



COLLEGE OF AGRICULTURE

SCHOOL OF ANIMAL AND RANGE SCIENCES

**ASSESSMENT OF SHEEP PRODUCTION SYSTEM, REPRODUCTIVE
PERFORMANCE AND HABIT OF SHEEP MILK CONSUMPTION BY THE
SOCIETY IN ALETA WONDO WOREDA, SIDAMA REGIONAL STATE,
ETHIOPIA**

MSc THESIS

BY

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OCTOBER, 2020

HAWASSA, ETHIOPIA

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PERFORMANCE AND HABIT OF SHEEP MILK CONSUMPTION IN ALETA
WONDO WOREDA, SIDAMA REGIONAL STATE, ETHIOPIA**

**THESIS SUBMITTED TO THE SCHOOL OF ANIMAL AND RANGE
SCIENCES, SCHOOL OF GRADUATE STUDIES IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE IN ANIMAL PRODUCTION**

BY

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DECLARATION

Hereby, I confirm that, this thesis is my own work and that; I have followed all ethical and technical principles of scholarship in the preparation, data collection, analysis and compilation of this thesis. All scholarly matter that is included in the thesis has been given recognition through appropriate acknowledgements. This thesis is submitted in partial fulfillment of the requirements in for the MSc degree with specialization in Animal Production, the Graduate program of the School of Animal and Range Science in Hawassa University. Copies of this thesis will be deposited in the Hawassa University library and will be made available to the borrowers under the rule and regulations of the library. I solemnly declare that, this thesis is not submitted to any other institution or anywhere for the award of any other academic degree, diploma or certificate.

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BIOGRAPHICAL SKETCH

I, Abiot Garo Dumo, the author of this Thesis, was born in Bensa Woreda, Sidama Regional State on October 02, 1986. I attended my elementary education at Hamesho Borena Elementary School. I completed my high school education at Bensa, Kebena Gata Senior Secondary School. After successfully completing my high school education, I joined Dilla Agricultural Technical and Vocational Educational Training (ATVET) College and received Diploma in Animal Science in July 2005. Immediately after graduation, I was employed in Aleta Wondo Woreda Agricultural office as Development agent and served for five years. In September 2009, I joined Dilla University as a summer student and received BA degree in Animal and Range Science in November 2014 and served for four years as Office Expert and team leader. Then, I joined Hawassa University to pursue my MSc degree in Animal Production in 2019.

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LIST OF ABBREVIATIONS AND ACRONOMYS

FAO	Food and Agricultural Organization
M.A.S.L	Meter above Sea Level
CSA	Central Statistics Agency
DA	Development Agent
NGOs	Non-Governmental Organizations
HHs	Households
IBC	Institute of Biodiversity Conservation
IGAD	Intergovernmental Association for Development
MoARD	Ministry of Agriculture and Rural Development
SE	Standard Error
SPSS	Statistical Package for Social Science

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Assessment of sheep production system, reproductive performance and habit of sheep milk consumption in Aleta Wondo Woreda, Sidama Regional State, Ethiopia

By: - Abiot Garo

ABSTRACT

This study was conducted in Aleta Wondo Woreda, Sidama Region to assess sheep production system, objectives of production, reproductive performance and habit of sheep milk consumption. For the study 158 households (HHs) owning at least one milking sheep were selected from Highland and Midland agro ecologies using systematic random sampling method and data were collected using structured questionnaire, key informant interview, field observation and secondary data. The family size was variable ranging from 2-4(44.9%), 5-8(50%) and above 9(5.1%). The mean total land holding was 0.88 ± 0.0534 ha per with a difference between agro-ecologies. The average sheep flock size per HH was 3.02 ± 0.08 with a difference between agro-ecologies. Generating income, saving, meat and milk followed by manure and skin in their decreasing order of importance were main purposes of keeping sheep. Mixed crop- livestock production system was the dominant farming system in the area. Natural pasture, crop residues and crop aftermath, improved forage and enset and banana were feed resources available in the area. Mostly tethered system of feeding is practiced with no difference between agro ecologies. Above half of the respondents have no experiences of cultivating improved forages. Although feed types used for supplementation differs, all respondents were supplementing their sheep both in dry and wet seasons. Feed shortage in terms of quality and quantity throughout the year was one of the major problems of sheep production. Pond and deep well during dry season and river and pond during wet season were the main sources of water. Majority of the respondents in midland agro ecology suffer from shortage of water due to drying and pollution from coffee industries in dry season. Majority (58.2%) of the respondents house their sheep in main house with a difference between agro ecologies. Controlled mating was a common practice in both agro ecologies. All respondents in the area were selecting and culling sheep for production using different criteria. About 74.7% and 59.5% of the farmers were not castrating and fattening sheep respectively. For sheep, estimated average age at first service is 7.9 ± 0.07 months for male and 9.5 ± 0.11 months for female, age at first lambing 13.5 ± 0.11 month and lambing interval 8.04 ± 0.06 month with a difference between agro ecologies. Most (76.4%) of the respondents in Highland area are consuming sheep milk whereas the inverse is true for Midland agro ecology with 90.7% due to unawareness. The constraints were land and feed shortage, disease and parasites, lack of improved breed, lack of extension service, water shortage and market price fluctuation. The major opportunities ranked by respondents were high market demand, increase of urbanization, and suitability of agro ecology and government attention for sheep production in decreasing order of their importance. Therefore, to use the available opportunities, the identified constraints should be solved in Aleta Wondo Woreda.

Key words: agro ecology, milk, reproductive performance, sheep production system

1. INTRODUCTION

1.1 Background of the study

Ethiopia has one of the largest livestock population in Africa with the estimated number of 59.5 million heads of cattle, 30.7 million sheep, 30.2 million goats, 1.21 million camels, 56.53 million chicken, 2.16 million horses, 8.44 million donkey and 0.41 million mules (CSA, 2017).

Sheep and goats are adapted to different agro-ecologies, reared by different communities and they are found in all production systems (Solomon et al., 2010). In Ethiopia, almost all sheep and goats are produced in mixed crop-livestock and pastoral and agro-pastoral production systems characterized by low levels of input and technologies, feed scarcity and disease challenges (Alemayehu, 2006). The mixed crop-livestock production system is often found in the highland agro-ecological zones where livestock production is secondary to crop production. The system comprises of very small flock sizes due to shortage of grazing areas per household, limited feed availability and land degradation (Solomon et al., 2014). On the other hand, the pastoral and agro-pastoral production systems are found in the arid and semi-arid agro-ecological zones where the majority of sheep are available. These areas have a potential for Ethiopian export market of livestock products (Solomon et al., 2010; Legese and Fadiga, 2014). The pastoral system is based on wide-ranging communal grazing lands primarily using natural vegetation where thorny enclosures are common while the agro-pastoral system is characterized by a combination of pastoral and mixed crop-livestock production systems with periodic use of crop residues (Grum, 2010). Large flocks of sheep are kept in the extensive lowlands agro-pastoral systems, while small flocks and tethering is maintained in densely populated areas.

Sheep are important parts of the livestock sector of Ethiopia and mainly kept for the purpose of meat, milk and wool production and income generation by smallholder farmers (Dhaba et al., 2012). At the

farm level they serve as investment and insurance due to high fertility, short generation interval, small feed requirement and adaptability to harsh environment conditions (Tsedeke, 2007). The sheep enterprise in the Ethiopian highland crop and livestock system is the most important form of investment and cash income and provides social security in bad crop years (Getachew, 2008). They also serve as living banks to their owners (Tsegaye et al., 2013). Sheep also play an important role in providing export commodities such as live animals and skins/leather to earn foreign currency (Getachew et al, 2010; Shimelis et al., 2011). In Ethiopia, sheep account for 19% and 95% of the total livestock and small ruminant live animal export, respectively (Hailemariam et al., 2013).

In Ethiopia, the performance of the sheep industry has been poor compared with other African countries due to inadequate feed and nutrition, widespread disease and health problem, poor management, inadequate extension service, drought and marketing system (IGAD, 2011, Gizaw et al., 2010; Tesfay 2018).

Sheep milk has more protein, energy, fat and total solids than cow and goat milk and produces more cheese than both milks and it has higher amount of calcium, phosphorus, zinc, magnesium and potassium than cow milk (Muhammad, 2007). The fat globules in sheep milk are smaller than the fat globules in cow's milk, making sheep milk more easily digested (Schoenian, 2012). However, the sheep milk is rarely consumed in Ethiopia due to traditional taboo, unawareness and other factors (Tekle, 2008; MoARD 2007). Similarly, consumption of milk from Sheep is very low in Kenya due to different factors like unawareness, traditional taboo, and also lack of interest for sheep milk (Mutua et.al, 2017).

1.2 Statement of the problem

Aleta Wondo Woreda is one of the 36 Woredas of Sidama Regional State in Ethiopia. In the area sheep production is an important activity for the livelihood of farming community. Even though the area has a potential for sheep production, there are no works done to characterize production system, identify factors affecting the production and to identify status of sheep milk consumption in the area. Therefore, this survey research was conducted to narrow this gap. In this study, sheep production system, purpose of production, reproductive performance, status of milk consumption, constraints and opportunities were identified and possible recommendations were forwarded based on the results in order to find possible solution for futures development plans. The study will also serve as baseline data for Livestock and fishery sub sector, agricultural office, researchers and non-governmental organizations (NGOs). Therefore, this study was designed with the following objectives.

1.3. Objectives of the study

1.3.1. General objectives:

To assess sheep production system, reproductive performance and habit of sheep milk consumption in Aleta Wondo Woreda

1.3.2. Specific objectives

- To assess the sheep production system and objectives of production in Aleta Wondo Woreda
- To assess the reproductive performance of sheep in the study area
- To assess milk consumption habit and factors affecting the consumption of sheep milk
- To assess constraints and opportunities of sheep production in Aleta Wondo Woreda

2. LITERATURE REVIEW

2.1. Importance and purpose of Sheep production in Ethiopia

Sheep and Goats contribute significantly to the national economy and food security of the country. In addition to their ability to continue and reproduce in harsh environments, sheep and goats are the major or only source of income and wealth for many of the smallholders. They are important in feeding the rapidly expanding population of the developing world (Tibbo et al., 2006). In addition to this, they require low initial capital and maintenance costs, are able to use marginal land and crop residues, produce milk and meat in readily usable quantities, and are easily cared by most family members (Tesfay, 2018). They are also considered as insurance mainly against crop failure, as saving, socio-cultural and ceremonial purpose (Adane and Girma, 2008).

Sheep are relatively cheap and often the first asset acquired by a young family or by a poor family recovering from a disaster. Being small sized animals, sheep require small initial investment (Adane and Girma, 2008). Their small size, together with early maturity, makes them more flexible and suitable for meeting subsistence needs of the rural family for meat and milk (Adane and Girma, 2008). The short generation interval of sheep coupled with high frequency of multiple births allow for rapid increases in animal numbers. This builds financial capital and allows the sale of surplus animals for cash that can be used for other agricultural enterprises, school fees, medical bills, etc (Yenesew et al., 2013).

In the mixed crop-livestock production system, income generation is the primary objective followed by meat production and wealth accumulation (Helen et al., 2013). According to Tesfay (2018) farmers keep sheep not for a single purpose rather they keep for multiple purposes in Tigray areas. Similarly, different authors (Getachew et al., 2010; Solomon et al., 2010) mentioned that multi-

purpose sheep rearing is common in Ethiopia and linked to the need to maximize output from an animal that can survive on a low input of resources. Multiple functions are particularly important in low-to medium-input production environments (Zewudu et al., 2012). Very often, there are no banking facilities in rural areas and an easy way to store cash for future needs is through the purchase of them and in some areas they have been described as the “village bank” (Adane and Girma, 2008; CSA, 2017).

2.2. Sheep production systems in Ethiopia

Sheep in Ethiopia and most developing countries are kept under traditional extensive systems. They are largely produced in mixed crop–livestock, specialized pastoral and agro-pastoral systems. Livestock production is of subsistence nature. Market-oriented or commercial production is almost non-existent. Smallholder livestock production predominates in the highland mixed crop–livestock systems because of land and capital limitations. Large flocks are maintained in the extensive lowland (agro) pastoral systems, while small flocks and tethering is practiced in densely populated areas (Solomon G, 2010).

2.2.1. Mixed crop-livestock farming system

Mixed farming system is where the altitude ranges between 1500 and 3000 masl and the climate is favorable for farming of crops and keeping of livestock. In this production system, livestock production is secondary to crop production and it usually comprises of sheep and goats with very small flock sizes as a means to generate cash income from sale of animals and produce meat (Solomon et al., 2014). Sometimes, manure is used as nutrient cycling to benefit vegetable gardens, food and cash crops. Here, mixed species (cattle, sheep, goats and other livestock) grazing system has been predominantly practiced (Lebbie, 2004) and livestock were freely grazed on communal pastures

and seasonally on fallow crop lands with no extra-supplement. However, due to human population growth and urbanization, there is shrinkage of grazing lands from time to time (Workneh, 2000). Hence, in some areas, free grazing is limited and tethering is practiced (Kidus, 2010) others are herded to graze and browse on communal lands (Deribe, 2009; Tegegne, 2012). In addition, due to a gradual shift from keeping large to small ruminants, the relative importance and population of small ruminants is increasing and feeding animals in a limited available grazing lands, crop residues, forages, bushes and shrubs, home left overs and industrial by-products are becoming the features of mixed crop-livestock production system (Sheriff and Alemayehu, 2018). Accessibility of water is not a limiting factor in most areas under this production system. However, the system is characterized by low productivity due to recurrent drought, nutritional stress, severe resources degradation and internal and external parasites (IBC, 2004).

