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Assessment of On-Farma Reproductive Performance and Sheep Breeding Practice: A case of Dubulk District of Borana Zone

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ABSTRACT

This study aimed to assess on-farm reproductive performance, sheep breeding practices, and breeding objectives in the Dubulk district. In the current study, 150 households were selected and included in the survey. A total of 450 sample sheep were monitored for three months to collect quantitative data per 15-day interval. The data was gathered through structured questionnaires, focus group discussions, field observations, quantitative data collecting, and assessment of secondary data sources. The Body weight, body measurements, and qualitative records were taken and observed from each sheep. Within each sex group, the main effects of breed and dentition were fitted to the model for quantitative data analysis. In the Dubulk district, breeding was mostly uncontrolled mating without record keeping. The sheep population in the study area were plain, patchy, pied, body white, and blackhead. Accordingly, in Karsa damb, Lafto, and Dubulk center Kebele, male and female sheep were dominant coat colors of body white and black head, with proportions of 87.5 %, 80 %, 74.3 %, and 66.96 %, 73.04 %, and 66.1 %, respectively. Body weight was significantly affected (p<0.05) by the Sex and age of the sheep. In general, body weight and body measurements were higher for males than females and also increased as the age increased from the pairs of permanent incisors (0PPI) to the oldest age group (>2PPI). Feed shortage, frequent drought, and disease were the most important sheep production constraints. It was concluded that pastoral indigenous knowledge of the sheep breeding system needs to integrate the trait preference of pastoralists. Furthermore, lamb mortality and disease prevalence were among the most important constraints limiting the productivity of sheep breeding.

Keywords; pastoralism, on-farm, sheep breeding, reproductive performance

1. INTRODUCTION

Ethiopia is Africa's greatest livestock population, with 70 million cattle, 42.9 million sheep, 52.5 million goats, 57 million chickens, 8.1 million camels, 2.15 million horses, 0.38 million mules, and 10.80 million donkeys (CSA, 2020/21). Livestock production accounts for 30–35 percent of Ethiopia's agricultural GDP, 19 percent of the country's total GDP, and more than 85 percent of farm cash revenue (Benin et al. 2006). Sheep and goats provide 40 percent of agricultural households' financial revenue, 19 percent of the entire value of subsistence food generated from all livestock production, and 25% of overall domestic meat consumption (Hirpa and Abebe 2008).

Most of the sheep population of the country was kept by smallholder pastoral/farmers and their production was traditional (EARO, 2001). In Ethiopia, sheep and their products provide direct cash income through the sale of live sheep and hides. Thus, they are living banks for their owners. Hence, focusing on their development can be one way of reducing poverty and ensuring food security among the poor. Despite the large population of sheep and their contribution to both poor farmers and the national economy at large; their productivity is low due to low technical capacity (genotype), feed scarcity, diseases, poor infrastructure, and lack of market information and planned breeding programs and policies (Gemeda, et al. (2013).

Indigenous knowledge of animal breeding is developed through continuous practices used by livestock breeders to influence the genetic composition of their herd, and a valuable resource about the existence of breeds and their adaptive traits and can be a source of information about scientifically undocumented breeds and traits (Kohler-Rollefson, 2000). Indigenous knowledge includes cultural concepts about how to use an animal, local preferences for certain characteristics, such as color size, and behavioral patterns, disease and drought tolerance, selection practices for certain qualities (offspring testing), social restrictions on selling animals, and leading closed gene pools. The pastoralists' Indigenous Knowledge has been developed from direct interaction of the user groups and their herds in a typical natural and social environment. It operates under particular economic and political frame conditions, and it is influenced by certain cultural values. It was the product of pastoralists' adaptability in reaction to external interference, and is therefore dynamic (Emery 2000). Pastoralists in Ethiopia like the other African countries have continuously suffered from a long history of political, economic, and socio-cultural marginalization. Indigenous knowledge of pastoralists in sheep breeding practices, selection criteria, and evaluation of the productivity level of sheep population in their habitat is a prerequisite for genetic improvement in smallholder levels (Tibbo M, et al., 2009). Therefore, the first step towards progress was defining breeding goals, adequate techniques, and methodology for measuring the production performance of animals. For breeding purposes, pastoralists select sheep based on color, body size/length, tail size, appearance, horn presence/absence, and ear size and shape ranked in decreasing order of importance to select rams in southern Ethiopia Yosef (2007). Across all the production systems, overall appearance is the most preferred attribute for selecting both breeding rams and breeding ewes.

A genetic improvement program requires the definition of comprehensive breeding goal traits incorporating the specific needs and social circumstances of the target group as well as ecological constraints. The description of the production environment, breeding objectives, traits to be selected, the decision about breeding method, and breeding population have to be considered in designing breeding programs (; Kosgey and Okeyo, 2007). The program was mainly focused on Indigenous genetic resources of sheep and traditional breeders involved in all steps of the breeding program (Tibbo et al.; 2009; Haile et al. 2011). Thus, the knowledge gap usually led to the setting up of unrealistic breeding goals in the design of livestock genetic improvement programs, the consequence of which often endangered the conservation of indigenous animal genetic resources (Zewdu et al., 2006).

Sheep traits need to be recorded for genetic and management improvement. Given the current and future growing demand for sheep products and the role of sheep in food production in the subsistence of Ethiopian agriculture, a step towards improvement plays a great role to reduce poverty among the rural poor and produce more food to feed the ever-increasing human population. However, the lack of recorded data on the on-farm performance of sheep breeds and all aspects of management, the lack of regular sheep health programs, and market information make it difficult to assess the importance and contribution of past attempts to improve the sector. As a result, there is a need to assess management practices and define the present performance of sheep in every corner of the country. Even though different research has been conducted by different research on sheep breeding and performance evaluation practices at the farmers' level as well as on-station at the research center, a study on the performance of Blackhead Ogaden sheep in the Borana general has not yet been conducted. Therefore, this study was designed to assess on-farm reproductive performance and sheep breeding practices in the Dubulk district.

2. MATERIALS AND METHODS

2.1. Study Areas

The study was conducted in the Dubulk district which is located in the southern part of the Borena zone in the Oromia region. Generally, the Borena area represents a vast lowland area in Southern Ethiopia at a distance of 565 km far from Addis Ababa the capital city of Ethiopia. The Borana zone land area covers about 95,000 km^2. The area bordered Kenya to the South, the Somali region to the East, the Guji zone to the North, and the Southern People Nation and Nationalities Region to the West. The Borena plateau gently slopes from high mountain massifs (1650 m.a.s.l) in the North to (1000 m.a.s.l) in the South bordering Kenya with slight variation due to central mountain ranges, and scattered volcanic cones and craters (Coppock, 2002). the study area of Dubulk district which was located on the way from Yaballo to moyale, in the southern part of the Borane zone, distance from Yaballo was 65 km, and the land area covering about 24,132.52 $km^{2,}$ and is located at the zone was situated between 3^0 36'-6^0 38' North latitude and 3^0 43'–39^0 30' East longitude. The map of the study areas is presented in Fig. 1.

