frequency of milking was reliant on on the mode of milking in the household and feed availability (season). Some owners milked their ewes in the morning and left the afternoon milk for the lambs, while others who reported milking twice a day milked only one teat during milking and left the second for the lambs to suck. The frequency of milking based on feed availability could be either only in the morning during the dry season and twice during the wet seasons or only in the morning in both the wet and dry seasons.

4.5. Reproductive Performances

The reproductive performance of the rams and ewes, as presented in Table 7, indicates that the reproductive parameters of the rams and ewes did not vary across the study areas, which may be ascribed to the similar management of the rams and ewes across the studied locations. Besides the genotype of the breeds [54], districts had no significant effect on LI in Bong and Horro. The age at first lambing (AFL) of this study is in strong agreement with the reports of [48] for Arsi Bale sheep. Similar reports have also been reported by [43] for Gumuz sheep breed of Ethiopia. In contrary, the AFL observed in this study was higher than that reported by [23] for Gamogofa native sheep and by the research [21] for Illu Abba Bora native sheep. The differences observed in AFL may be associated with the management of the sheep, in addition to the genotypes being reared in the studied areas [54]. The AFL of sheep in the study locations was lower than that reported by the author [24] for Blackhead Ogaden sheep.

The results pertaining to the lambing interval (LI) recorded in this study are similar to the report of Zewdu [54] for Horro sheep. The current result of LI was lower than those reported by [5] for Konta and Tocha native sheep and [1] for sheep found around Diredawa. However, the lambing interval reported by [43] for the Gumuz breed compared to the present result under the traditional management system. LI is a trait that has a lot of economic importance; therefore, ewes with shorter LI are usually profitable, as higher numbers of lamb crops are available in a ewes' lifetime [33]. LI is a lowly heritable trait that can be improved through proper management of ewes and by improving the nutritional status of ewes [26].

The prolificacy of ewes can also vary across the study areas, which can be related to the availability of feed and fodder [54]. Prolificacy can also be improved by providing flushing rations prior to the mating of ewes [25].

4.6. Sheep Marketing Systems

There is an upsurge in the demand for the Ethiopian sheep and goats for both local and export markets [10]. Many studies have shown that smallholder farmers mainly use sheep and goats as a source of income [34, 20, 48, 29], which may show a higher demand for shoats. [9] Ethiopia exports chilled goat meat to five countries and mutton to the Gulf States of Saudi Arabia and the United Arab Emirates, which are the largest receivers [42]. Still, there is a very high degree of inter-annual disparity in traded volume, both within and across species. A huge number of Ethiopian animals are unofficially traded to the Gulf States via the borders of Somaliland, Djibouti, and Sudan [49, 8]. The net marketable off-take rate is very low over different periods for sheep and goats for smallholder farmers and pastoralists in Ethiopia [49, 8]. A similar report indicated that in 1999/2000, the average net marketable off-take rates of sheep and goats for smallholder farmers in the highland areas of Amhara, Oromia, and Tigray were 22 and 18%, respectively, while in 2004/05, the average net commercial off-take rates for smallholder farmers in the highland and lowland areas of Ethiopia were 7 and 8%, respectively [49]. In the case of the Borana pastoral production system, the average net marketable off-take rates of sheep and goats for the three-year period (2003–05) for large ruminant and shoats were 6 and 7%, respectively [8].

4.7. Marketable Age of Sheep and Sex

Farmers sell their animals in times of cash need, but the age category determined for selling will depend on the need for cash and its urgency. From the interviewed households, the majority (39.95%) sold the post-weaning ram age group, followed by breeding rams (36.7%), while post-weaning ewes (33.49%) were predominantly sold, followed by barren ewes (29.04).

4.8. Castration, Fattening Practice and Season of Marketing Sheep

The results, as indicated in (Table 9) pertain to castration and the provision of supplementary feed for this purpose. Castration is an important farm practice for the prevention of unwanted breeding [48]. Castrated rams are docile and are

used for fattening purposes [54]. The present findings are in close agreement with those [46] in Menz sheep. However, the number of respondents practicing castration varied across locations, which is in close agreement with [54] findings. The results also show that both modern (burdizzo) and traditional castration methods are used; this too varied across location findings is in close accordance with the observations [46]. The modern method of castration is usually bloodless; hence, the chance of infection is minimized [46]. The report by [14] disagrees with the current notion that farmers do not castrate rams because of the norms of society.

Fattening of the rams varied across locations, with higher incidences reported at Kofele and Asasa, which may be ascribed to the availability of crop residues, non-conventional feed, and concentrates in the area, which is in line with the results obtained by [4]. Fattening is usually carried out by correlating with holidays when the prices of rams are higher [36]. According to Solomon et al. [44], the economic benefit of sheep production could be enhanced by the introduction of finishing technology, selling animals after attaining the optimum desired market weight, which would have a positive effect on improving the standard of living of poor farmers and increasing export earnings. Fattening is usually carried out correlating with the holidays where the prices of the rams are higher [36]. Targeting holiday markets for fattened small ruminants has also been reported by different authors in other parts of Ethiopia [19, 48].

5. Conclusion and Recommendation

In Ethiopia, many sugarcane factories produce surplus bagasse; in some cases, the accumulation of this by-product has become a problem. On the other hand, there are many smallholder farmers who live near and around sugar factories but are not using sugarcane bagasse as animal feed.

In the present study, there were no statistically significant differences in daily weight gain (DWG), total weight gain (TWG), final body weight (FBW), and carcass characteristics of yearling Arsi bulls fed on the three feed options with sugar cane baggase as a basal feed. Even if this is the case, efforts must focus on the best way to use such a by-product, from both technical and economic points of view, by using appropriate dietary levels and applying the necessary physical or chemical treatments.

As there are many available feed resources that could be more effectively used as animal feeds in Ethiopia, more investigations must be carried out in order to identify the potential local feed resources that could be incorporated into the diets of animals. The use of such locally available feed resources by farmers will definitely increase their income, and hence their living standards, as such feeds are cheap and easily available.

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