2.2.2. Agro pastoral and pastoral system

The majority of small ruminants (40% of sheep and 40% of goats) are concentrated in the pastoral and agro-pastoral areas (Asfaw and Jabbar, 2008) kept under extensive systems which make them major sources of livestock products for the Ethiopian export market (Legese and Fadiga, 2014). In this production system, there is relatively lighter human pressure on natural resources and higher land holding per households than that observed in the mixed farming system. As the arid and semi-arid agro-ecological zones, within altitudes below 1500 masl, receive low moisture in most of the time and feed is scarce in the dry season, pastoralists and agro-pastoralists travel long distances with their animals in search of feed and water. The system is either transhumant (the whole system moving periodically) or sedentary (limited movement) (Solomon et al., 2008). The pastoral production system is based on wide-ranging communal grazing lands primarily using natural vegetation where thorny enclosures are common while the agro-pastoralists, on the other hand, are characterized by a

combination of pastoral and mixed crop-livestock production systems with periodic use of crop residues (Grum, 2010; Legese and Fadiga, 2014).

2.3. Reproductive performance of sheep in Ethiopia

Good reproductive performance is a prerequisite for any successful genetic improvement and it determines production efficiency (Zewdu, 2008). Reproductive performance depends on various factors including age at first service, age at first lambing, litter size, lambing interval and the life time productivity of the ewe (Amelmal, 2011).

2.3.1. Age at first service

According to Zewdu (2008) age at first service for Bonga breeds were 7.51 ± 2.14 and 9.3 ± 2.2 months for males and females, respectively and for Horro breeds were 7.1 ± 3 and 7.8 ± 2.4 months for males and females, respectively. According to the Amelmal (2011) Age at sexual maturity (puberty) was 11.05 ± 1.6 , 10.88 ± 1.7 and 9.5 ± 1.4 months for males and 11.13 ± 2.7 , 10.8 ± 1.9 and 9.5 ± 1.4 months for females in Tocha, Mareka and Konta, respectively. The result of Tsedeke (2007) for age at puberty of local Alaba sheep were 6.7 and 6.9 months for male and female respectively.

2.3.2. Age at first lambing

Total life time production (life time lamb crop) can be increased by encouraging first lambing at an early age (Amelmal, 2011). Age at first lambing for Arsi-Bale sheep bred was reported within the range of 11.8-17 months (Getahun, 2008).

2.3.3. Lambing interval

The interval between two successive parturitions is called lambing interval. According to Solomon (2007) Gumuz breed had an average lambing interval of 6.64 ± 1.13 months so the breed can produce

three lambing in two years even under the traditional management system but the work of (Belete, 2009) and Zewdu (2008) indicates that lambing interval of Bonga and Horro ewes were around 8 and 7.8 ± 2.4 month respectively. The other breeds of sheep in Ethiopia, Menz and Afar sheep had 8.5 month and 9 month of lambing interval respectively (Tesfaye 2008).

2.4. Constraints and opportunities of sheep production in Ethiopia

2.4.1. Constraints

Identification of major constraints for a given livestock production system in a given area is thought to be a prerequisite to devise appropriate development intervention strategies for improving production and productivity of livestock. According to Tesfay (2018) the major constraints are feed shortage, land problem, shortage of water, inadequate access to veterinary drugs and services, inadequate extension service, predator, market problems, drought and lack of knowledge and skills.

2.4.1.1. Feed shortage

A major constraint to livestock production in developing countries including Ethiopia is the scarcity and fluctuating quantity and quality of the year round feed supply (Yayneshet, 2010; Solomon et al., 2017). The reasons for shortage of feed vary depending on the agro-ecology and production system. Lack of adequate feed resources as the main constraint to animal production is more pronounced in the mixed crop-livestock production systems, where most of the cultivated areas and high human population are located (Sisay, 2006). The problem of good quality and quantity feed is observed in lowlands where pastureland seems relatively abundant. There is a great seasonal variation of quality and quantity of feed resources in most part of the country. According to Dhaba et al (2012), the dry season extends from 3- 6 months during which chronic feed shortage occurs (mid-January to mid-April). Feed shortage is one of the limiting factors of livestock production in most parts of the country because of seasonal availability and poor quality of feeds. Animals have to walk great

distances in search of fodder and water during dry seasons. The quality of available forage is low and browse species which provide higher levels of proteins and energy are sparsely grown. Report of Mesay et al. (2013) in Lemu-Bilibilo district in Arsi zone indicated that, shortage of feed at the end of dry season when all crop residues have been consumed and pasture growth is poor, was the major constraint for livestock production in the area. According to Belete (2009) feed shortage in both seasons (dry and wet) limits productivity of small ruminants and it was further worsened due to the absence of awareness and practice of feed conservation techniques. Moreover, forage development has been given less attention in most part of Ethiopia. According to Yenesew et al. (2013) there was feed shortage problem both during the dry and the rainy seasons. Feed shortage occurs in the dry season from February to May and in the rainy season, from July to end of October as most of the land will be covered by food crops during this season (Matawork, 2016).

Shrinkage and yield decline of grazing lands driven by increased livestock population, drought, increases of human population and decline of carrying capacity of grazing land was reported to be the leading reasons for feed shortage (Fikru and Gebeyew, 2015).

2.4.1.2. Health constraints

Diseases and parasites are the major constraints to improved small ruminant production and productivity in most production systems/agro-ecological zones. This causes high mortality among kids and lambs, diminishing the benefits of their high reproductive performance (Markos, 2006). Dereje et al. (2013) in Daro Labu district of west Hararghe reported that, 21.7% farmers in lowland and 6.7% farmers in midland area traveled more than 10 km to reach government clinics. Tsetse flies, with the highest infestation in the humid and sub humid zones, are also major problems in these areas. Further losses are caused by abortions and stillbirths (Getahun, 2008; Markos, 2006). Other diseases that have limited the productivity of small ruminants in Ethiopia include pneumonia and Brucellosis.

Individually, these diseases might not constitute serious problems, but combinations of them or their occurrence under marginal conditions could result in serious losses (Markos, 2006; Tsedeke, 2007). According to Belete (2009) and (Matawork, 2016) diseases and parasites hamper small ruminant production by causing high mortalities especially among suckling animals. Here animals with good adaptive potential are needed in these stressful environments to sustain the livelihoods of the communities (Solomon et al., 2010; Helen et al., 2013).

2.4.1.3. Water shortage

Water shortage is also reported as limiting factor in most lowland areas and to a limited extent in mid altitudes. In eastern, north-eastern and south-eastern part of the country there is critical shortage of water; however, small ruminants are somehow adapted to these agro-ecologies through their physiological adaptation mechanisms (Matawork, 2016). According to Belete (2009) water shortage and drought occurs due to relatively smaller rainfall and shorter rainy seasons in most of goat producing areas of the country. Restrictions of water may result in poor nutrition and digestion, because there is a relationship that exists between water intake and consumption of roughages, particularly during dry season (Tesfay, 2018). Long distance travel of small and large ruminants in searching of water was another problem (Mesay et al., 2013). Tsedeke (2007) reported that problem of water shortage in mixed flock areas of Alaba Woreda.

2.4.1.4. Poor genetic performances

According to (CSA, 2016), 99.72% of the sheep are indigenous breeds in Ethiopia. Because of this large number of indigenous sheep, their contribution to the agricultural and the overall national economy is below the potential (Legese and Fadiga, 2014). Similarly, compared to all other countries and the global average, the productivity of Ethiopian small ruminants is reported to be one of the

lowest (Sheriff and Alemayehu, 2018). This could be attributed to their various interactive factors such as poor genetic performance exacerbated by low input traditional production system (Gizaw et al., 2008).

2.4.1.5. Predators

According to Tesfay (2018), the other serious problem is predators in Tigray area of the lowland. This is similar with the finding of Tsedeke (2007) in Alaba southern Ethiopia, Assen and Aklilu (2012) in different agro-ecological zones in Tigray and Solomon et al. (2014) in Amhara National Regional State of Ethiopia. Yadeta (2016) also noted that there were massive attacks of fox on young stock and hyena/other wild animals on adult flock in west Shoa.

2.4.1.6. Marketing constraints

The indigenous sheep and goat are year round breeders and mating is not controlled. However, the current off take rate is very low (Markos, 2006); with an average carcass weight of about 10kg, which is the second lowest amongst Sub-Saharan African countries (FAO, 2004). In Ethiopia, the marketing of livestock and livestock products is underdeveloped. The major problems are the traditional management systems which are not market oriented, underdeveloped marketing systems and poor infrastructure, poor financial facility, and presence of cross-border trade (Azage et al., 2006, Berhanu et al., 2006). According to Seid (2019), the major constraints for sheep marketing identified and ranked by the herders were seasonal fluctuation in the price of sheep as the main marketing problems followed by distance of markets and low prices respectively in Chifra district of Afar region. The price fluctuation might be due to the reliance of both production systems on domestic consumers whose demand is greatly influenced by the presence of the religious fasting period and festivities (Seid, 2019). The other fact that reported by the same reporter is, the majority of the pastoral

communities live in remote areas isolated from main service centers, and sheep are trekked 3-10hrs leading to lose weight, condition, and market value. Seasonality in marketing is a common phenomenon with most agricultural products including livestock in general and sheep in particular (Ayen, 2004). The study of Yenesew (2010) in Burie woreda, west Gojjam, indicated that sheep sellers get market price information mainly from traders or their neighbors because there is no public market information source in the area. This reduces the marketing system transparency and efficiency. In the sheep markets there is no weighing or grading of animals at the time of sale. Buyers and sellers judge the sheep they buy/ sell through physical observation only (Juma et al., 2010; Ramesh et al., 2012). This is a disadvantage especially for sellers.

2.4.2. Opportunities

High demand of the small ruminants in the local market as a result of population increase, urbanization, and increase in income (even within a district) can be considered as an opportunity for the small ruminant producers (Fikru and Gebeyew, 2015). According to Matawork (2016), availability of many Non-Governmental Organizations (NGO) that are working on improving living and livelihood through improving the production and productivity of their animals is taken as opportunity in Arsinegelle and Fantalle woredas of Oromia Regional State. Government is also working to solve the challenges (Arse G et al., 2012).

2.5. Milk consumption and factors affecting sheep milk consumption

Compared to cow milk, sheep milk have higher protein, energy and fat contents with beneficial amino acids which will narrow nutrient deficiency in smallholder family, however, the goat milk is consumed only in some parts of Ethiopia and sheep milk is also rarely used (Tekle, 2008). According to Seid (2019), fresh milk, fermented milk, whey, and butter were among the common milk products

produced and consumed in the chifra district of Afar region. But, according to Mutua et.al (2017), consumption of milk from Sheep is very low in Kenya. In Ethiopia there are different factors (like traditional taboo, unawareness and others) which affect milk consumption from sheep (MoARD, 2007). Similarly, Unawareness, Traditional Taboo, and also Lack of Interest listed as factors affecting milk consumption in Kenya (Mutua et.al, 2017).

Table 1. Composition of goat, cow and sheep milk

Composition	Goat (%)	Cow (%)	Sheep (%)
Total solid	13.9	13.5	19.3
Fat	4.8	4.8	7.6
Protein	3.7	2.8	5.5

Source : Devendra and McLeroy (1996)

3. MATERIALS AND METHODS

3.1. Description of the study area

Aleta wondo woreda is one of the Woredas among the 36 Woredas of Sidama Regional State of Ethiopia located between 6° 15' N and 6° 45' N latitude and between 38° 15' N and 38° 45' longitudes (CSA, 2008/09). The altitude of the woreda Ranges between 1700 to 2500 m.a.s.l. It is located at a distance of 333 km south east of Addis Ababa and at about 67 km from Hawassa, which is the capital city of Sidama Regional State. The Woreda has 640 km² area of land with an estimated 188976 human population (CSA, 2007). Annual rainfall in the area ranges from 900 to 1400 mm. whereas; mean minimum and maximum temperature approximately ranges between 10°C and 24°C (Woreda report, 2013/14). The Woreda has 27 kebeles with three agro ecologies namely highland or 'Dega' (30%), midland or 'Weyina Dega' (70%). Aleta wondo woreda is bordered on the south by Dara woreda, on the west by Chuko, on the north by Dale and Wonsho, on the east by Bursa and on the south east by Hula. Livestock population is estimated to be 138,251 Cattle, 39211 Sheep, 22421 Goat, 3918 Horses, 8586 Donkeys, 168 Mules and 169256 Poultry (woreda animal and fishery Office annual report, 2016/17). The main agricultural practices in the area includes, coffee plantation, inset plantations, maize & cereal crop production, cattle fattening, apiculture, vegetables and different fruits production.

3.2. Study design

The designs involved in study were formal survey, field observation, and key informants discussion.