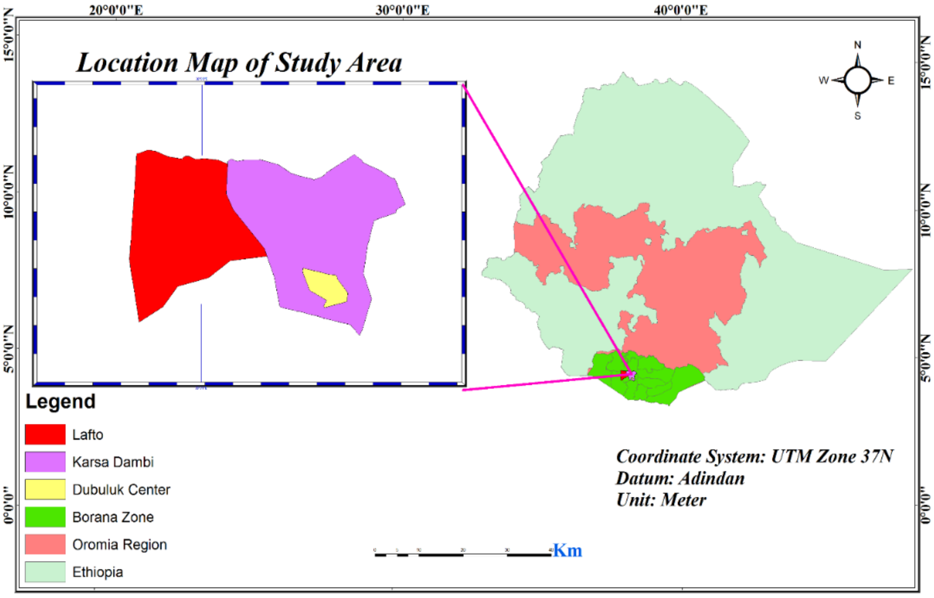

Figure 1. Maps of the study areas

2.2. Sampling Technique

The research was carried out in Dubulk Districts. A rapid field survey was conducted before the main survey to validate the geographical distribution and concentration of sheep breed populations. Three (3) rural kebeles were selected based on sheep population, agroecology, accessibility, and security. A basic random sample procedure was used to identify and list the households. Yamane's (1967) sampling approach was used to determine the number of respondents per kebele. As a result, the household sample size was calculated using the technique above with a marginal error of 8%. Accordingly, a total of 150 households were selected, with 51 HHs from Karsa Dambi kebeles, 50 HHs from Lafto kebeles, and 49 HHs from Dubulk central kebele.

$$n_i = \frac{N}{1+N(e)2}$$

Where:

n = represents sample size,

N represents the total population size

e= sample error

Kersa Dambi kebeles, $\mathbf{n_i} = \frac{\mathbf{N}}{\mathbf{1+}\,N(e)\mathbf{2}}$ = 1,185/1+ 3,465(0.08) ^2 = 1,185/23.176 = 51

Lafto kebeles, $\mathbf{n_i} = \frac{\mathbf{N}}{\mathbf{1+}\,N(e)\mathbf{2}}$ = 1,155/1+ 3,465(0.08) ^2 = 1,155 / 23.176 =50

Dubulk center kebele, $\mathbf{n_i} = \frac{\mathbf{N}}{\mathbf{1+}\,N(e)\mathbf{2}}$ = 1,125/1+ 3,465(0.08) ^2 = 1,125/ 23.176 = 49

A total of 450 sheep populations were monitored for data gathering, with three sheep per HH. At the outset of the investigation, selected animals were identified using a permanent marking on their bodies, with enhancements to use phenotypic variables such as color. Households were sampled based on a minimum flock size of three (3), one-year experience in small ruminant husbandry, and willingness to complete a questionnaire.

2.3. Data Collection Procedure

To collect qualitative traits and pastoral sheep breeding practice, a questionnaire, group discussion, field monitoring, quantitative traits, and secondary sources were employed. Structured questionnaires were prepared to collect information from each flock owner and key informant via an interview on the existing socio-economic characteristics of the household (sex, age, education level, household size, livestock possession, and major production constraints), reproductive performances (age at first lambing, lambing interval, litter size, and lambing pattern), flock structure, management practices, and major diseases of sheep in the area. Focal group discussion was held with a recommended group size of 8-12 HHs that included a variety of stakeholders at each kebele. District experts, developmental agents (DAs), model pastoralists, and village leaders, as well as elderly female and male members of society who were known to have a better understanding of the current and past social and economic situation of the area, were among the stakeholders. The focus group discussion (FGD) was focused on the history of the breeding practices of sheep breed, sheep production, pastoral indigenous knowledge of sheep breeding practices, and management practices.

2.4. Flock monitoring

For quantitative data collection, 450 sample flocks were followed for three months and data was collected every 15 days. During the initial visiting period, all lambs were recognized using a permanent marker on the body of the lambs and the name of the owner of the lambs. The monitoring lasted for three (3) months to collect reproductive data (age at first lambing, lambing interval, and litter number), as well as productive (birth weight and weaning weight) and mortality data. Weaning weight was recorded every 15 days for 90 days. Every 15 days, body weights were collected on a spring balance scale (50 kg capacity with 100g precision). Qualitative characteristics such as coat color, type, coat color pattern, head profile, hair type, and ear type are all examples of qualitative characteristics.

2.5. Data Management and Analysis

The quantitative and qualitative data from the questionnaire (survey) were entered into the Statistical Package for Social Sciences (SPSS, 2011 ver. 20). According to the following methodology, an index was generated to offer an overall ranking for qualitative data such as the objective of keeping sheep: For each qualitative variable, the index equals [3 for rank 1 + 2 for rank 2 + 1 for rank 3] divided by [3 for rank 1 + 2 for rank 2 + 1 for rank 3] for all qualitative variables considered. Data on reproductive and growth performance were subjected to the Statistical Analysis System's GLM technique (SAS, release 9.1, 2003). The F-test was used to determine the statistical significance of quantitative data. The effects of location (1), sex (2), and parity (3) were all fixed variables in the model.

The statistical fixed model was explained as follows:

Yinlmjyo=μ +Li +Xj +Pl + Bm +Sn +eijlmnyo, Where;

Yinlmjo =Weights and weaning of the n^{th} lamb

μ =the overall mean

Li = the fixed effect of the i^{th} location

Xj = the fixed effect of jth sex

Pl = the fixed effect of l^{th} parity

Bm = the fixed effect of m^{th} type of birth

S_n= the fixed effect of the n^{th} season, einlmjo= the random error

Descriptive statistics such as mean, standard deviation, frequency, and percentage were used to summarize the survey results.

3. RESULTS AND DISCUSSION

3.1. Households Information and Pastoralist Activities

In the current study, 150 households were selected and included in the household survey. The results of the demographic and socioeconomic features of the interviewed households were reported (Table 1).

Table 1. Households information.

Factors and levels	Research sites			
Family size	Karsa dambi kebele %	Lafto kebele %	Dubulk center kebele %	Mean ± SD
Sex				1.02 ± 0.14
Male	88.23	84	91.8	
Female	11.76	16	8.2	
p-value	0.46	0.18	0.25	
Educational level				1.36± 0.72
Illiterate	66.6	60	51.02	
Reading and writing	21.6	18	28.6	
Primary	7.84	14	12.24	
Literate	3.92	8	8.16	
p-value	0.001	0.072	0.009	
Age of respondent				1.84±0.62
20-30	23.53	20	28.57	
31-40	35.3	32	38.77	
41-50	31.4	26	24.48	
51-60	5.88	20	4.1	
>60	3.92	2	4.1	
p-value	0.07	0.07	0.08	

N= number of household respondents; Illiterate = unable to read and write; Literate = having formal education of grade 4 to above

The majority of households in the study areas were male-headed. Female-headed households indicated that they were either widowed or divorced. The data showed there was a significant difference (P<0.05) between male and female heads of household in the research areas of study kebeles.

The average mean educational level in Karsa Dambi kebele was (1.390.75), which was significantly higher (P<0.05) than (1.360.72) Lafto kebele and (1.330.69) Dubulk center kebele. However, there was no significant difference (P>0.05) between the study kebeles.

Several studies in Ethiopia (Kosgey and Okeyo, 2007; Lishan, 2007; Tesfaye, 2009; Tesfaye, 2010; Grum, 2010) indicate that the majority of sheep owners are unable to read or write. In the same way, the current study found that the majority of sheep owners in the Karsa Dambi, Lafto, and Dubulk center kebele were illiterate. Shiferaw (2006) reported that 90 % of respondents in the Fentalle area of Oromia's East Shoa zone were illiterate. Furthermore, households in the Karsa Dambi, Lafto, and Dubulk center kebele were literate at 3.92 %, 8%, and 8.16 %, respectively.

3.2. Livestock Composition and Sheep Flock Size

The overall average of livestock species held by each household was reported (Table 2). The major livestock species observed in the study areas were small ruminants (goats and sheep), cattle, camels, and donkeys. As a result, livestock composition in the study kebeles was not significantly different (P>0.05). The result obtained in the current study related to the lowlands, a larger flock size of 16.0 for Gumuz sheep and 19.2 for Blackhead Somali sheep were reported by Solomon (2007) and Fekerte (2008), respectively.

The percentage of Sheep and goats composition showed the predominant population across the study areas accounting for 30.86%, 33.32%, and 29.46% for sheep and (32.03%, 30.34%, and 32.70% for goats in Karsa dambi, Lafto, and Dubulk center kebele, respectively. Livestock species that constitute the largest share in the value of livestock assets of a household were defined as the principal animal (Fredu et al., 2009). The percent share of sheep was relatively smaller in total livestock availability at Dubulk Center Kebele where an average of cattle possession (22.95%) higher than Karsa dambi kebele (21.80) and Lafto kebele (21.87). The survey result revealed there was no significant difference (P<0.05) in livestock population across the study kebeles.

The average mean flock size for same age (less than 6 months in both male and female) sheep in the study areas was 5.08±1.53 at Karsa Dambi kebele, 5.86±1.67 at Lafto kebele, and 4.27±1.28 in Dubulk center kebele. The data showed that there was a significant (P<0.05) lower than the two kebeles.

The average mean of sheep at age 6 months to 1 year was 4.49±1.55 in Karsa Dambi kebele, 4.43±2.18 Lafto kebele, and 2.53±1.25 Dubulk center kebele. The result of the Dubulk center kebele was significantly lower (P< 0.05) than the result of the reported two kebeles. In the Karsa Dambi, Lafto, and Dubulk center kebele, breeding males were found to be 1.31±0.477, 1.37±0.60, and 1.14±0.35, while breeding females were found to be 9.43±2.66, 9.52±2.48, and 6.75±1.97. The higher proportion of breeding females in the flock followed by Lambs aged less than one year in all study areas agreed with the findings of other researchers in Ethiopia (Tsedeke, 2007; Tesfaye, 2009; Belete, 2009).

Across all research sites, there was a higher proportion of adult females (over 1 year) than other age groups, indicating that females are kept for breeding. Solomon's (2007) finding was contradicted by the current study working with Gumuz sheep revealed that mature females made up 42.58 percent of the flock. The lower number of youngest male lambs compared to the youngest female lambs could be related to the marketing of younger male lambs over female lambs.

According to the respondent report 3.27%, 2.83%, and 2.47% castrated were lower than the average castrated flock sizes (4.2, 5.0, 6.7, and 6.97) reported for the southwest of Ethiopia Alaba reported by (Tsedeke, 2007), Fentale (Shiferaw, 2007) and around Dire Dawa (Aden, 2003), respectively. Small flock size result in the study area was identified as the limiting factor in applying within breed selection at the household level. Furthermore, the level of inbreeding was high (Jaitner et al., 2001). From this result, it can be concluded that pastoralists in the study area sheep keep weaned lambs for a long period which might be attributed to the poor growth rate performance of sheep.

Table 2. Livestock composition and flock size per household in the study area

Descriptor	Karsa Damb kebele (N = 51)		Lafto kebele (N = 50)		Dubulk center Kebele (N=49)		Overall	P-value
	Mean ± SD	%	Mean ± SD	%	Mean ±SD	%		
Cattle	12.88±6.94	21.80	14.36±7.00	21.87	12.96±5.46	22.95	13.4±6.46	0.063
Goats	18.92±7.74	32.03	19.92±7.17	30.34	18.47±7.40	32.70	19.1±7.44	0.067
Sheep	18.23±8.01	30.86	21.72±7.96	33.32	16.64±6.76	29.46	18.86±7.58	0.002
Donkey	2.57±1.62	4.35	2.60 ± 1.68	3.96	2.59 ±1.67	4.59	2.59±1.66	0.001
Camel	6.47±3.56	10.95	7.04 ± 5.21	10.72	5.82±2.81	10.30	6.44±3.86	0.004

N = number of household respondents, SD = standard deviation

3.3. Sheep feeding and watering resources

The availability and quality of feed are largely determined by meteorological and seasonal conditions. During the dry seasons, pastoralists reported a lack of feed and water. The current survey also revealed the scope of the problem in the research areas. Natural pasture, fallow land, and hay were among the feed resources recorded in the research areas (Table 3). Grazing on natural pastures was found to be the most important source of feed for pastoralists in the study district. Natural pasture (shrubs and bushes) was the most common feed source in all study regions during both the dry and wet seasons.

Natural grass was the most common source of nutrition for sheep in the study area during the rainy season. The importance of fallow lands as a feed resource for sheep was also reported by Berhanu. (2002), Improved pasture and Hay, on the other hand, were used as dry-season feed supplies in the research area due to the importance of fallow land. In Karsa dambi, Lafto, and Dubulk center kebele, respectively, fallow land and improved pasture (kallo) played a role as a feed resource during dry seasons. To alleviate the current feed scarcity, it was necessary to investigate the most efficient use of available resources, which may include hay production and grazing pasture conservation.

Table 3. Feed resources in the study areas during rainy and dry seasons

Type of Feed Resources and Research Sites	**Seasons**			
	Rainy season		Dry season	
Karsa Dambi kebele	N	Percent	N	Percent
Natural pastures	39	76.47	32	62.74
Grazing pasture	11	21.56	10	19.61
Fallow land	-	-	4	7.84
Improved pasture	-	-	3	5.88
Hay	1	1.96	2	3.92
Total	51			
Lafto Kebele				
Natural pastures	38	76	33	66
Grazing pasture	10	20	9	18
Fallow land	-	-	-	-
Improved pasture	-	-	6	12
Hay	2	4	2	4
Total	50			
Dubulk center kebele				
Natural pastures	36	73.47	35	71.43
Grazing pasture	10	20.41	9	18.37
Fallow land	-	-	1	2.04
Improved pasture	-	-	3	6.12
Hay	3	6.12	1	2.04
Total	**49**			

N= number of households

3.4. Disease

The most common sheep disease in the study district was identified (Table 4) . Pasteurellosis, liver fluke, pneumonia, coenuruses, and lungworms were the most often reported sheep diseases in the research area. The prevalence of certain diseases, on the other hand, varied according to the season. The present study was similar to the disease problems reported in Ethiopia by (Tesfaye, 2009; Grum, 2010; Dereje et al., 2013).

According to the respondents' of Karsa dambi Kebele ranked 1st, 2nd, and 3rd by index (0.39, 0.27, and 0.18), liver fluke (bovine fascioliasis), lungworm, and coenuruses (sirgo). The Lafto and Dubulk center kebele lungworm, liver fluke, and coenuruses (sirgo) scored first, second, and third, respectively, with indexes of (0.43, 0.38, and 0.13) and (0.41, 0.26, and 0.21). Diseases such as liver fluke and diarrhea were more prevalent during the rainy season and during the dry season, when some leaves were still growing, and after eating within snail contact, liver fluke, and diarrhea illness assaults occurred. This could be because grazing grass regions differ in nature. In the Dubulk area, there was a significant frequency of liver fluke and lungworm. However, the majority of the respondents don't have access to veterinary services and rely on unprescribed drugs from the open market in Dubulk.

The majority of pastoralists rely on contemporary pharmaceuticals obtained from government facilities and legally accessible markets. When sheep were affected by diseases such as pneumonia, liver fluke, and skin disease, several pastoralists in the research region stated that they used traditional therapies such as the root of the tree and iron tag based on the disease of animals. However, this practice was not supported by science. Contaminated urine for animal diseases like coenuruss disease and anthrax were among the diseases received. This could be easily accomplished by burying or burning the head of a slaughtered sheep to prevent domestic dogs from eating it, as the dog was the intermediary host for the life cycle's continuation.

Table 4. Ranking of sheep disease prevalence in study areas.