3.3. Sampling techniques and sample size

The overall household survey was carried out at house to house level to gather enough information both by interviewing farmers and field observation of the actual situation. For this study from 27 kebeles of the woreda, 5 representative kebeles (2 kebeles namely Gerbicho Kila and Dande from

Dega agro-ecology, and 3 Kebeles namely Woto, Gidibo and Bulesa from Weina Dega agro ecology) were selected based on the number of kebeles. Accordingly, kebeles were selected purposively by considering agro ecological conditions, access to transportation and the potential of the sheep production. From the selected kebeles HHs possessing at least one milking ewe was selected again purposively. Then after the HHs for the survey was randomly (using systematic random sampling) selected from the purposively selected HHs. To decide on total sample size of Aleta Wondo Woreda, the standard sample size selection formula of Yemane (1967) was used. $n = \frac{N}{1+N(e^2)}$ where,

$$\frac{N}{1+N(e^2)} \text{ where,}$$

n = number of sample size, N = number of population in study kebeles of Woreda and e = level of precision. According to the above formula, $n = 4392 / (1 + 4392(0.078)^2) = 158$.

Therefore, the sample size for the socio-economic data was 158 households. The sample size of each kebeles was calculated as follows. $nk1 = \frac{Nk1 * n}{N}$, $nk1 = 1158 * 158 / 4392 = 42$

Table 2.The sample size of the study kebeles in the Aleta Wondo Woreda

S/No	Name of Kebeles	Agro ecology	Total number of households	Sample size
1	Gerbicho kila	Dega	1158	42
2	Dande	Dega	838	30
3	Woto	Woinadega	840	30
4	Gidibo	Woinadega	751	27
5	Bulesa	Woinadega	805	29
Total			4392	158

Source: Aleta wondo woreda agricultural office 2016/17

3.4. Methods of Data Collection

Household Survey: Primary data such as respondents profile, land and livestock holdings, sheep production systems, objectives of production, sheep management practices, reproductive performances, milk consumption status by the society, constraints and opportunities of sheep production and other information were collected from the randomly selected respondents via pretested structured questionnaires and interviews. Secondary data was collected from Aleta wondo woreda Animals and Fishery office, different journals, books and other relevant written documents. For primary data collection, 10 DAs (2 DAs from each kebele) were used.

Field observation: Field observation was conducted in order to obtain all the necessary information and determine the questions that need to be included in the survey. It is a useful technique to characterize and understand the actual condition of the production system. Types of sheep breed, management practice, forage availability and utilization etc. were observed. Field observation was done by the researcher and other selected animal science experts of the woreda and using this actual information enabled to adjust the household survey questionnaires prior to undertaking the actual survey process.

Key informant interview: key informants interview was conducted to gather relevant information regarding to sheep production systems, management practices, major constraints and opportunities, reproductive performances, sheep milk consumption status and factors affecting consumption. The interview was also extended to service providers such as DAs and woreda livestock sector experts. A total of about 15 elder respondents (3 from each kebele) were participated in key informant interview in Aleta Wondo Woreda.

3.5. Methods of Data management and Analysis

The SPSS software, version 20 was used for data analysis. The descriptive statistical analysis like frequency, percentages, means, standard error and cross tabulation was employed for data analysis and the result was reported in the form of tables and figures. The quantitative data means between study sites were compared by means of one way analysis of variance (One-Way ANOVA) in SPSS). The differences between means was declared significant at ($P < 0.05$) ANOVA was carried out using GLM procedure of SPSS. The following formula was used to compute index according to Musa et al. (2006).
$$\text{Index} = \frac{R_n * C_1 + R_{n-1} * C_2 + \dots + R_1 * C_n}{\sum R_n * C_1 + R_{n-1} * C_2 + \dots + R_1 * C_n}$$
 Where, R_n = value given for the least ranked level (example if the least rank is 5th, then $R_n = 5$, $R_{n-1} = 4$, $R_1 = 1$)
 C_n = Counts of the least ranked level (in the above example, the count of the 5th rank = C_n , and the count of the 1st rank = C_1)

Model of statistical analysis

Model statements for this study regarding the effect of agro-ecologies on various parameters of sheep production practices is as follows;

$$Y_{ij} = \mu + a_i + e_i \text{ where}$$

Y_{ij} = Response variables

μ = Population mean

a_i = effect of agro-ecology on various parameters of sheep production ($i=2$; highland and midland),

and e_i = Random error

4. RESULTS AND DISCUSSION

4.1. Socio economic characters of respondents in Aleta Wondo Woreda

4.1.1. Sex, marital status, occupation and religion

According to table 3, majority (91.1%) of families were male headed in both highland and midland whereas very small (8.9%) percentage was headed by female in the highland and midland who were widowed and divorced. The number of families headed by males in current study was comparable with the finding of Belay et al. (2018) who reported 85% and 15% male and female headed respectively in Kambata Tambaro zones, Southern Ethiopia and lower than the findings of Dhaba et al. (2012) who reported 96% of male headed families in Illu Abba Bora Zone of Oromia regional state. Most (87.3%) of the respondents both in the highland and midland are Protestants whereas only very small percentages are followers of Orthodox religion. This may create a good opportunity for sheep production in the area due to less fasting period of this religion for sheep product consumption. The current result was different from the report of Gebrekidan (2018) who indicated the majority number of Orthodox Christians in Tigray Region. The result revealed that most of the respondents were married and there was no difference between agro ecologies. The current result was in accordance with the finding of Beyene et al. (2018) in Dawuro Zone of Southern Region.

Most (73.4%) of the respondents were farmers, and very few of them were house wives and merchants in both the highland and midland agro ecologies. The results in table 2, revealed that the number of respondents engaged in farming were higher in highland than in midland agro ecology whereas the number of respondents who were participating as merchant in addition to agriculture were higher in midland agro ecology. In general majority of the respondents in the Aleta Wondo Woredas were farmers with no difference between agro ecologies. The current result was in

accordance with the finding of Gebrekidan (2018) and Beyene et al. (2018) in Tigray Region and Dawuro Zone of Southern Region.

Table 3: Socio-economic characteristics of respondents in Aleta Wondo Woreda

Parameters	Variables	Agro ecology					
		Highland (n= 72)		Midland(n=86)		Overall (n= 158)	
		Freq	%	Freq	%	Freq	%
Sex of HHs	Male	68	94.4	76	88.4	144	91.1
	Female	4	5.6	10	11.6	14	8.9
	Total	72	100	86	100	158	100
Religion	Orthodox	12	16.7	8	9.3	20	12.7
	Protestant	60	83.3	78	90.7	138	87.3
	Total	72	100	86	100	158	100
Marital status	Married	68	94.4	76	88.4	144	91.1
	Widowed	3	4.2	8	9.3	11	7.0
	Divorced	1	1.4	2	2.3	3	1.9
	Total	72	100	86	100	158	100
Occupation	Farmer	62	86.1	54	62.8	116	73.4
	House wife	4	5.6	10	11.6	14	8.9
	Farmer merchant	6	8.3	22	25.6	28	17.7
	Total	72	100	86	100	158	100

n=number of sample population freq= frequency, HHs= households

4.1.2. Family size of respondents in Aleta Wondo Woreda

According to figure 1, the majority (56.9%) of the respondents had 2-4 members, followed by 5-8 and above 9 in highland agro ecology whereas majority (60.5%) had 5-8 members followed by 2-4 and 9 in midland area with the overall family size of 2-4(44.9%), 5-8(50%) and above 9(5.1%) families. The number of the respondents who had a family size of 5-8 persons per households in midland agro ecology was higher compared to the highland agro ecology (figure 1). In general the family size of Aleta Wondo Woreda was ranging between 2 and 9. The highest proportion of family size 5-8 in current study was higher than that reported by CSA (2003) the average national family sizes 5.2 persons per households. The number of high respondents with large family size in the study area may show that family planning should be encouraged to practice. Similarly, Ergena and Abera (2018) reported 5-8(66.7%) family size in Shashogo Woreda, Hadiya Zone of Suothern Ethiopia.

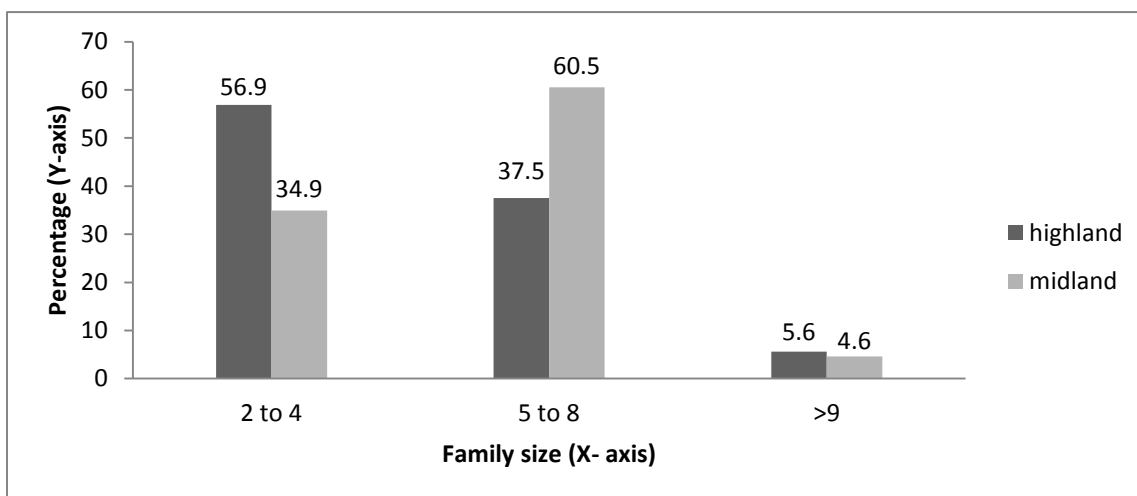


Figure 1: Family size of respondents in Aleta Wondo Woreda

4.1.3. Age category

According to figure 2, there were more young respondents (25-40years old), followed by (41-55years old) and above 56 years in the highland and less of young respondents (25-40years old), but more of matured respondents (41-55 years old) but very few above 56 years in midland agro ecologies.

Totally 84.2% and 15.8% of the respondents in Aleta Wondo Woreda were found in age category of 25-55 (the first two categories) years and above 56 years respectively. This indicates that most of the sheep producers were found in productive age groups with no difference between agro ecologies. The result is similar with the finding of Belay et al. (2018) who reported the same finding in Kembata Tembaro zone of Southern Region.

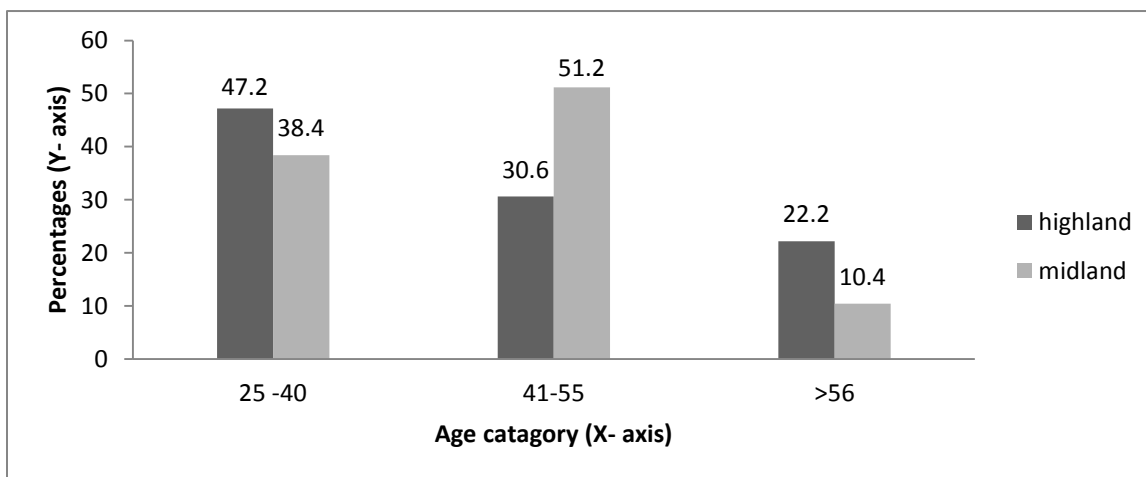


Figure 2: Age category of respondents in Aleta Wondo Woreda

4.1.4. Educational level

According to figure 3, higher (47.2%) percentage of the respondents were found to be illiterate in highland while relatively small percentage in the midland which indicates that education in the highland should be encouraged. About one third of the respondents got primary education (1-4 grades) in both agro ecologies. Grade 5-8 were 12.5% and 27.9% in the highland and midland respectively. Grade 9-12 were 4.2% and 16.3% in highland and midland respectively. Generally speaking the educational status of the respondents in Aleta Wondo Woreda was 32.9% and 67.1 illiterate and educated respectively (figure 3). This indicates that the presence of high percentage of literates in farming community can be an opportunity for easily training, transfer and adoption of improved management practice. The current result was in accordance with the finding of Admasu et

al. (2017) and Belay et al. (2018) who reported 67.9% and 90% educated households in Wolayta Zone and Doyogena Woreda, Kembata Tembaro zone of Southern Region respectively. It was different from the report of Ergena and Abera (2018) who found 62.9% of illiterate households in Shashogo Woreda, Hadiya Zone of Southern Ethiopia.

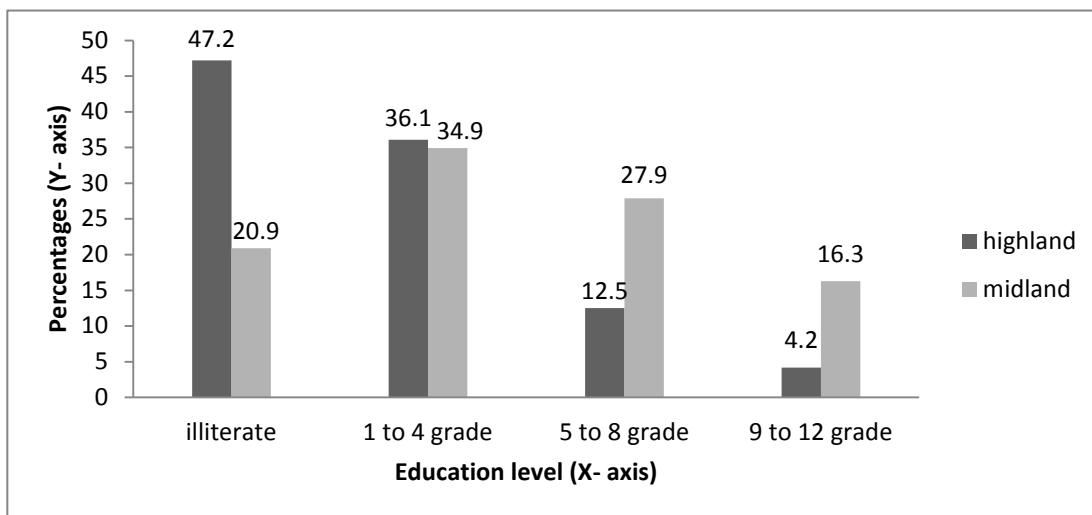


Figure 3: Educational status of respondents in Aleta Wondo Woreda

4.1.5. Land holding and using system of the respondents in Aleta Wondo Woreda

The average land holding in the highland (1.28 ± 0.085 ha) was much higher than in midland (0.54 ± 0.042 ha). In general the average land holding was 0.88 ± 0.0534 hectare. This indicates that there was shortage of land with no difference between agro ecologies. The result of current study was comparable with Admasu et al. (2017) who reported an average land holding of 1.1 hectare in Wolayita zone of Southern Ethiopia and less than that of the finding of Beyene et al. (2018) and Sisay and Kefyalewu (2015) who reported 3.13 and 3.68 hectare in Dawuro zone of South Ethiopia and Degahabur zone of Eastern Ethiopia. The land size used for crop, pasture and fallow was much higher in the highland (0.92 ± 0.068 , 0.23 ± 0.009 and 0.13 ± 0.018 ha) than in the midland (0.36 ± 0.028 , 0.14 ± 0.0083 and 0.041 ± 0.01 ha). In both agro ecologies the land size used for crop production was higher and

followed by pasture land and fallow land. This result shows that farmers in Aleta Wondo Woreda were depending on crop- livestock production for their food item and income sources in addition to other services. The current result in line with the finding of Dhaba et al. (2012) and Beyene (2018) who reported the same report in Illu abba Bora Zone of Oromia regional state and Dawuro zone of Southern Ethiopia respectively.

Table 4. Land holding and use of respondents in Aleta Wondo Woreda

Parameters	Variables	Agro ecology		Over all (N=158)	Sig
		Highland(n= 72)	Midland(n=86)		
		Mean± SE	Mean± SE	Mean± SE	
Land holding	Total land holding(ha)	1.28 ^a ±.085	0.54 ^b ±.042	0.88±.0534	0.00
	Crop land(ha)	0.92 ^a ±.068	0.36 ^b ±.0284	0.62±.041	0.00
	Pasture land(ha)	0.23 ^a ±.009	0.14 ^b ±.0083	0.18±.0071	0.00
	Fallow land(ha)	0.13 ^a ±.018	0.04 ^b ±.01	0.08±.01	0.00

Different subscripts indicates significant differences at $p < 0.05$ between means with in rows; M=mean; SE=standard error, Sig =significance; n=number of sample population ha=hectare

4.1.6. Livestock holding and composition in the area

According to the result of current study all respondents in highland and midland agro ecology were keeping a mix of different livestock species (Table 5). The average cattle holding per household in highland was significantly ($p < 0.05$) higher than that of midland due to comparatively higher land and feed availability in the highland agro ecology. The average number of crossbred cattle per household was significantly ($p < 0.05$) higher in midland agro ecology whereas indigenous breed was significantly ($p < 0.05$) higher in highland agro ecology. The overall mean of the cattle holding per household was 2.84. The current overall average number of cattle per household was higher than 2.4 average size of cattle per household reported by Selamawit and Matious (2015) in Gedio zone of Southern Ethiopia. It was lower from the finding of Beyene et al. (2018), Guye and Tamir (2014) and

Kassahun (2011) who reported 7.51, 7.6 and 14.8 average herd sizes of cattle per household in Esera Woreda, Dawuro Zone, Burji Woreda of Southern Ethiopia and Chilega Woreda, North Gondar, Amhara Region respectively. The average size of sheep holding per household in the highland was higher ($p < 0.05$) than that of the midland comparatively due to natural resource difference. The overall average size of sheep holding per household in Aleta Wondo Woreda was 3.02 ± 0.08 . The current result was less than the report of Selamawit and Maticious (2015), Beyene et al. (2018) and Dhaba et al. (2012) who noted 5.33, 6.08 and 4.8 average numbers of sheep per household in Gedio Zone, Dawuro Zone of Southern Ethiopia and in Illu Abba Bora Zone of Oromia Region respectively. There were no significant ($p > 0.05$) difference in goat number per household between agro ecologies. Discussion with key informants revealed that the number of goats become less due to shortage of browsing area. The current average number of goats (0.92) per household was less than that of 3.99 and 3.46 average numbers of goats per household reported by Dhaba et al. (2012) and Selamawit and Maticious (2015) in Illu Abba Bora Zone and Gedio Zone respectively. According to the group discussion with key informants chicken were economically very important especially by meeting emergency cash need of females and children. The average number of chicken per household in highland and midland agro ecologies was 3.9 ± 0.15 and 4.17 ± 0.14 respectively with no significant ($p > 0.05$) difference between agro ecologies. The average size of exotic chicken per household in midland agro ecology (3 ± 0.16) was significantly ($p < 0.05$) higher than that of highland (1.4 ± 0.094) due to difference in weather condition suitability between two agro ecologies for exotic breed. The overall average number of chicken per household in Aleta Wondo Woreda was 4.06 ± 0.01 . The current result was less than that of 10.95 overall average number of chicken per household reported by Beyene et al. (2018) in Esera woreda of Dawuro Zone in Southern Region.

Equines were also one of the components of livestock in Aleta Wondo Woreda. According to the discussion with the key informants Horse and Donkey were economically important by transporting cash crop from village to the marketing area in highland and midland agro ecology respectively. The average number of horses per households was significantly ($p < 0.05$) higher in highland agro ecology than midland whereas the average size of donkey per households was significantly ($p < 0.05$) higher in midland agro ecology. There was no significant ($p > 0.05$) difference of mule number per household between agro ecologies. The overall average number of equines per household was 1.06 ± 0.025 in Aleta Wondo Woreda. The average number of equines per household was comparatively similar with the finding of Beyene et al. (2018) and Gebregziabher et al. (2016) who reported 0.92 and 0.8 average size of equines per household in Esera woreda Dawuro Zone and Humbo Woreda Wolayta Zone of Southern Region.

4.2. Sheep production system in Aleta Wondo Woreda

4.2.1. Purposes of sheep production in Aleta Wondo Woreda

The objects for which sheep were reared by the farmers in Aleta Wondo Woreda were presented in the table 6 below. Based on the respondents in Aleta Wondo Woreda, the primary objectives for sheep rearing were for generating income, saving, milk and meat followed by manure and skin in highland agro ecology whereas for generating income, saving, meat and for manure followed by milk and skin in midland areas. According to the results of the current study sheep milk was more preferred in highland than in midland agro ecology. The current results differ from the finding of Gebrekidan (2018), who reported least rank of milk importance in all agro ecologies of the Tigray Region. According to the group discussion, income generation comes by selling live animals to meet cash emergency to buy agricultural inputs, to pay school fees and used for other purposes. The current result was similar with the finding of Belay et al. (2018), Beyene et al. (2018), Admasu et al.

(2017) and Gebrekidan (2018) who reported the same report in Kambata Tambaro zone, Dawuro zone, Wolayta zone of Southern Ethiopia and in Tigray Region respectively. Similarly small ruminants are reared in different parts of the country especially for income generation (Arse et al., 2013; Yenesew et al., 2013; Zergaw et al., 2016). Apori et al. (2011) and Abraham et al. (2017) reported that keeping livestock, especially sheep and goats play a role as safety net that enables households to get quick income to settle urgent financial needs in different rural parts of the country. Skin was ranked as least important with no difference between agro ecologies. According to the result of group discussion skin has very poor economic value due to absence of hide and skin collectors in Aleta Wondo Woreda. The discussion revealed that some of the farmers in study area used skin for equine harness whereas most of the farmers thrown it away as a waste. Similarly, Seid (2019) noted that selling of skin to gain income was not common in the pastoral and agro pastoral production systems of Chifra Woreda's of Afar Region. The same author reported that, most of households utilized skin for different purposes such as sitting or bedding materials, water and butter container, knife cases, and equine harness, prayers rug and shoes whereas very few respondents from agro pastoral production system thrown it away as a waste.

Table 5: Livestock composition in Aleta Wondo Woreda

Parameters	Agro ecology		Over all(n= 158)	Sig
	Highland(n= 72)	Midland(n=86)		
	Mean± SE	Mean± SE	Mean± SE	
Cattle	3.67 ^a ± 0.2	2.15 ^b ± 0.15	2.84 ± 0.14	0.000
Local	3.67 ^a ±0.203	1.62 ^b ±0.1	2.55±0.134	0.000
Cross breed	0 ^b ±0.000	0.53 ^a ±0.095	0.29±0.056	0.000
Sheep	3.5 ^a ± 0.12	2.6 ^b ± 0.08	3.02 ± 0.08	0.000
Goats	0.99 ± 0.16	0.87 ± 0.12	0.92 ± 0.1	0.558
Chicken	3.9 ± 0.15	4.17 ± 0.14	4.06 ± 0.01	0.223
Local	2.5 ^a ±0.1	1.16 ^b ±0.13	1.78±0.1	0.000
Exotic breed	1.4 ^b ±0.094	3 ^a ±0.16	2.27±0.12	0.000
Equines	1.061±0.04	1.057±0.032	1.06±0.025	0.939
Horses	0.3 ^a ± 0.06	0.06 ^b ± 0.025	0.17 ± 0.03	0.000
Donkeys	0.15 ^b ± 0.04	0.6 ^a ± 0.05	0.4 ± 0.04	0.000
Mules	0.028 ± 0.02	0.00	0.013 ±0.01	0.121

Different subscripts indicate significant differences at $p < 0.05$ between means with in rows; M=mean; SE=standard error; n= sample population

Table 6. Purposes of sheep production ranked by respondents in Aleta Wondo Woreda

Agro ecology	Purposes	Rank						Score	Index	Rank
		1 st	2 nd	3 rd	4 th	5 th	6 th			
Highland (n= 72)	milk	16	2	37	0	11	6	282	0.187	3 rd
	meat	0	6	11	54	1	0	238	0.157	4 th
	skins	0	0	4	6	0	62	96	0.063	6 th
	income	52	16	4	0	0	0	408	0.27	1 st
	manure	0	0	0	12	60	0	156	0.103	5 th
	saving	4	48	16	0	0	4	332	0.22	2 nd
Midland(n=86)	milk	0	0	0	8	78	0	180	0.1	5 th
	meat	0	21	45	20	0	0	345	0.19	3 rd
	skins	0	0	0	0	0	86	86	0.048	6 th
	income	49	25	12	0	0	0	467	0.26	1 st
	manure	0	0	20	58	8	0	270	0.15	4 th
	saving	37	40	9	0	0	0	458	0.253	2 nd
Overall(n=158)	milk	16	2	37	8	89	6	462	0.14	4 th
	meat	0	27	56	74	1	0	583	0.176	3 rd
	skins	0	0	4	6	0	148	182	0.055	6 th
	income	101	41	16	0	0	0	875	0.26	1 st
	manure	0	0	20	70	68	0	426	0.13	5 th
	saving	41	88	25	0	0	4	790	0.24	2 nd

Index=the sum of (6 times First order +5times second order + 4times third order + 3 times fourth order + 2 times fifth order +1 times sixth order) for individual variables divided by the sum of (6 times First order +5times second order + 4times third order + 3 times fourth order + 2 times fifth order +1 times sixth order) for all variables.

4.2.2. Sources of stock foundation

The major sources of stock foundation for highland were gift from parents followed by purchased and shared with other farmers whereas purchased was the most sources of stock foundation followed by gift from parents and share in the midland agro ecology (table 7). The overall result of the study showed the major sources of sheep stock foundation in Aleta Wondo Woreda was purchased and very few are gifted from parents. The results in the current study was the same with the finding of Belay et al. (2018) and Feleke et al. (2015), who reported the same in Kembata Tembaro zone of Southern Region and differ from the report of Yisehak et al. (2013) in south western Ethiopia, Helen et al. (2013) in Eastern Ethiopia and Abraham et al. (2017) in Western Tigray reported that home birth as the major form of sheep and goat acquisition. The same to Gebrekidan (2018), contribution of shared as foundation stock was minimal in Aleta Wondo Woreda.