Local Name/ common name	**Karsa kebele**			**Dambi**		**Lafto Kebele**			**Dubulk Kebele**			**Center**
	Rank			Index	Rank			Index	Rank			Index
	1st	**2nd**	**3rd**		**1st**	**2nd**	**3rd**		**1st**	**2nd**	**3rd**	
Lungworm (CCPP)	8	29	2	0.27	1	33	5	0.38	3	33	0	0.26
Liver fluke	36	5	1	0.39	36	11	0	0.43	34	10	0	0.41
Diarrhea	0	10	17	0.12	11	0	1	0.11	2	2	10	0.07
Pneumonia	1	0	9	0.04	0	4	10	0.06	0	0	1	0.00
Coenuruses	6	7	22	0.18	2	1	31	0.13	10	4	23	0.21
Pasteurellosis	0	0	0	0.0	0	1	3	0.02	0	0	15	0.05

Index= sum of (3 for ranked first + 2 for ranked second + 1 for ranked third) for each disease within a production system of households divided by the sum of (3 for ranked first + 2 for ranked second + 1 for ranked third) for all of the diseases within household a production system.

3.5. Pastoralist Sheep Breeding practices

Indigenous knowledge as a source of information scientifically undocumented breeds understanding and traits (Kohler-Rollefson, 2000). Indigenous knowledge of sheep breeding was made up of various concepts and practices used by livestock breeders to influence the genetic composition of their herd.

Breeding of sheep was an uncontrolled mating system (Table 5). According to respondents, uncontrolled mating systems were recorded at 98.04%, 96.0%, and 100% in Karsa Dambi, Lafto, and Dubulk Center Kebele, respectively. The primary reason for uncontrolled mating was a lack of awareness, use of communal grazing land, and watering points. All interviewed respondents in the study areas kept their breeding male sheep in their flock.

The pastoralists use their knowledge to identify sire breeding. The majority of the respondents interviewed reported that they were able to identify the sire depending on a newborn lamb by relating the lamb with the color and appearance/conformation of a male breed. Pastoralists in the study areas kept average breeding males for above three (3) years with a range of 1 to 5 years. The households reported that had no side effects of inbreeding. This might be a lack of awareness of the disadvantages of inbreeding.

Table 5. Pastoralists' Indigenous Knowledge in sheep breeding at study areas

Breeding knowledge	**Karsa Dam b kebele**	**Lafto kebele**	**Dubulk center kebele**
	%	%	%
sire of the lamb			
Yes	96.1	100.0	97.95
No	3.92	-	2.04
Do you allow inbreeding?			
Yes	100.0	100.0	100.0
No	-	-	-
effect of inbreeding			
Yes	1.96	4	6.12
no	98.04	96	93.87
have breeding ram			
yes	96.1	98.0	95.91
no	3.92	2.0	4.08
mating systems			
uncontrolled	98.04	96.0	100
controlled	1.96	4.0	-

N = number of respondents

The predominance of uncontrolled mating in sheep production and small flock sizes potentially increased the level of inbreeding. The majority of breeding males originated from their flocks, which might be an increased rate of inbreeding. According to Kosgey (2004), inbreeding can be minimized by communal herding which allows breeding females from another flock to mix with breeding males of other flocks, early castration of undesired males, and rotational use of breeding males.

In study areas, most of the community practiced communal sharing of grazing lands which could increase the rate of inbreeding through the use of related breeding males from the sub-populations. Mixed herding and sharing males could potentially help to decrease the risk of inbreeding. For the upcoming breeding program, this could be an opportunity and it has to be strengthened. Pastoralists should also need to be convinced about the disadvantages of inbreeding and the benefits of improved animals and they should develop an interest in keeping better males for breeding rather than selling at younger ages or castrating for fattening.

3.6. Sheep Trait Preference for Breeding

Pastoralists prefer traits, such as body size, coat color, growth rate and drought tolerance (adaptability), tail type, and reproduction rate for sheep breeding (Table 6). Preference for coat color was associated with socio-cultural practices, market demand, drought tolerance, and disease tolerance. Among the wide range of colors, a pastoral prefers white with black head colors and brown coat color. The current study was in line with the Halima et al. (2012) observation that, the black coat color was not preferred by the producers in all study areas. In contrast, black and white colored animals were less preferred by almost all respondents. This might be due to less demand in the market and ceremonies or weddings. Less preference for white coat color by pastoralists in the study area was associated with the belief that white-colored animals are more prone to drought as they could easily be damaged. The reported preference for coat color pattern matches the observed patterns in sample flocks, where the population's uniform colors were more common than mixed ones, but moreover dominated by body white with black head color types. mmm

Sheep breed Selection practices depend on traits the ability of social restriction on selling animals and leading closed gene pools. Among the preferred traits, body size was the most preferred and frequently ranked trait followed by coat color as well as tail types ranked 3rd. However, in Lafto and Dubulk Center Kebele's reproduction rate ranked 3rd. As a result, sheep keepers gave more weight to cash income generation traits than meat production. This implies that designing a sheep improvement strategy in the area should primarily target cash income and meat production traits. Whereas, in study areas, both cash income and meat production traits were important and should be considered together. Therefore, a sheep breeding improvement intervention program should be designed to consider these differences accordingly.

Table 6. Ranking of sheep trait preference for breeding

Traits preferred for breeding	**Karsa Dambi Kebele**				**Lafto Kebele**				**Dubulk Center kebele**			
	Rank			Index	Rank			Index	Rank			Index
	1st	2nd	3rd		**1st**	2nd	3rd		**1st**	2nd	3rd	
Body size	30	4	2	0.33	28	3	4	0.30	29	3	5	0.32
Coat color	7	23	07	0.24	6	27	7	0.25	6	26	7	0.25
Growth rate	0	12	0	0.08	0	0	11	0.04	0	0	9	0.03
Reproduction	6	2	21	0.14	7	4	24	0.17	8	4	24	0.18
Tail type	8	8	5	0.15	8	7	3	0.13	6	7	3	0.11
Adaptability	0	10	0	0.07	3	7	0	0.08	3	7	0	0.07
Pedigree	0	4	5	0.04	0	3	5	0.04	0	2	6	0.03

Index = sum of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] for a particular trait divided by the sum of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] for all traits

Traits like body size, tail type, and color were all considered important in the study of the area and given due to weight in selecting breeding males. Large body size, white with black head coat color, fat tail, broad and thin tip tail were most preferred traits by most of the pastoral in Dubulk district. Disposition and age were given relatively little emphasis in selecting breeding animals. Body size 1st ranked for index (0.43) followed by tail types and color 2nd and 3rd Ranked with index 0.25 and 0.11, respectively in Karsa dambi kebele.

Body size in Lafto and Dubulk Center Kebele 1st ranked with index (0.37 and 0.37) for breeding female sheep selection, respectively. Coat color and tail types for 2nd and 3rd ranked with index 0.27 and 0.25, respectively. Unlike Lafto and Dubulk centers, Karsa Dambi second (2nd) ranked for tail type but in these two kebele for 2nd ranked was color types for different ideas of respondent information for males, body size, color, and tail formation were the most highly rated traits in selecting breeding females in that communities. Lambing interval, mothering ability, age at first lambing, and single rate were also considered in selecting breeding females.

Breeding programs should be geared towards functional traits and top-ranked and management practices such as better feeding and health care should be in line with genetic improvement programs. This survey further confirmed the importance of considering traits like body size, mothering ability, tail type, and coat color in designing sustainable breeding strategies.