Table 7. Sources of stock foundation for sheep in Aleta Wondo Woreda

Parameter	Variables	Agro ecology					
		Highland(n= 72)		Midland(n=86)		Over all(n= 158)	
		Freq	%	Freq	%	Freq	%
Sources of stock	Gift from parents	31	43.1	11	12.8	42	26.6
	Share	12	16.7	4	4.7	16	10.1
	Purchased	29	40.3	71	82.6	100	63.3
	Total	72	100	86	100	158	100

Freq= frequency, n=sample population

4.2.3. Flock structure of sheep

Figure 4 shows flock structure of sheep in Aleta Wondo Woreda. The flock types of sheep reared in Aleta Wondo Woreda was ewes, lambs and rams. Lambs and ewes together were dominant followed

by small percentages of rams in sheep flock structure of highland and midland. Higher number of lambs in both agro ecologies was due to the presence of ewes which give twining birth. The overall number was 41.1%, 47.6% and 11.3% ewes, lambs and rams respectively in Aleta Wondo Woreda. In the current study; ewe and ram number was less than that of 51.4% and 14.1% and 42% and 26% reported by Admasu et al. (2017) and Belay et al. (2018) in Wolayta Zone and Kambata Tambaro Zone of Southern Region respectively.

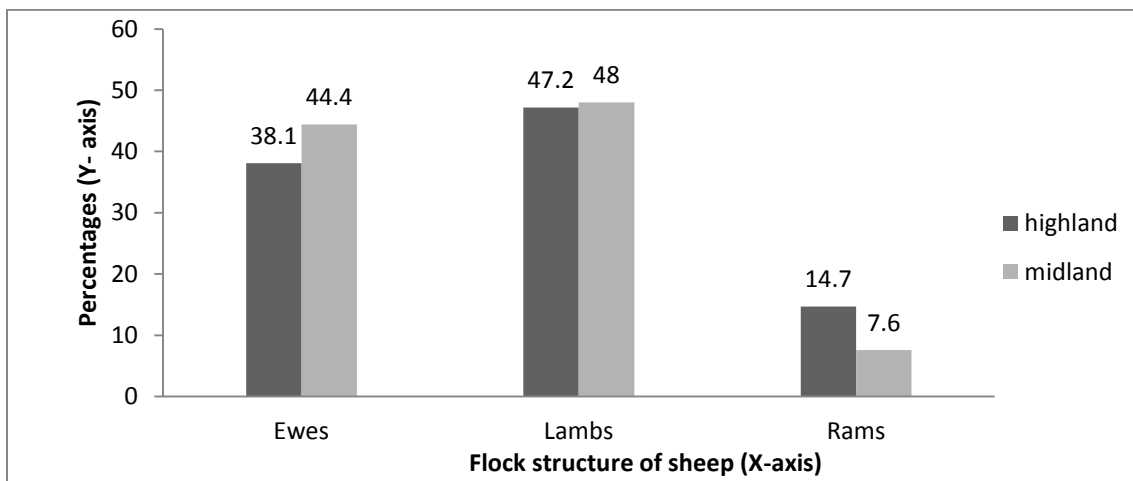


Figure 4: Flock structure of sheep in Aleta Wondo Woreda

4.2.4. Sheep production system

Aleta Wondo Woreda was known by rain fed agriculture with annual cereal crops like barley, wheat, bean, pea, maize and other crops in the highland parts of the woreda in addition to perennial crops like enset, coffee and fruits. The midland agro ecology of the woreda was dominated by perennial crops like coffee, enset and different fruit types in their order of dominances and followed by annual crops like maize, haricot bean and others. In addition to crop production, livestock production was practiced in an integrated way with crop in Aleta Wondo Woreda. According to table 8, all respondents in Aleta Wondo Woreda were practicing crop –livestock (mixed) production system. Belay et al. (2018), was noted the same in Kambata Tembaro zone of Southern Region. According to the results the survey the majority of the respondents in highland area were practicing extensive

system whereas above half of the total respondents in midland agro ecology was following semi intensive system. The overall result of the study revealed that 53.8% and 46.2% of the respondents follow extensive and semi intensive system of production in Aleta Wondo Woreda. The current study was comparable with the finding of Beyene et al. (2018) and Belay et al. (2018) who reported 69.1% and 30.9% and 72.5% and 27.5% extensive and semi intensive in Dawuro zone and in Kambata Tambaro zone of Southern Ethiopia respectively.

Table 8. Sheep production system in Aleta Wondo Woreda

		Agro ecology					
		Highland(n= 72)		Midland(n=86)		Over all (n= 158)	
Parameters	Variables	Freq	%	Freq	%	Freq	%
Production	Crop-livestock	72	100	86	100	158	100
system	Extensively	45	62.5	40	46.5	85	53.8
	Semi-intensive	27	37.5	46	53.5	73	46.2
	Total	72	100	86	100	158	100

Freq= frequency; n=number of sample population

4.3. Sheep husbandry practices in Aleta Wondo Woreda

4.3.1. Feeds and feeding practices

4.3.1.1. Major feed sources and feeding system

Major feed sources and feeding system was summarized in the table 9. The feed sources in Aleta Wondo Woreda include Grazing on natural pasture, crop residue and aftermath, improved forage and inset and banana. According to the group discussion with key informants, natural pasture was the main sources of feed used year round in the Aleta Wondo Woreda. It includes private, communal, fallow and road and river side grazing lands. Even if the quality and quantity of feed got from the

natural pasture was poor during dry season most of the farmers depend on it as main sources of feed. The current study was similar with the finding of Ergena and Abera (2018) and Beyene et al. (2018) who reported the same in Hadiya Zone and Dawuro Zone of Southern Ethiopia. According to the respondents, crop residues and aftermaths were other main sources of feed used in the area especially during dry season (table 8). Group discussion with key informants revealed that crop residue in highland was mainly from barley, wheat, maize and from pea and beans whereas teff straw and maize Stover was main crop residues in midland agro ecology. Crop aftermath was used after crop harvest took place in Aleta Wondo Woreda. According to the respondents and group discussion with key informants' enset (its leaf) and banana plants were main feed source during dry season in both agro ecologies. The current result was in line with the finding of Admasu et al. (2017), who reported the importance of inset in Wolayta Zone of Southern Region. More percentage of the respondents in midland use improved forage as the source of feed than in highland with overall result of 46.2%. Strong extension should be performed to improve adoption and utilization of improved forages. Almost (94.9%) all of the respondents in Aleta Wondo Woreda were following tethered system of feeding to avoid crop damage, save labor and protect from predators and thefts with no difference between agro ecologies. This was due to the area was densely populated and there was a shortage of private and communal grazing land in the Aleta Wondo Woreda. The current result was in lined with the finding of Beyene et al. (2018) who reported 72.7% and 94.4% of tethered system of feeding in highland and midland agro ecologies of Dawuro Zone, Southern Ethiopia. Similarly, 100% tethered system of feeding was reported by the Dhaba et al. (2012) in the Illu abba Bora Zone of Oromia Region. The current result was different from the findings of Gebrekidan (2018) and Fikru and Kefyalewu (2015) who reported less practice of tethered feeding system in Tigray and Somali Region.

Table 9. Major feed sources for sheep and feeding system in Aleta Wondo Woreda

Parameters	Variables	Agro ecology				Over all(n= 158)	
		Highland(n= 72)		Midland(n=86)			
		Fre	%	Freq	%	Freq	%
Major sources of feed	Grazing on natural pasture	72	100	86	100	158	100
	Crop residues and crop aftermath	72	100	86	100	158	100
	Improved forages	27	37.5	46	53.5	73	46.2
	Inset and banana	72	100	86	100	158	100
Feeding system	Free grazing	8	11.1	0	0	8	5.1
	Tethered grazing	64	88.9	86	100	150	94.9
	Total	72	100	86	100	158	100

Freq= frequency, n =number of sample population

Table 10. Reason for tethered feeding in Aleta Wondo Woreda

Parameters	Variables	Agro ecology				Over all(n=158)	
		Highland(n= 72)		Midland(n=86)			
		Freq	%	Freq	%	Freq	%
Reasons for tethered feeding	To avoid crop damages	64	100	86	100	150	100
	To save labor	64	100	86	100	150	100
	To protect from predator: and thefts	64	100	86	100	150	100

Freq= frequency; n=number of sample population

4.3.1.2. Experience of cultivating improved forage

Experience and reason why improved forage was not cultivated in Aleta Wondo Woreda were summarized in table11. According to the result of the current study about one third and half of the respondents cultivate improved forages in highland and midland agro ecologies respectively. According to the survey results the adoption and utilization of improved forage was higher in midland

than in highland agro ecology. The result of the current study was different from the finding of Gebrekidan (2018) who reported higher adoption and utilization of improved forages in highland agro ecology than in midland agro ecology of Eastern Tigray. The main reason for not cultivating improved forage in highland agro ecology was 62.2% and 37.8% lack of seed or planting materials and problem of awareness respectively whereas 80% out of the total respondents said land shortage was main reason in midland parts of Aleta Wondo Woreda (table 10). According to the overall result and group discussion with key informants, lack of seed or planting material (42.6%) and land shortage (37.6%) were leading reasons for majority (53.8%) of respondents for not cultivating improved forages in Aleta Wondo Woreda whereas the problem of awareness was a minimum factor in the area. The current result was comparable with the finding of Gebrekidan (2018), who reported similar reasons why farmers not cultivated improved forage in Tigray Region. According to the group discussion with key informants and personal observation during survey, Elephant grass (*Pennisetum purpureum*), Guatemala grass, Desho grass and Tree lucern were the most widely available grasses in Aleta Wondo Woreda.

Table 10. Experiences of respondents on cultivating improved forages in Woreda

Parameters	Variables	Agro-ecology				Over all (n=158)	
		Highland(n= 72)		Midland(n=86)		Freq	%
		Freq	%	Freq	%	Freq	%
improved	Yes	27	37.5	46	53.5	73	46.2
forage cultivation	No	45	62.5	40	46.5	85	53.8
	Total	72	100	86	100	158	100
Reason for	Problem awareness	17	37.8	0	0	17	20
not cultivating	Land shortage	0	0	32	80	32	37.6
	Lack of seed	28	62.2	8	20	36	42.4
	Total	54	100	40	100	94	100

Freq= frequency; n=number of sample population

4.3.1.3. Feed Supplementation and types of feeds

Natural pasture and crop residues do not fulfill the nutritional requirements of animals particularly in the dry season due to poor management and poor quality. Thus, provision of supplementary feeds to increase the productivity of livestock is essential (Beyene et al. 2018). Although feed types used for supplementation differs, all respondents in Aleta Wondo Woreda supplemented their sheep both in dry and wet season (Table 12). The current result was greater than that of Beyene et al. (2018) who reported about 92.7% of farmer's practice supplementing feeds for small ruminant animals in Esera Woreda, Dawuro Zone. In general feed supplementation interval for sheep was 63.3% and 27.2% daily and once in 2 days respectively in Aleta Wondo Woreda. In accordance with current study Beyene et al. (2018) reported 62.5% of respondents who supplement their sheep once a day but the difference was 30.2% farmers supplement their sheep twice a day in Esera Woreda, Dawuro Zone of Southern Region. According to the response of respondents in both agro ecologies the major feed sources used for supplementation of small ruminant were Food leftovers and Natural browses. A similar finding was reported by Gebrekidan (2018) in Tigray Region. According to the discussion with key informants food leftover was supplemented to the sheep both in dry and wet season whenever available. About half of the respondents in midland and one third of them in highland supplement their sheep with wheat bran and salt in addition to the above listed feed types. The current result was greater than that of 23.5% and 24.7% of the respondents reported by Gebrekidan (2018) in highland and midland of Tigray Region.

Table 11. Feed supplementation for sheep in Aleta Wondo Woreda

Parameters	Variables	Agro ecology					
		Highland(n=72)		Midland(n=86)		Over all(n=158)	
		Freq	%	Freq	%	Freq	%
feed supplementation	Yes	72	100	86	100	158	100
Season of supplementation	During dry & wet season	72	100	86	100	158	100
Interval of supplementation	Daily	45	62.5	55	64	100	63.3
	Once in 2 days	20	27.8	23	26.7	43	27.2
	When available	7	9.7	8	9.3	15	9.5
Type of feeds for supplementation	Food leftovers	72	100	86	100	158	100
	Natural browses	72	100	86	100	158	100
	Wheat bran & salt	27	37.5	46	53.5	158	46.2

4.3.1.4. Feed shortage reasons and mitigation

Feed shortage in quality and quantity was one of the year round problems of sheep production in Aleta Wondo Woreda (Table 13). This result is similar with the finding of Assen et al. (2015), who reported the same report in northern part of Ethiopia. Similarly, Gebrekidan (2018) and Alemu et al. (2013) reported shortage of feed in different parts of Ethiopia. All respondents in Aleta Wondo Woreda and group discussion with key informants revealed that shortage and decline in productivity of grazing land, increase of human population and expansion of crop cultivation on grazing land were the main reasons for the shortage of feed in Aleta Wondo Woreda. Similarly, Beyene et al. (2018) and Dhaba et al. (2012) noted the same reasons for feed shortage in Dawuro Zone of Southern Region and Illu abba Bora of Oromia Region. According to the result of the interview and group discussion with key informants, buying feed from other sources and reducing herd size were used to mitigate feed shortage in Aleta Wondo Woreda. A few respondents in highland area practiced feed

conservation. This shows that strong extension should be built to encourage farmers to conserve feed when surplus feed was available. Similarly, different coping mechanisms for feed shortage were used in different parts of the country (Gebrekidan, 2018; Alemu et al., 2013; Assefa et al., 2014).