Table 7. Ranked of selection criteria for female sheep

Character	Karsa Damb Kebele				Lafto Kebele				Dubulk Center kebele			
	Rank			Index	Rank			Index	Rank			Index
	1st	2nd	3rd		1st	2nd	3rd		1st	2nd	3rd	
Body size	40	5	1	0.43	31	9	1	0.37	30	9	1	0.37
Color	2	1	26	0.11	6	28	4	0.27	6	27	1	0.25
mothering	0	1	13	0.05	5	3	12	0.11	5	3	12	0.11
Lamb surveil	0	0	1	0.00	0	2	0	0.01	0	2	0	0.01
Tail type	4	29	5	0.25	2	5	25	0.14	2	5	25	0.14
Lamb growth	0	1	0	0.01	0	1	5	0.02	0	1	5	0.02
lambing interval	0	0	4	0.01	0	0	0	0	0	0	0	0.0
sexual maturity	4	0	0	0.04	1	0	0	0.01	1	0	0	0.01
Adaptability	1	14	1	0.10	5	2	6	0.08	8	3	4	0.12

Index = sum of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] for a particular trait divided by the sum of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] for all traits

3.7. Reproductive Performances of sheep in the study areas

Age at first lambing, lambing interval, and lambing per ewe per life span were important traits of sheep breeding in the study area (Table 8). Those traits were more related to most of the breeding and economically important traits. In addition to the animal's genetic potential environmental factors such as nutrition, management, and climate had an impact on the reproductive performance of a breed. Good reproductive performance was a prerequisite for any successful livestock production program. The current result showed that the age at first sexual maturing (mating) of male sheep at Karsa dambi, Lafto, and Dubulk center kebele was (267.65±44 days, 277±55.6 days, and 269.2±35.6 days, respectively. Data of Lafto Kebele showed significantly higher ($P<0.05$) than Karsa dambi and Dubulk Center Kebele. The current result agreed with the age at sexual maturity for Afar ram lambs 7.10 months under pastoral management (Gizaw et al., 2013).

The female sheep age at first lambing was (260.4±27.1 days, 315.7±36.5 days, and 333±31.4 Days at Karsa Dambi, Lafto, and Dubulk center kebele, respectively. The average age at first lambing was significantly different ($p<0.05$) across the study Kebeles. The variation might be due to the availability of feeding, the physical environment, and the presence of males in the sheep flock. The results revealed that the age at first mating and first lambing of both sexes was not fixed with the period of the stage. Therefore, reproductive performance depends on the growth of hormones, feeding available, nutrients, and environmental factors.

The average lambing interval of sheep breeds of the study district was 179.2±10.5 days, 167.3±13.3 days, and 168.3±16.2 days at Karsa dambi, Lafto, and Dubulk center kebele, respectively. The result showed significant differences ($p<0.05$) across the study area. The result of karsa dambi kebele was higher than Lafto and Dubulk center kebele. However, this result value was shorter than the result reported by Solomon (2007) in association with the reported thought Gumuz sheep breed had an average lambing interval of 6.64 ±1.13 months. The breed can produce three lambing in two years yet under the traditional management system. The lambing interval of sheep breeds in the study area was (179.2±10.5, 167.3±13.3 and 168.3±16.2 days). However, the current result was shorter than Menz (8 and half months) and Afar sheep (9 months) Tesfaye (2008).

The shortest lambing interval obtained in this study area might be due to poor management production systems and uncontrolled mating to the male which allows most of the females to give three (3) lambing in two years indicating good reproductive performance of the breeds under low input system. However, the result disagrees with Wilson and Murayi (1988) obtained a longer lambing interval for station-managed long fat-tailed sheep in Rwanda than most of the intervals reported from African traditional systems where controlled breeding was not practiced. Mukasa-Mugerwa et al., (2002) indicated that through the provision of better nutrition and management in organized farms of the tropics it was practically possible to attain three lambing in two years. Such a breeding schedule would permit the exploitation of the full reproductive potential, while at the same time avoiding overstressing females. Therefore, to achieve such optimum reproductive performances in the study areas feeding regime needs to be adequate throughout the year.

Lambing interval estimates obtained under area conditions were mostly in the range of 160 to 180 days in the semi-arid zone of study areas. The average of the Litter size (single rate) for sheep breeding in the study areas was 1.10±0.30 (%) single, 1.18±0.39 (%) single, and 1.06 ±0.24 (%) in karsa dambi, Lafto and Dubulk center kebele, respectively. Litter size was influenced by genotype, parity, season, and female body weight at mating (Mukasa-Mugerwa et al. 2002 and Gbangboche et al., 2006), and the management system was also a major source of variation in litter size as reported by Mekuriaw et al. (2013). The Litter size for sheep breeding under the pastoral management system was in the range of 1.10, 1.18, and 1.06 at Karsa Dambi, Lafto, and Dubulk center kebele, respectively. The result was similar to the Litter size for East African sheep under pastoral management systems was reported in the range of 1.03, 1.05, and 1.14 in Ethiopia, Kenya, and Sudan, respectively (sources).

According to the respondents, the average reproductive life span of sheep females in study areas was 2.86±0.35, 2.94±0.24, and 2.95±0.19 years. This result agreed with the Zewdu, (2008) report reproductive performance (long living, high fertility, ability to produce more offspring) of mothers should be given more importance in selection programs. The sheep were slaughtered at an average of 190.98±61, 192.3±61.5, and 172±13.4 days, in Karsa dambi, Lafto, and Dubulk Center Kebele, respectively. However, the result disagreed with the range of East African sheep breeds (349 to 540 days) reported by Wilson (1989). Comparatively, shorter averages (190.98±61, 192.3±61.5 and 172±13.4 days) for slaughtered age in study areas were obtained for sheep breed implying that achievement to slaughtered age depended on the difference for Season of birth was influenced through its effect on feed supply under management condition.

Table 8. Reproductive performances of sheep in the study areas

Sheep reproductive performances	Karsa dambi Kebele	Lafto Kebele	Dubul center kebele
	Mean±SD	Mean±SD	Mean±SD
Age at first mating	267.65±44	277±55.6	269.2±35.6
Age at first lambing	260.4±27.1	315.7±36.5	333±31.4
Lambing interval	179.2±10.5	167.3±13.3	168.3±16.3
Litter size (%)	1.10±0.30	1.18±0.39	1.06±0.24
Reproductive of lamb per ewe	2.86±0.35	2.94 ± 0.24	2.95 ± 0.19
Slaughter age Days/month	190.98±61	192.3±61.5	172±13.4

SD = standard deviation

3.8. Weaning Age

Weaning was an important period in the undermanagement of female and male sheep. weaning was the practice of removing lambs from the milk diet provided by the mother. Early weaning allows the female to return to breeding conditions earlier and accelerate lambing. Lambs were naturally weaned when the lambs could not get milk from their mother. The average weaning ages for sheep breed in the study areas were under three months with the average of 62.71%, 60.0%, and 65.3% months, with a range of 1 to 7.5 months in Karsa Dambi, Lafto, and Dubulk center Kebele, respectively.

The weaning age of sheep in the study areas was 2 to 3 months. The present result was shorter than the result reported for indigenous sheep breeds in Ethiopia by Tembely et al. (2012). Weaning weights were affected by season, age, sex, and type of birth. The weaning weight obtained in the current study agreed with the findings of Tsedeke (2007) for Arsi Bale sheep.

The effect of unrestricted suckling particularly for a long period on the onset of oestrus needs further study.

Table 9. Summary of sheep weaning age in study areas

Average weaning age	Karsa damb kebele %	Lafto kebele %	Dubulk center kebele %
<3 months	62.71	60.0	65.3
3-4 months	21.56	24	20.41
5-6 months	9.80	8.0	10.20
> 6 months	5.88	8.0	4.08
Total	**100**	**100**	**100**

N=Number of households.

3.10. Birth and weaning weight

Growth was the most important trait in sheep production affecting the contribution of the kebeles to the pastoralist household through live animal sale and meat production (Kosgey, 2004). Growth performances of lambs in the study areas were studied under different ages (less than three months, six months, and yearling) by considering the sex of lambs, season of year, and type of births as fixed independent non-genetic factors. The analysis of GLM producers showed that the fixed factors considered (type of birth and sex of lamb) were not significantly different (P>0.05) but not involved in the season of lambing, or birth weight of the sheep in the study area. This may relate to the breeding season and lambing compared with the rainy season which was naturally selected. The current results agreed with the report of Getahun, (2009) that sex and season had significant effects on birth weight. The birth type affected the birth weight of the sheep breed in the study areas (Table 23-25). Single-born lambs were heavier than twin-born lambs at the same age (2.64±0.04 compared with 1.05±0.01) in Karsa Dambi kebele. However, no report on twins born lamb in Lafto and Dubulk center Kebele. This result agreed with the result reported by Gemeda et al. (2002; 2007). Gardner et al., (2007) reported the finite capacity of the maternal uterine space to gestate offspring. As litter size increases the individual birth weight decreases.