4.3.2. Water sources and frequency of watering

Water is very crucial nutrient required by livestock in large amount to transport nutrient around the body, regulate body temperature, form and maintain body tissue. As described in the table 14, most (59.7%) of the respondents in the highland and all respondents in midland agro ecology provided water for sheep in Aleta Wondo Woreda. But 40.3% of the respondents in highland agro ecology did not provide water for sheep due to miss understanding for causes of fasciola or bottle jaw disease which causes swelling around neck region. According to the discussion with the experts of Aleta Wondo Woreda veterinary service center fasciola or bottle jaw disease comes not by providing clean water but will occur when the sheep drinks water from marshy area and affected by liver fluke. According to group discussion with the key informants' farmers those who did not provide water used juice of "kocho" or "mocha" in local language whenever available instead of water. According to table14, during dry season river and pond were main water sources in highland whereas pond and deep well were main sources of water in midland. During dry season respondents in midland area were not used river as source of water due to pollution from coffee industries. During wet season the sources of water was river and pond in highland whereas river, pond and deep well in midland area. During wet season most of the respondents in the highland area did not provide water for sheep by considering moisture content of the feed. This indicates creating awareness on the importance of water should be encouraged in the area. In general pond and deep well during dry season and river and pond during wet season were the main sources of water in Aleta Wondo Woreda. Similarly, Beyene et al. (2018) reported river water as one of the important source of water for small ruminants

in both seasons in Dawuro Zone of Southern Region. Dhaba et al. (2012) noted river and deep well as main sources of water for small ruminants during dry season in Illu Abba Bora Zone of Oromia Region. In contrast the same author was reported that rain water used during wet season in Illu Abba Bora Zone of Oromia Region.

As summarized in the table 15, during dry season most of the respondents provide water for sheep once a day in Aleta Wondo Woreda. The result was in accordance with the report of Dhaba et al. (2012) who reported the similar result in Illu Abba Bora Zone of Oromia Region. Similarly, Gebrekidan (2018) reported that majority of the respondents in highland and midland of Tigray region provides water once to the small ruminants during dry season. The current result was different from report of Beyene et al. (2018) who noted that most of the respondents in Esera Woreda of Dawuro Zone provide water twice for small ruminants during dry season. During wet season all (those who provide water during wet season) of the respondents in the highland provide water for sheep once a week whereas majority (75.6%) of respondents in midland area provide once a week but very few once in three days. According to the discussion with key informants, most (79.4%) of the respondents in Aleta Wondo Woreda provide water for sheep once a week by considering moisture content of the feed during wet season. The current result was different from report of Beyene et al. (2018) who noted all of the respondents in Esera Woreda of Dawuro Zone provide water once a day for small ruminants during wet season.

Table 12. Feed shortage and reasons for feed shortage in Aleta Wondo Woreda

Parameters	Variables	Agro ecology					
		Highland (n= 72)		Midland (n=86)		Over all (n= 158)	
		Freq	%	Freq	%	Freq	%
Feed shortage	Yes	72	100	86	100	158	100
	Shortage and decline in grazing land	72	100	86	100	158	100
Reasons for feed shortage	Increase of human population	72	100	86	100	158	100
	Cultivation on grazing lands	72	100	86	100	158	100
Mitigation for	Buying feed from other sources	37	51.4	55	64	92	58.2
feed shortages	Conserving feeds	10	13.9	0	0	10	6.3
	Reducing herd size	25	34.7	31	36	56	35.4

Freq= frequency; n=number of sample population

4.3.2.1. Water shortage and reason for water shortage

According to table 16, very few (25%) in highland and majority (75.6%) of respondents in midland had the problem of water during dry season. The number of respondents faced the shortage of water were higher in midland than in highland agro ecology. In general half of the respondents had the problem of water shortage during dry season in Aleta Wondo Woreda. Similarly, Beyene et al. (2018) reported that 79% of the respondents who had the shortage of water in Esera Woreda of Dawuro Zone in Southern Ethiopia. The major (72.2%) reason for the shortage of water in highland was drying of water sources followed by pollution from coffee industries in highland and in midland they are equally important reasons. The majority (52.3%) of respondents in midland area faced water shortage due to pollution from coffee industries. The reason for this problem was Aleta Wondo Woreda specializes coffee in midland agro ecology and there were many coffee industries planted on the water sources (river) in this area where as most parts of the highland area specializes annual crops like barley, wheat, bean, pea and others than coffee plants. According to the discussion with key informants farmers who had the problem of shortage use water sources like deep well and other sources from neighbor farmers.

Table 13: Sources of water for sheep in Aleta Wondo Woreda

Parameters	Variables	Agro ecology					
		Highland(n= 72)		Midland(n=86)		Over all(n= 158)	
		Freq	%	Freq	%	Freq	%
Water provision	Yes	43	59.7	86	100	129	81.6
	No	29	40.3	0	0	29	18.4
	Total	72	100	86	100	158	100
Sources of water during dry season	River	15	34.9	0	0	15	11.6
	Pond	28	65.1	39	45.3	67	51.9
	Deep well	0	0	47	54.7	47	36.4
	Total	43	100	86	100	129	100
Sources of water during wet season	River	9	20.9	34	39.5	43	33.3
	Pond	7	16.3	39	45.4	46	35.7
	Deep well	0	0	13	15.1	13	10.1
	Not provided	27	62.8	0	0	27	20.9
	Total	43	100	86	100	129	100

Freq= frequency; n=number of sample population

Table 14. Frequency of watering and reason for not watering for sheep in the Woreda

Parameters	Variables	Agro ecology					
		Highland (n=72)		Midland (n=86)		Overall (n= 158)	
		Freq	%	Freq	%	Freq	%
Frequency of watering during dry season	Once a day	28	65.1	75	87.2	103	79.8
	Twice a day	15	34.9	11	12.8	26	20.2
	Total	43	100	86	100	129	100
Frequency of watering during wet season	Once in 3 days	0	0	21	24.4	21	20.6
	Once a week	16	100	65	75.6	81	79.4
	Total	16	100	86	100	102	100

Table 15. Water shortage, season of shortage and reason in Aleta Wondo Woreda

Parameters	Variables	Agro ecology					
		Highland (n= 72)		Midland(n=86)		Overall (n= 158)	
		Freq	%	Freq	%	Freq	%
water shortage in the area	Yes	18	25	65	75.6	83	52.5
	No	54	75	21	24.4	75	47.5
	Total	72	100	86	100	158	100
Season for water shortage	Dry season	18	100	65	100	83	100
	Wet season	0	0	0	0	0	0
	Total	18	100	65	100	83	100
Reason for water shortage	Drying of water	13	72.2	31	47.7	44	53
	Due to pollution	5	27.8	34	52.3	39	47
	Total	18	100	65	100	83	100

Freq= frequency; n=number of sample population

4.3.3. Housing of sheep

The result showed that majority (79.2%) of the respondents in the highland agro ecology were practicing main house with separate room than in midland area (table 17). According to the group discussion with key informants this is due to the fact that main cash crop (coffee) was available more in midland agro ecology and economically they have more capacity to build separate house for livestock than highlands. The overall result revealed that 58.2% and 41.8% respondents in Aleta Wondo Woreda were housing their sheep in main house with separate room and in separate barn respectively. The current result was in line with the finding of Admasu et al. (2017) and Beyene et al. (2018) in Wolayta Zone and Dawuro Zone of Southern Ethiopia. The result was different from the report of Berihu (2016), Gebrekidan (2018), and Dhaba et al. (2012) who noted different findings in different parts of the country. According to the discussion with key informants, all farmers in Aleta Wondo Woreda housed all classes of sheep together except new born lambs and at late stage

pregnancy. The current result was in accordance with the finding of Assen and Aklilu (2012) and Mulata et al. (2013) who noted the same report in Tigray Region. Frequency of house cleaning was different based on the season. Frequency of cleaning house during dry season was practiced once by all respondents in Aleta Wondo Woreda. In general majority (63.9%) of the respondents clean house twice a day during wet season with no difference between agro ecologies. This is due to sheep urinating frequently during wet than dry season and the floor gets muddy easily than dry season. Similarly, Yenesew et al. (2013) reported the same in Burie district of Amhara Region.

4.3.4. Breeding practices, selection and culling of sheep in Aleta Wondo Woreda

4.3.4.1. Breeding practices

According to table 18, controlled mating was a common practice in both agro ecologies. The result of respondents showed that majority in highland (81.9%) and midland (94.2%) practiced controlled mating and very few uncontrolled mating. In general 88.6% of the respondents in Aleta Wondo Woreda practicing controlled mating system. The current result was less than the finding of Beyene et al. (2018) who reported 98.5% of respondents who were practiced controlled mating in Esera Woreda, Dawurro Zone of Southern Region. The result was different from the report of Admasu et al. (2017) who noted the common practice of uncontrolled mating in wolayta Zone of Southern Region. The sources of breeding ram were from both own and neighbor farmers in highland and in midland mainly from neighboring farmers. The source of breeding ram from own was greater in highland than in midland area due to comparatively more natural resource (land and feed resources) availability in highland agro ecologies. The overall sources of breeding ram in Aleta Wondo Woreda were 34.2% and 65.8% from own and neighboring farmers respectively. According to the results majority of the farmers were using ram by borrowing from neighboring farmers. The current result was in line with report Admasu et al. (2017) who reported 20.7% and 78.3% sources of breeding ram from own and

neighbor farmers respectively in Wolayta Zone of Southern Region. The result was different from the report of Gebrekidan (2018) who reported 65.2 % and 64.3% sources of breeding ram from own in highland and midland of Tigray Region.

Table 16. Housing, types of houses, reason for housing and frequency of house cleaning

Parameters	Variables	Agro ecology				Over all(n= 158)	
		Highland(n= 72)		Midland(n=86)		Freq	%
		Freq	%	Freq	%	Freq	%
Housing practice	Yes	72	100	86	100	158	100
Types of houses	In main house with separate room	57	79.2	35	40.7	92	58.2
	In separate barn	15	20.8	51	59.3	66	41.8
	Total	72	100	86	100	158	100
Frequency of house cleaning during dry season	Once a day	72	100	86	100	158	100
	Once a day	25	34.7	32	37.2	57	36.1
Frequency of house cleaning during wet season	Twice a day	47	65.3	54	62.8	101	63.9
	Total	72	100	86	100	158	100

Freq= frequency; n=number of sample population

Table 17. Breeding system and source of breeding ram in Aleta Wondo Woreda

Parameters	Variables	Agro ecology				Overall (n= 158)	
		Highland (n= 72)		Midland(n=86)		Freq	%
		Freq	%	Freq	%	Freq	%
System breeding	Controlled	59	81.9	81	94.2	140	88.6
	Uncontrolled	13	18.1	5	5.8	18	11.4
	Total	72	100	86	100	158	100
Source of breeding ram	Own	37	51.4	17	19.8	54	34.2
	Neighbor	35	48.6	69	80.2	104	65.8
	Total	72	100	86	100	158	100

Freq= frequency; n=number of sample population

4.3.4.2. Selecting and culling of sheep in Aleta Wondo Woreda

Selection and culling are practices used to improve the productivity of the flock. According to the survey results in Aleta Wondo Woreda, all respondents were practicing selection to improve their flock productivity (table 19). The criteria used for selecting were color, posture or body conformation and health in both agro ecologies. In both agro ecologies pure red and mixed colors were dominant colors selected by the majority of respondents both in highland and midland followed by black color in the highland and by white and black in midland agro ecologies. According to the current result black and white colors have less importance in Aleta Wondo Woreda which is similar to the report of Gebrekidan (2018) and Selamawit and Matiois (2015) in Tigray Region and Gdeo Zone of Southern Ethiopia respectively. Culling was also practiced in the area to improve productivity of the flock. According to the table 20, all respondents in Aleta Wondo Woreda practiced culling due to poor production and reproduction performances, physical defects, symptom of sickness and old age of sheep. The current result is in line with finding of Belete et al. (2015) and Beyene et al. (2018) who noted the same in Bale Zone, Oromia Region and Dawuro Zone Southern Ethiopia respectively.