Table 9. Birth weight and weaning weight of sheep breed in Karsa Dambi Kebele

Factors		Traits				
	N	Birth weight	P-value	N	Weaning weight	P-value
Over means	20	2.53± 0.05	0.022	29	8.56±0.38	0.0672
Year of birth						
2013	20	2.38±0.14		16	9.12±0.42	
Sex			0.0023			0.1546
Male	10	2.69±0.08		12	8.73±0.43	
Female	10	2.37±0.03		17	8.39±0.33	
Type of birth			0.0013			0.157
Single	19	2.64±0.04		29	8.86±0.26	
Twin	1	1.05±0.01		-	-	
Season of Birth			0.0072			0.0026
Autumn (Sep-Nov)	8	2.37±0.16		12	8.45±0.25	
Winter (Dec - Feb)	3	2.97±0.10		3	9.02±0.42	
Spring(Mar-May)	8	2.43±0.05		11	8.72±0.64	
Summer(Jun – Aug)	1	1.12±0.11		3	8.23±0.55	

N = number of observation animal

The observed average mean of birth weight was (2.53±0.05kg, 2.63±0.06kg, and 2.49±0.03kg) in sheep breeds in the study area at Karsa Dambi, Lafto, and Dubulk Center Kebele respectively. The average mean of birth weight for sheep breed in the study areas had a higher value than the report (2.45±0.40kg) of Berhanu and Aynalem (2009) for sheep around Jima Zone south-west Oromia, 2.30±0.03kg for Alaba sheep was reported Gemiyu (2009). Birth weight was a trait that has a lot of economic importance and therefore the lambs with higher birth weight usually had higher growth performance throughout their lifetime (Kosgey, 2004).

Table 10. Birth weight and weaning weight of sheep breed in Lafto Kebele

Factors		Traits				
	N	Birth weight	P-value	N	Weaning weight	P-value
Over means	18	2.63±0.06	0.013	26	7.80±0.36	0.0742
Year of birth						
2013	18	2.79±0.06		15	8.62±0.43	
Sex			0.001			0.073
Male	8	2.37±0.04		10	7.93±0.45	
Female	10	2.89±0.08		16	7.68±0.28	
Type of birth			0.0013			0.073
Single	18	2.87±0.03		26	8.79±0.72	
Twin	-	-		-	-	
Season of Birth			0.0645			0.006
Autumn (Sep-Nov)	8	2.66±0.05		11	8.01±0.51	
Winter (Dec - Feb)	2	2.83±0.05		3	8.11±0.27	
Spring(Mar-May)	6	2.69±0.12		10	7.96±0.54	
Summer(Jun – Aug)	2	1.95±0.02		2	8.05±0.45	

N = number of observation animals

The findings belong to the weaning weight performances of the sheep breed show (8.56±0.38, 7.80±0.36 and 8.35±0.42) in Karsa dambi, Lafto, and Dubulk center Kebele, respectively.

The findings show that the weaning for the lambs was not different across the type of birth and sex of the lambs. This might be described as similar management of the lambs and ewes in the studied areas. The weaning weight obtained in study areas agreed with the findings of Tsedeke (2007) for Arsi Bale sheep. Similar results were also reported by Solomon et al. (2007) in the Gumuz breed of sheep reared at Benushangul Gumuz in Ethiopia. The differences might be described in the management of the sheep beside the genotypes being reared in the studied areas. Similarly, Deribe (2009) reported 10.35±0.19 for Alaba sheep.

Table 11. Birth weight and weaning weight of sheep breed in Dubulk Center Kebele

Factors		**Traits**				
	N	Birth weight	P-value	N	Weaning weight	P-value
Over means	20	2.49±0.03	0.025	28	8.35±0.42	0.0675
Year of birth						
2013	20	2.82±0.07		12	8.33±0.56	
Sex			0.005			0.2461
Male	9	2.52±0.04		10	8.56±0.36	
Female	11	2.46±0.02		18	8.15±0.48	
Type of birth			0.0025			0.125
Single	20	2.75±0.06		26	8.79±0.64	
Twin	-	-		2	6.23±0.15	
Season of Birth			0.0065			0.0057
Autumn (Sep-Nov)	9	2.86±0.13		14	9.12±0.23	
Winter (Dec - Feb)	2	2.99±0.23		2	8.15±0.31	
Spring(Mar-May)	7	2.74±0.11		10	8.25±0.62	
Summer(Jun – Aug)	2	3.02±0.26		2	8.14±0.44	

N = number of observation animals

3.11. Weaning weight and yearling weight

The result described the six-month weight and yearling body weight was presented in Tables 13, 17, and 18. The average mean of the finding shows that the six-month weight for the lambs had no more difference across the seasons. However, there was a significant difference ($P<0.05$) between study kebeles. Average mean of sex for the lambs in the male and female (13.64±0.56) and (12.96±0.63) in Karsa Dambi Kebele, (13.42±0.54 and 12.60±0.15) in Lafto kebele and (12.09±0.36 and 11.89±0.46) Dubulk Center Kebele, respectively. There was a significant difference ($P<0.05$) between the sex of male lambs higher than female lambs. This was in the case of describing different hormone and management practices of the lambs and ewes in the study areas of Dubulk districts. Whereas the six-month weight was significantly (P<0.05) different on the season of birth with the highest value observed in the autumn and spring season which may be due to the rain time availability of feed resources in this season.

Table 1. The least squares mean of Six-month weight and Yearling weight of sheep

Factors	N	Six-month weight	P-value	N	Yearling weight	P-value
Over means	34	13.31±0.59		25	18.44±0.43	
Year of birth						0.002
2012	19	12.84±0.47	0.045	17	15.96±0.35	
2013	15	14.52±0.59	0.001	8	16.01±0.62	
Sex			0.001			0.001
Male	13	13.64±0.56		11	18.04±0.61	
Female	21	12.96±0.63		14	17.84±0.26	
Type of birth			0.069			0.0065
Single	34	11.86±0.21		25	19.03±0.23	
Twin	-	-		-	-	
Season of Birth			0.003			0.002
Autumn (Sep-Nov)	15	12.76±0.42		11	16.02±0.28	
Winter (Dec - Feb)	3	12.43±0.26		4	15.77±0.38	
Spring(Mar-May)	12	13.15±0.76		8	16.25±0.49	
Summer(Jun – Aug)	4	12.86±0.48		2	16.92±0.35	

The average means six months weight of the Dubulk district in the study area of sheep year of birth (2012 and 2013) in the (12.84±0.47, 14.52±0.59) and (12.16±0.65, 12.83±0.72) and (11.84±0.27, 12.68±0.15) in Karsa Dambi, Lafto and Dubulk Center Kebele, respectively. Average of the type of birth in almost all of the Single birth rates were (11.86±0.21, 12.87±0.23 and 12.78±0.65) in Karsa Dambi, Lafto, and Dubulk Center Kebele, respectively, but there was twins birth reported in the study areas.

Table 2. Six-month weight and yearling weight of sheep breed in Lafto Kebele

Factors	N	Six-month weight	P-value	N	Yearling weight	P-value
Over means	26	13.01± 0.34		23	18.04±0.42	
Year of birth			0.004			0.001
2012	12	12.16±0.65		15	16.58±0.22	
2013	14	12.83±0.72		8	16.11±0.43	
Sex			0.010			0.001
Male	10	13.42±0.54		11	18.23±0.33	
Female	16	12.60±0.15		12	17.86±0.51	
Type of birth			0.072			0.885
Single	26	12.87±0.23		23	19.14±0.28	
Twin	-	-		-	-	
Season of Birth			0.001			0.001

The current result of six-month weight was lower than those reported by Birhanu and Ayinalem (2009) for sheep around Jima native sheep. The current result indicated that the year of birth, season of birth, and sex of the lamb significantly affected (P<0.05) the yearling weight of the lambs. However, the type of birth had no effect (P>0.05) on the yearling weight of lambs study Kebeles. The overall average mean yearling weight in the study areas was (18.44±0.43, 18.04±0.42, and 16.7±0.44) in Karsa Dambi, Lafto, and Dubulk Center Kebele, respectively. The current study is in line with the findings of Duguma et al. (2017) for Afar sheep (16.10) of the same breed sheep.