Table 18. Selection criteria for sheep

Parameters	Variables	Agro ecology				Overall (n= 158)	
		Highland (n= 72)		Midland(n=86)		Freq	%
		Freq	%	Freq	%	Freq	%
Selection practices	Yes	72	100	86	100	158	100
	Total	72	100	86	100	158	100
Selection criteria for ewes	Color	72	100	86	100	158	100
	Posture	72	100	86	100	158	100
	Health	72	100	86	100	158	100
Selection criteria for rams	Color, posture, health and motivation for mating	59	100	81	100	140	100
Preferred colors for both sexes	Pure red and mixed	50	69.4	66	76.7	116	73.4
	Pure red, black and mixed	22	30.6	8	9.3	30	19
	Pure red, white and mixed	0	0	12	14	12	7.6

Table 19. Culling and reason for culling sheep in Aleta Wondo Woreda

Parameters	Variables	Agro ecology					
		Highland (n= 72)		Midland (n=86)		Overall (n= 158)	
		Freq	%	Freq	%	Freq	%
Culling practices	Yes	72	100	86	100	158	100
	Total	72	100	86	100	158	100
Reason for culling	Poor production and reproduction	72	100	86	100	158	100
	Physical problem	72	100	86	100	158	100
	Sickness	72	100	86	100	158	100
	Age	72	100	86	100	158	100

Freq= frequency; n=number of sample population

4.3.5. Castration

According to table 21, most (74.7%) of the farmers in this study did not practice castration with no difference between agro ecologies. Only one fourth of the respondents were practicing castration in highland and midland. From those who practice castration, majority of the respondents in highland and all respondents in the midland agro ecology were practicing castration using burdizo from veterinary center. Very few (27.8%) respondents in the highland practiced castration using traditional method. The overall result showed that 87.5% and 12.5% of respondents practiced castration using burdizo from veterinary center and using traditional method using stone, knife and hammer respectively. The current result was comparable with the finding of Dhaba et al. (2012) and higher than the report of Beyene et al. (2018) who reported 91.1% and 8.9% and 51.4% and 14% of respondents who used burdizo and traditional method respectively in Illu abba Bora Zone Oromia Region and Dawuro Zone of Southern Region. Similarly Tassew et al. (2014) noted the majority of respondents who used burdizo in Northern Wollo of Amhara Region. The result of current study was different from the finding of Gebremeskel (2014), who reported 88.2% and 11.8% of respondents

who used traditional and modern methods to practice castration respectively in Tigari Region. As showed in table 20, the reason for castration was to get higher price by controlling breeding to avoid body condition loss due to mating with female sheep in both agro ecologies. Similarly Gebrekidan (2018) and Belete et al. (2015) were reported the same finding in Tigray Region and Bale Zone of Oromia Region. In addition to these reasons, the discussion with Woreda veterinary office workers showed that farmers castrate sheep to make docile to manage them easily. Similarly Animut and Wamatu (2014) were noted the same finding in Ethiopia.

Table 20. Castration and reason for castration in Aleta Wondo Woreda

Parameters	Variables	Agro ecology					
		Highland (n= 72)		Midland(n=86		Overall (n= 158)	
		Freq	%	Freq	%	Freq	%
Practice castration	Yes	18	25	22	25.6	40	25.3
	No	54	75	64	74.4	118	74.7
	Total	72	100	86	100	158	100
Methods castration	Traditional	5	27.8	0	0	5	12.5
	Using burdizo	13	72.2	22	100	35	87.5
	Total	18	100	22	100	40	100
Reason castration	To get higher price	18	100	22	100	40	100
	To control breeding	18	100	22	100	40	100
	For fattening purpose	18	100	22	100	40	100

Freq= frequency; n=number of sample population

4.3.6. Fattening

As indicated in table 22, more (54.2%) people practice fattening in highland than in midland (29.1%) agro ecology. The overall results showed that above half of respondents in Aleta Wondo Woreda were not practice fattening. The current result was better than the result of Assen and Aklilu (2012) who reported 11% and 15% of fattening practices in highland and midland agro ecology of Tigray

Region. Rams were preferred over ewes for fattening both in highland and midland in Aleta Wondo Woreda. The current study was similar with the report of Gebrekidan (2018) and Assen and Aklilu (2012) who noted most of the respondents fatten more male than female sheep in Tigray Region.

The majority (69.2%) of the respondents in highland and all farmers in midland agro ecology were supplementing fattening sheep with different supplements like wheat bran, salt, food leftovers and crop residues in addition to grazing. Very few (18.8%) respondents practiced fattening using grazing only and there were no respondents who practiced stall feeding in Aleta Wondo Woreda. The current study was different from the finding of Gebrekidan (2018) who reported methods of stall feeding followed by grazing plus supplementation in Tigray Region. According to the interview results there was no difference on period of fattening between two agro ecologies unless there was difference in feeding system. The study revealed that respondents who provide supplements in addition to grazing finish fattening period in three months whereas those who practice fattening using only grazing finish fattening period in more than three months. The current finding was different from the report of Animut and Wamatu (2014) who reported the difference of fattening periods in highland due to cold weather condition in Ethiopia. According to the information from group discussion land shortage feed scarcity and capital problem was the dominant problems that affect fattening program of farmers in Aleta Wondo Woreda. The interview result also showed that feed shortage was a limiting factor in both agro ecologies. Similarly, Gebrekidan (2018) and Animut and Wamatu (2014) reported the problem of feed in different parts of the country. According to table 22, holidays like New Year, Easter and Christmas were main time of selling fattened animals in both agro ecologies. In addition to this during wedding fattened sheep sold in the area. Similarly, Yenesew et al. (2013), Assen and Aklilu (2012), Animut and Wamatu (2014) and Gebrekidan (2018) were reported the same report in different parts of the country.

Table 21. Fattening of sheep in Aleta Wondo Woreda

Parameters	Variables	Agro ecology					
		Highland (n= 72)		Midland(n=86)		Overall (n= 158)	
		Freq	%	Freq	%	Freq	%
Practices of fattening	Yes	39	54.2	25	29.1	64	40.5
	No	33	45.8	61	70.9	94	59.5
	Total	72	100	86	100	158	100
Methods of fattening	Grazing + supplement	27	69.2	25	100	52	81.2
	Grazing only	12	30.8	0	0	12	18.8
	Total	39	100	25	100	64	100
Sex preferred for fattening	Male	29	74.4	18	72	47	73.4
	Male and female	10	25.6	7	28	17	26.6
	Total	39	100	25	100	64	100
Fattening period	For 3 months	27	69.2	25	100	52	81.2
	For above 3 months	12	30.8	0	0	12	18.8
	Total	39	100	25	100	64	100
Time of selling	During holidays	39	100	25	100	64	100
	During wedding	39	100	25	100	64	100
	Total	39	100	25	100	64	100
Reason for not fattening	Shortage of feeds	33	100	61	100	94	100

Freq= frequency; n=number of sample population

4.3.7. Reproductive performance of sheep

Good reproductive performance is a prerequisite for any successful genetic improvement and it determines production efficiency (Zewdu, 2008). The result of current study revealed that average age at first service for male and female sheep was 8.4 ± 0.096 and 10.3 ± 0.16 and 7.54 ± 0.08 and 8.7 ± 0.08 months in highland and midland agro ecologies respectively (table 23). It was significantly ($p < 0.05$) higher for both sexes in highland agro ecology than in midland due to difference in management system. The overall average age at first service was 7.9 ± 0.07 and 9.5 ± 0.11 months for

male and female sheep respectively in the Aleta Wondo Woreda. The current result was comparable with the 7.11 and 8.9 months of age at first service for male and female respectively reported by Admasu et al. (2017) in Wolayta Zone. Compared to the current result the less age at first service for male and female (6.65 and 7.29 months) was reported by Beyene et al. (2018) in Dawuro Zone of Southern Region. The average age at first lambing was 14.3 ± 0.16 and 12.7 ± 0.8 months in highland and midland respectively. The average age at first lambing was significantly ($p < 0.05$) higher in highland agro ecology. The overall average age at first lambing was 13.5 ± 0.11 months in the Aleta Wondo Woreda. The current result was in accordance with 13 and 13.5 months of age at first lambing reported by Selamawit and Matious (2015) and Admasu et al. (2017) in Gedio Zone and Wolayta Zone respectively. The current study showed that the lambing interval of sheep 8.4 ± 0.07 and 7.8 ± 0.08 months in highland and midland respectively (table 23). The lambing interval was higher ($p < 0.05$) in highland agro ecology. The overall lambing interval in Aleta Wondo Woreda was 8.04 ± 0.06 months. This result was in line with 7.9 months reported by Admasu et al. (2017) in Wolayta Zone.

Table 22. Reproductive performances of sheep in Aleta Wondo Woreda

Parameters	Variables	Agro ecology				
		Highland (n= 72)	Midland(n=86)	Over all (n= 158)		
		M± SE	M± SE	M± SE	Sig	
Reproductive performances	AAFS	Male	$8.4^a \pm 0.096$	$7.54^b \pm 0.08$	7.9 ± 0.07	0.000
		Female	$10.3^a \pm 0.16$	$8.7^b \pm 0.08$	9.5 ± 0.11	0.000
	AAFL	$14.3^a \pm 0.16$	$12.7^b \pm 0.8$	13.5 ± 0.11	0.000	
	LI	$8.4^a \pm 0.07$	$7.8^b \pm 0.08$	8.04 ± 0.06	0.000	

Different subscripts indicates significant differences at $p < 0.05$ between means with in rows; M=mean; SE=standard error; n=sample population AAFS=average age at first service; AAFL=average age at first lambing; LI= lambing interval

4.3.8. Diseases, Parasites and health management

Sheep disease and parasites were the main constraints for sheep productions. Disease lowers the productivity of animals and may cause economic loss. According to table 24, pasteurolosis, bottle jaw and parasites (internal and external) were the main diseases and parasites which affect sheep production in Aleta Wondo Woreda. According to the results of interview bottle jaw disease was more occur in highland (47.2%) than in midland (12.8%) agro ecology. The current result was in accordance with the finding of Beyene et al. (2018) who reported internal parasites, external parasites and pasteurolosis in order of their importance in Esera Woreda, Dawuro Zone.

The interview result revealed that 16.7%, 58.3% and 25% of respondents in highland agro ecology were using ethno veterinary practice in addition to Government veterinary center, used Government veterinary center and buy medicines from private center respectively whereas in midland area 88.4% and 11.6% respondents were used Government veterinary center and private veterinary center respectively (table 24). According to the discussion with key informants farmers were using ethno veterinary practices and buying medicines from private veterinary centers due to the problem of access and cost of medicines. According to Addisu (2015) due to distance, awareness and cost of veterinary service, farmers use traditional methods to control common diseases following by veterinary services in Ethiopia.

Table 23. Diseases, Parasites and health management of sheep in Aleta Wondo Woreda

Parameters	Variables	Agro ecology					
		Highland (n= 72)		Midland (n=86)		Over all (n= 158)	
		Freq	%	Freq	%	Freq	%
Availability of government vet center	Yes	72	100	86	100	158	100
	Total	72	100	86	100	158	100
Diseases	Pasteurolosis	72	100	86	100	158	100
	Fasciola/bottle jaw	34	47.2	11	12.8	45	28.5
Parasites	Internal parasites	72	100	86	100	158	100
	External parasites	72	100	86	100	158	100
Sheep health management	Use ethno and vet center	12	16.7	0	0	12	7.6
	Use government vet center	42	58.3	76	88.4	118	74.7
	Use private vet center	18	25	10	11.6	28	17.7
	Total	72	100	86	100	158	100

Freq= frequency; n=number of sample population, vet= veterinary

4.4. Utilization of sheep milk by the society in Aleta Wondo Woreda

According to the results of the interview no one measure the amount of milk got from sheep in both agro ecologies. Result in table 25 showed that most (76.4%) of the respondents in the highland agro ecology consume sheep milk and majority (80%) of them use it mixing with coffee and but very few (20%) mix it with cow milk. The information from discussion with key informants in highland agro ecology showed that mixing sheep milk with cow milk improves the content of cow milk. In midland agro ecology only few (9.3%) respondents who shared boundary with highland agro ecology utilized sheep milk mixing it with coffee whereas most of the respondents were not consuming due to lack of awareness. The discussion with key informants and the result of the interview revealed that there was less awareness on the importance of sheep milk due to this majority of the respondents did not consume sheep milk in Aleta Wondo Woreda. This indicates that strong extension should be needed

to create awareness on importance of sheep milk in Aleta Wondo Woreda. In contrast to the current study, Seid (2019) reported fresh milk, fermented milk, whey, and butter were among the common sheep milk products produced and consumed in the chifra district of Afar region.