Table 3. Six-month weight and yearling weight of sheep breed in Dubulk Center Kebele

Factors		**Traits**				
	N	Six-month weight	P-value	N	Yearling weight	P-value
Over means	31	11.99± 0.41		23	16.7±0.44	
Year of birth			0.001			0.0001
2012	18	11.84±0.27		14	16.39±0.27	
2013	13	12.68±0.15		9	17.32±0.49	
Sex			0.0020			0.001
Male	9	12.09±0.36		8	17.11±0.46	
Female	22	11.89±0.46		15	16.29±0.43	
Type of birth			0.0682			0.5303
Single	31	12.78±0.65		23	16.85±0.64	
Twin	-	-		-	-	
Season of Birth			0.0012			0.003

3.11. Body Weight and Body Measurements

Information on body weight and body measurements of sheep breeds at constant age has paramount importance in the selection of genetically superior animals for production and reproduction purposes. Blackhead sheep breeds in the study area increased at a larger rate from milk tooth stage (0 pairs of permanent incisors) to 1 pair of permanent incisors (1PPI) which was 2.3 kg and from dentition class 1 PPI to 2 PPI increased by 4.3 kg for female. After dentition class 2PPI (approximately 20.5 months) body weight increased. From ≥2 PPI the body weight change was 1.5 kg by increasing the intervals of 15th days for sheep breeds. The age of the sheep at which the body weight change became maximum was obtained from the quadratic equation using the body weight change of each sex as the response variable and dentition class as an explanatory variable. A similar trend was observed by Riva et al. (2004) who observed little change in body weight and other body measurements after 24 months in the Bergamasca sheep breed of Italy. Thus, subsequent data analysis was done based on age grouping sheep into three age categories: those were 0PPI, 1PPI, and ≥2PPI. The body weight of blackhead sheep started to decrease at old age (dentition class 5) when sheep started to wear their permanent incisors (approximately above 6 years old).

Sex effect: The least squares mean and standard errors for the effect of sex, age group, and their interaction on Body weight and body measurements of male and female Blackhead sheep in the study area. Body weight and many of the body measurements were affected by the sex of animals. The sex of the sheep had a significant effect on body weight (BW), chest girth (CG), body condition score (BC), body length (BL), and tail circumference (TC).

Whereas pelvic width (PW), tail length (TL), and ear length (EL) were affected by the sex of sheep. Male sheep were higher than females. However, ear length (EL) and tail length (TL) were in both sexes. The effect of sex on body weight and other body measurements obtained in this study area was in agreement with the results of that authority (Kasahun, 2000; Markos et al., 2004).

The differences in body weight and most of the body measurements between sexes observed in the study areas showed that these parameters were sex-dependent. Females had a slower rate of growth and reached maturity at a smaller size than males due to the effect of nutrients and estrogen hormones in restricting the growth of the long bones of the body (Sowande and Sobola, 2007).

Age effect: Body weight and most of the body measurements were significantly affected by the age group of blackhead sheep breeds in the study area but, EL and TL were not affected. Furthermore, BW, BL, and CG were increased as the age increased from the youngest (0 PPI) to the oldest (≥ 2 PPI). In other body measurements (BL, WH, PW, BC, and TC) age group (1 PPI) were larger ($p<0.05$) values than the youngest age group (0PP) but these values were slightly the same with the oldest age group thought these measurements achieve their maximum at (1PPI) age group.

The tail circumference of sheep in all study areas was significantly higher ($P<0.05$) in the oldest (>2PPI) age group than the youngest (0PPI) age group. The Scrotum circumference of male sheep in the study areas of the (1 PPI) age group was significantly higher ($P<0.05$) than the youngest age group and there was a difference with the oldest age group. Similarly, the effect of age on body weight and other body measurements was also observed in different goat breeds in Ethiopia (Yoseph, 2007).

Sex by age group: The interaction of sex and age group was significantly different ($P<0.05$) for BW, BL, CG, PW, BCs, and TC. However, there was no significant difference ($P>0.05$) for TL and EL for-sheep breed in the study area. Body weight and body measurement

(BW, BL, CG, TC, BC score) at Karsa Dambi kebele for male sheep in youngest age groups were 18.86±0.27Kg, 44.39±0.67cm, 52.91±0.61cm, 39.58±0.69cm, and 1.64±0.35cm, respectively an d the females in the same age groups were 17.85±0.39kg, 38.53±0.538cm, 43.4±0.33cm, 35.33± 0.92cm, and 1.64±0.72cm, respectively. Male sheep for the intermediate age group (1PPI) were 22.49±0.29kg, 50.96±0.71cm, 56.82±0.9cm, 49.04±0.69cm, and 2.10±0.52cm , respectively, and females in the same age were 20.03±0.16kg, 47.96±0.39cm, 55.41±0.53cm, 45. 28±0.37cm and 1.98±0.54cm, respectively.

The measurements for the male sheep above >2PPI age group were 34.92±0.46kg, 62.06±0.86c m, 69.41±0.95cm, 55.96±0.58cm, and 2.35±0.45cm, respectively and the value for the females in the same age was, 31.98±0.27kg, 56.17±0.40cm, 64.58±0.38cm, 53.12±0.45cm and 1.84±0.75c m, respectively. Body condition scores were the same for males and females in the youngest age group and male's body conditions were good in the intermediate and oldest age group. These results indicated that during the dry and wet seasons, relatively better body conditions where the sheep could get better feed sources. However, during the dry season, sheep lose body condition in the wet season. This affects male breeding capacity and female loss condition as they provide milk for their offspring/lamb.

Body weight and body measurement at Lafto kebele (BW, BL, CG, TC, BC score) for male sheep in the youngest age group were 18.40±0.57kg, 45.41±0.68cm, 52.91±0.59cm, 36.48±0.98c m, and 1.45±0.26cm and were the same age for female sheep were 17.95±0.58kg, 38.55±0.54cm, 44.41±0.38cm, 37.53±0.89cm, and 1.44±0.07cm, respectively. Male sheep body weight was significantly different (P<0.05) heavier than female sheep in body weight and body m easurement, except for BC score at the youngest age group of male and female sheep in Lafto K ebeles. Whereas the body measurements of male and female sheep for the above (>2PPI) age group were 35.61±0.49kg, 63.06±0.86cm, 72.04±0.36cm, 54.36±0.85cm, and 2.25±0.24cm and 32.02±0.27kg, 5.71±0.40cm, 64.61±0.39cm, 51.23±0.42cm and 2.12±0.55 cm in Lafto Kebele, respectively.

The body weight and another measurement in Dubulk Center Kebele in male and female sheep at the youngest age group (0PPI) results were 18.94±0.27kg, 37.19±0.66cm, 45.51±0.61cm, 35.1±1.45cm, and 2.04±0.35cm and 18.15±0.39kg, 39.53±0.73cm, 45.46±0.33c m, 36.3±0.96cm, and 1.94±0.07cm, for respectively. There was a significant difference (P>0.05) between BL and TC for female sheep higher than male sheep in the youngest age group.

For the body weight and body measurement (BW, BL, CG, TC, and BC) of the intermediate (1PPI) age group of male and female sheep in Dubulk Center Kebele were 20.68±0.39kg, 50.76±

0.99cm, 57.82±0.91cm, 47.82±1.2cm, and 2.10±0.52cm and 20.45±0.20kg, 49.64±0.55cm, 52.01 ±0.53cm, 46.1±0.65cm, and 1.84±0.54cm, respectively. Whereas for oldest age group (>2PPI) of male and female sheep were 34.16±0.46kg, 57.53±0.91cm, 68.44±0.93cm, 53.9±0.89cm, and 2.15±0.23cm and 32.80±0.32kg, 57.14±0.84cm, 65.38±0.39cm, 52.7±0.53cm and 1.75±0.54cm for respectively. There was a significant difference ($P>0.05$) between male and female sheep in the oldest age group were male sheep higher than female sheep in the same age group but there was no significant difference ($P<0.05$) between the male and female sheep at the intermediate age group (1PPI).

In all age groups of sheep breeds in the study area male sheep body weight and body measurement were higher ($P<0.05$) than females according. Body weight and body measurements obtained in this current study for the youngest sheep breed were lower than the afar male and female in the youngest age group were 20.3±0.71 kg and 18.5±0.36 kg, respectively, and also on-station yearling weight of Afar sheep was 25.6 kg and 23.5 kg for male and female, respectively (Yebrah, 2008). However, the result of the present study was that the oldest age group was higher than the body weight of Afar sheep in the oldest age group for males and females were 29.0±0.84 and 24.5±0.13 kg, respectively. The comparatively younger age group for the lower body weight of male and female sheep breeds recorded in the current study than another study might be attributed to the difference in the level of management. This was because of the good management and the other studies the difference might also be related to the location (soil) effect or year effect.

Generally, the body weight of sheep breed in the Dubulk district obtained in this study was by extended inferior to achieve a recommended body weight of 32 kg at yearling age, similar to the report of that authority (Markos, 2006). The current research result was lower ($P<0.05$) than in northwestern Ethiopia, a body weight of 32.5 kg at 13 to 18 months of age was recorded for Gumuz ram under on-farm management (Solomon, 2007); and 33.1 kg for Washera ram and 26.1 kg for Washera ewe were reported (Mengiste, 2008) at the age when sheep had 3 PPI, under farmer management.

Where the body size and reduced productivity of the blackhead sheep in the Dubulk district breed might be attributed to the fact these could be used as a means of survival in the harsh environmental situation (Silanikove, 2000; Kosgey, 2004). However, the Yaballo Research Centre finding indicated the possibility of genetic improvement in these sheep breeds due to the existence of within-breed variability and moderate to high heritability for body weight (Solomon et al., 2007). Under the pastoralist studies area sheep breeding following were the ways of indigenous knowledge where depended on qualitative and quantitative of the animal breed like, such as body length, chest girth, wither height, and color type.

Under the study area Indigenous sheep breed selected for yearling weight reached 32 kg live weight at yearling under better management conditions (Solomon et al., 2006).

The body length of the youngest age group obtained in the present study was the body length of 50.96±0.71cm and the oldest age group was a body length of 63.06±0.86cm for males and females at 12 months of age and 55.96 ± 0.39 cm for females at 24 months (2 year) age. Similarly, the Body length of the youngest age group male and female oldest age group obtained in the present study was lower than the body lengths of 57.6cm and 61.9cm, but the male oldest age group (63.06 ±0.856 cm) was higher than that of the oldest age group male at 58.6 cm reported by Markos et al. (2004) for female and male at 12 months of age and 61.9 cm for females at 24 months age.

The scrotum circumference of males in the youngest age group was (13.38±0.26cm, 13.58±0.25cm, and 13.38±0.25cm) and was lower (P<0.05) than the value of the intermediate age group (22.34±0.41cm, 22.64±0.61cm, and 22.44±0.43cm) and the oldest age group (31.52±0.59cm, 32.52±0.39 cm, and 31.1±0.43cm) in Karsa dambi, Lafto, and Dubulk center Kebele, respectively, Whereas the depend on age groups were not significantly different (P>0.05) from each other but they have effect of significantly different (P<0.05) between the difference of age group. The values obtained for scrotum circumference were comparable with the results of other studies (Sisay, 2002; Markos et al., 2004; Söderquist and Hultén, 2006). The effect of age group on SC obtained in this study was in agreement with other findings Yoseph, 2007) on different goat breeds of Ethiopia.

The all-tail length of sheep by age group was similar (P>0.05) in the youngest, intermediate, and oldest age groups, but for the Lafto kebele of the youngest age group was lower than the karsa dambi and Dubulk center kebele, and for Dubulk center kebele on the oldest age group was higher than at the Karsa dambi and Lafto kebele. However, the actual measurement of tail length was measured following the tailbone from the base to the tip of the tail.

The tail circumference of the youngest (0PPI) age group male and female were (39.58±0.69cm, 36.48±0.98cm, 35.1±1.45cm) and 36.33±0.92cm, 37.53±0.89cm and 36.3±0.96cm at Karsa dam bi, Lafto, and Dubulk center Kebele, respectively. The male sheep in the Dubulk center kebele was significantly (P<0.05) lower than for the study area of two kebeles. Tail circumference was significantly (P<0.05) more considerable for males than females in almost all age groups. The tail circumference of sheep recorded in this value was much higher than the earlier reported value of

16.0 cm for Menz and Horro sheep, and lower than the value of mature male and female 47.45 and 38.24 Afar sheep (Kasahun, 2000).

4. SUMMARY AND CONCLUSION

This study focused on the pastoralist Indigenous knowledge of sheep breeding and production systems in their respective. The pastoral Indigenous knowledge of animal breeding was developed through continuous practices used by livestock breeders to influence the genetic composition of their herd. Indigenous knowledge includes cultural concepts about how to use an animal, local preferences for certain characteristics, such as body size, color, and behavioral patterns, disease and drought tolerance, selection practices for certain qualities social restrictions on selling animals, and leading closed gene pools.

The study was conducted by implementing a single-visit questionnaire, observing and recording sheep qualitative characters, and recording body weight and body measurements.

Sheep breeding practice was an uncontrolled mating system in the study area.

The majority of the respondents kept their breeding male sheep in their flock. Knowledge of pastoralists in study areas respondents reported that they had not heard of the negative effect of inbreeding and about the same respondents (1.96%, 4%, and 6.12%) say they know of side effects of the inbreeding system but no one correct to avoid, in Karsa Dambi, Lafto and Dubulk center Kebele, respectively.

Knowledge of the pastoral about the identification of sire of the lamb and awareness about inbreeding. In the study area, the Selection of parents for the next generation was very common. Accordingly, body sizes ranked first for the selection of breeding males and females in the stud area. The tail type and color of male and female sheep were ranked 2nd and 3rd.

Good reproductive performance was a prerequisite for any successful livestock production program. Age at first sexual maturity for male sheep at Karsa dambi, Lafto, and Dubulk center kebele was found to be in 267.65±44 days, 277±55.6 days, and 269.2±35.6 days, respectively.

In the meantime, female sheep ages at first lambing were 260.4±27.1 days, 315.7±36.5 days, and 333±31.4 days in that orders at Karsa Dambi, Lafto, and Dubulk center kebele, respectively. The average age at first lambing was significant ($p<0.05$) different from the three studies Kebeles being the lowest in Karsa dambi kebele area.

Among the constraints Disease, drought, and feed shortage were the most relevant constraints for sheep production in that order for pastoralists in the Dubulk district

In the all of the male population, had tail type (100 %). The head profile of most of the observed sample population was flat/straight and their hair type was short/smooth (100%).

Sex and age of the sheep had a significant ($p<0.05$) effect on body weight and many of the body measurements. Generally, body measurements were higher for males and increased as the age increased from the youngest to the oldest age group.

Recommendations

To improve the income of the pastoralists through sheep production and to conserve the breed, it is important to design and implement appropriate community-based health and breeding programs for the Dubulk district sheep breed. There is an important need to establish the grazing system and watering points in the study area so that the flock should not move too far in search of grass and water. To increase the productivity of sheep in the study area, there is a need to develop a traditional strategy to deal with the acute shortage of natural feed resources, especially during the period of drought to three months.

ETHICAL DECLARATION

Ethics approval and consent to participate

The research ethics was approved by the Bule Hora University research ethics approval and consent committee

Consent for publication

Both the authors agreed to manuscript publication

Data Availability and Material

The data in the document are original and are mentioned in the text.

Conflict of Interest

For this research project, no conflicts of interest have been identified.

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Authors contribution

Mr. Galma Malicha: Data collection, data analysis, and manuscript writing. Dr. Birhanu Tesema: study design, planning, data analysis, manuscript writing, and editing.

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