Table 24. Utilization of sheep milk in Aleta Wondo Woreda

Parameters	Variables	Agro ecology					
		Highland (n= 72)		Midland(n=86)		Overall (n= 158)	
		Freq	%	Freq	%	Freq	%
Sheep milking practice	Yes	55	76.4	8	9.3	63	39.9
	No	17	23.6	78	90.7	95	60.1
Sheep milk measurement	No	72	100	86	100	158	100
	Total	72	100	86	100	158	100
Sheep milk consumption	Yes	55	76.4	8	9.3	63	39.9
	No	17	23.6	78	90.7	95	60.1
	Total	72	100	86	100	158	100
Forms of consumption	Mixing with coffee	44	80	8	100	52	82.5
	Mixing with cow milk	11	20	0	0	11	17.5
	Total	55	100	8	100	63	100
Reason for not consuming	Unawareness	17	100	78	100	95	100

4.5. Constraints and Opportunities of sheep production

4.5.1. Constraints

According to table 26, the major constraints ranked by the respondents were land and feed shortage, disease and parasites and lack of extension services followed by lack of improved breed, market price fluctuation and water shortage in order of importance in highland agro ecology. In midland agro ecology the major constraints were, land and feed shortage, disease and parasites and water shortage followed by lack of improved breed, lack of extension services and market price fluctuation. The

overall major constraints were, land and feed shortage, disease and parasites and lack of improved breed. The current result was the same with the report of Admasu et al. (2017) who reported feed and land shortage and disease as first and second ranked constraints respectively in Wolayta Zone of Southern Ethiopia. The shortage of land holding size creates a shortage of feed in both agro ecologies due to limited cultivation of improved forage. In addition to land shortage, the change of grass land to crop and decline in quality and quantity of feed production was the main reasons for feed shortage in the area. This situation affected sheep production maximization opportunities due to not use of low cost feed resources. According to the discussion with key informants the land size of most farmers was less than half hectare in Aleta Wondo Woreda. Similarly, Selamawit and Matious (2015) indicated that limitation of land was the second important top prioritized constraint next to feed shortage in Waleme area. Other similar findings were also reported by Beyene et al. (2018) in Dawuro Zone of Southern Region, Tsegaye et al. (2013) in Western Hararghe of Oromia Region, Yohannes et al. (2017) in North Western Lowlands of Amhara Region, Ethiopia. According to table 25, the constraint of disease and parasites was displayed as the second rank by the respondents in both agro ecologies. Similarly, Admasu et al. (2017) reported disease as second ranked sheep production constraints in Wolayta Zone. Additionally, Zemedu (2017) also noted that the majority of the sheep and goat holding households indicated that animal diseases and inadequate animal health services, shortage of feed, land, labor and predators as major constraints of sheep and goat production in Tahtay Adyabo, North Western Zone of Tigray. Water shortage was third ranked constraint of sheep production in midland agro ecology. According to the discussion with key informants water shortage was common in both agro ecologies especially during dry season due to drying of some water sources and pollution by the discharges from coffee industries although it was ranked sixth in highland agro ecologies. Similarly, Gebrekidan (2018) and Beyene et al. (2018) reported the constraints of water in Tigray Region and Dawuro Zone of Southern Region respectively. All

respondents in Aleta Wondo Woreda hold local breed only due to this lack of improved breed were ranked fourth by the respondents in both agro ecologies. The current result was in line with CSA (2016), reported 99.72% of the sheep are indigenous breeds in Ethiopia. Legese and Fadiga (2014) reported indigenous sheep contribution to the agricultural and the overall national economy is below the potential. Lack of extension service was ranked third and fifth in highland and midland agro ecologies respectively. According to the group discussion with key informants and result of the current study most of the respondents did not get training on an improved management system and on importance of sheep milk in Aleta Wondo Woreda. Similarly, Sisay and Kefyalew (2015) and Dhaba et al. (2012) were reported the lack of extension support in Deghabur Zone of Somali Region and Illu Abba Bora Zone of Oromia Region respectively. According to the group discussion with key informants and result of the current study there was no problem regarding to the access for market in Aleta Wondo Woreda. Seasonality of demand for sheep and price fluctuation were the major constraint of the market listed by key informants and respondents in Aleta Wondo Woreda. Similarly, Gebremeskel (2014) reported that the major factors that affect the selling price of sheep and goats were seasonality inflow of animals, market information and market locations. Zemeda (2017) noted that lack of livestock market information, seasonality of sheep and goat demand, distance to livestock market and low market price are some of the constraints in Tahtay-Adyabo District of Tigray. Gebrekidan (2018) noted that the demand was high especially during cultural and religious holydays and hence, farmers are forced to sell their sheep and goats during none fasting periods to meet their cash needs and fetch better income. Similarly, Abraham et al. (2017) indicated that higher numbers of goats are sold and better price is fetched during holidays although farmers sell goats at any time of the year depending on their need for money.

Table 25. Constraints ranked by respondents

Agro ecolog	Purposes	Rank						Score	Index	Rank
		1 st	2 nd	3 rd	4 th	5 th	6 th			
Highland (n=72)	Land and feed shortage	72	0	0	0	0	0	432	0.29	1 st
	Water shortage	0	0	0	0	25	47	97	0.07	6 th
	Diseases and parasites	0	47	25	0	0	0	335	0.22	2 nd
	Market price fluctuation	0	0	0	22	38	12	154	0.1	5 th
	Lack of extension service	0	11	58	3	0	0	296	0.2	3 rd
Midland (n=86)	Lack of improved breed	0	0	0	39	31	2	181	0.12	4 th
	Land and feed shortage	86	0	0	0	0	0	516	0.28	1 st
	Water shortage	0	0	65	21	0	0	323	0.18	3 rd
	Diseases and parasites	0	60	0	9	17	0	361	0.2	2 nd
	Market price fluctuation	0	0	0	10	9	67	115	0.06	6 th
Overall (n=158)	Lack of extension service	0	0	0	27	42	17	182	0.1	5 th
	Lack of improved breed	0	21	23	40	0	2	319	0.176	4 th
	Land and feed shortage	158	0	0	0	0	0	948	0.29	1 st
	Water shortage	0	0	65	21	25	47	420	0.13	5 th
	Diseases and parasites	0	107	25	9	17	0	696	0.21	2 nd
	Market price fluctuation	0	0	0	32	47	79	269	0.08	6 th
	Lack of extension service	0	11	58	30	42	17	478	0.14	4 th
	Lack of improved breed	0	21	23	79	31	4	500	0.15	3 rd

Index=the sum of (6 times First order +5times second order + 4times third order + 3 times fourth order + 2 times fifth order +1 times sixth order) for individual variables divided by the sum of (6 times First order +5times second order + 4times third order + 3 times fourth order + 2 times fifth order +1 times sixth order) for all variables.

4.5.2. Opportunities of sheep production

According to the discussion with key informants and interview of respondents there were many opportunities which motivate farmers to expand sheep production in Aleta Wondo Woreda. The major opportunity of small ruminant production identified and prioritized were high market demand, increase of urbanization, suitability of agro ecology and government attention for sheep production in order of their importance in Aleta Wondo Woreda (table 27). Similarly, Beyene et al. (2018) reported high market demand for sheep due to population increase and urbanization which was ranked second by the respondents in Esera Woreda, Dawuro Zone of Southern Ethiopia.

Table 26. Opportunities ranked by respondents in Aleta Wondo Woreda

Agro ecology	Purposes	Rank				Score	Index	Rank
		1 st	2 nd	3 rd	4 th			
Highland (n=72)	Market demand for sheep	72	0	0	0	288	0.37	1 st
	Urbanization	12	60	0	0	228	0.29	2 nd
	Government attention	0	0	23	49	95	0.12	4 th
	Suitability of agro ecology	7	19	42	4	173	0.22	3 rd
Midland(n=86)	Market demand for sheep	86	0	0	0	344	0.37	1 st
	Urbanization	29	57	0	0	287	0.31	2 nd
	Government attention	0	7	15	64	115	0.12	4 th
	Suitability of agro ecology	0	22	55	9	185	0.2	3 rd
Overall(n= 158)	Market demand for sheep	158	0	0	0	632	0.37	1 st
	Urbanization	41	117	0	0	515	0.3	2 nd
	Government attention	0	7	38	113	210	0.12	4 th
	Suitability of agro ecology	7	41	97	13	358	0.21	3 rd

Index=the sum of (4 times First order +3times second order + 2times third order + 1 times fourth order) for individual variables divided by the sum of (4 times First order +3times second order + 2times third order + 1 times fourth order)) for all variables

5. CONCLUSION AND RECOMMENDATION

5.1. Conclusion

This study was conducted in Aleta Wondo Woreda to assess sheep production system, reproductive performance and habit of sheep milk consumption by the society based on agro ecology. The study was done by interviewing selected farmers, key informants and experts. The study result showed that the majority of the families in Aleta Wondo Woreda were headed by males. The results showed that the main purpose of keeping sheep in the area were for generating income, saving, meat and milk followed by manure and skin in their order of importance. The result showed that mixed crop-livestock production system was the dominant farming system in the area. The feed sources in the Woreda were natural pasture, crop residues and crop aftermath, improved forage and enset and banana leaves. Most of the respondents in the Woreda were following tethered system of feeding. The results showed that above half out of the interviewed respondents in the Woreda have no experiences of cultivating improved forage. All respondents in the Woreda supplemented their sheep both in dry and wet season. The major feed sources used for supplementation of small ruminant were Food leftovers and Natural browses. Feed shortage in quality and quantity was one of the year round problems of sheep production. Pond and deep well during dry season and river and pond during wet season were the main sources of water in the Woreda. Some of the respondents in highland agro ecology do not provide water for sheep due to miss understanding. Majority of the respondents in midland agro ecology have a problem of water due to drying and pollution from coffee industries. Most of the respondents in highland area house their sheep in main house with separate room whereas majority of the respondents in midland area houses their sheep in separately constructed house. Controlled mating was a common practice in both agro ecologies. All respondents in the Woreda were practicing selection and culling sheep for production using different criteria. Pure red and mixed colors were the most preferred colors in the Woreda. The result showed that most of the farmers in

the Woreda did not practice castration and fattening. According to the result of the study comparatively reproductive performance of sheep was better in midland agro ecology. The current result revealed that majority of the respondents were using veterinary center when their sheep get sick. The current result showed most of the respondents in midland agro ecology does not consume sheep milk due to lack of awareness whereas majority of them in highland agro ecology were consume it. The major constraints of sheep production in the area were land and feed shortage, disease and parasites and lack of improved breed whereas high markets demand, increase of urbanization, suitability of agro ecology and government attention were major opportunities in the woreda.

5.2. Recommendation

Based on the study results the following recommendations are forwarded.

- Strong extension work should be done to raise awareness of farmers on improved management of sheep and importance of sheep milk for human beings.
- Feed conservation and improved forage development together with improved forage seed supply should be encouraged to alleviate feed shortage in Aleta Wondo Woreda.
- Attention should be given to veterinary services, especially on access to medicine and on improving genetic capacity of the local sheep.
- To protect pollution of water by discharges from coffee processing industries in Aleta Wondo Woreda, Animal and Fishery office, Environmental Protection and Forestry office and Agricultural office should work together.

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APPENDIX

APPENDIX 1: Household Questionnaires

I) Household Questionnaires

Title: - Sheep production system, reproductive performance and habit of milk consumption by the society in Aleta Wondo Woreda, Sidama zone SNNPs Region.

Zone _____ District _____ PA _____ Altitude (m a.s.l.) _____

Name of data collector.....Date.....Signature.....

A. Socio economic profile of the respondent

1. Name of respondent.....

2. Gender 1. Male 2. Female

3. Age of respondent.....

4. Religion of household head(HHs) 1) Orthodox 2) Muslim 3) protestant 4) catholic 5) others

5 Marital status 1) Married 2) Single 3) Widow 4) Divorced 5) Not relevant

6. . Family size:1. Male----- 2. Female -----

7. Educational level of the households: 1/ Illiterate 2) Read and write 3) 1-4 grade 4) 5-8 grade 5) 9-12 grade 6) Diploma and above

8. Respondent land holdings (ha/ timad);- 1). Crop land..... 2). Pasture land----- 3). Forest land --

8.1. Occupation of the farmer: 1/ farmer 2/ house wife 3/ merchant 4/ government employee

9. What are the major activities on your farm? (1) Crops farming only (2) Crops and livestock/ mixed
(3) Livestock only

9.1. How do you keep your sheep in the production system? 1/ extensive 2/ semi-intensive 3/ intensive

10. What are the compositions of the livestock kept in your farm?

s/no	Type of animal/bird	Total number of heads/birds		
		Male	Female	Total
1.	Goat – local			
	Does			
	Bucks			
	Kids			
2.	Sheep – local			
	Ewes			
	Rams			
	Lambs			
3.	chicken- local			
	-exotic breed			
4.1.	Cattle – local			

	Cows			
	Heifers			
	Bulls			
	Ox			
	Calves			
4.2.	-Cross breed			
	Cows			
	Heifers			
	Bulls			
	Ox			
	Calves			
5.	Horses			
6.	Donkeys			
7.	Mule			

B. Sheep management practices

11. What are the sources of sheep as foundation stock? 1/ gift from parents 2/ share 3/ purchased 12. Specifically why do you keep sheep? (Rank) (1) For milk (2) For meat (3) For skins (4) to generate income (5) For manure 6) to save money on them

13. What are the sources of feeds for your sheep? (Circle all options) 1) grazing on natural pasture land 2/ Crop residues and crop aftermath 3) Inset and banana 4) improved forages

14. How do you graze your sheep? 1) Free grazing 2) tethered grazing

15. If tethered grazing is practiced, why? (Circle all options) 1) To avoid crop and vegetation damages 2) To save labor 3) Protect from predators and theft

16. Do you have an experience of cultivating improved forage? 1/ yes 2/ no

17. If yes, what kinds of forages? -----

18. If no, why? 1/ problem of awareness 2/ shortage of land 3/ lack of seed or planting material

19. Do you provide your sheep with supplementary feeds? 1) Yes 2) No

20. If yes, what type of feeds? (Circle all options)

s/no	Feed types		
1.	Crop residues		
2.	Food leftovers		
3.	Fodder leaves		
4.	Wheat bran		
5.	Natural browses		

21. When do you usually offer your sheep with supplements? 1) Dry season 2) Wet season 3) Both

22. In what intervals you offer supplements to your sheep? 1) Daily 2/ once in 2 days 3) weekly 4) Whenever available

23. If you do not provide supplements, why? 1) Not accessible 2) Expensive 3) Others, specify--

24. Is there feed shortage/constraint for your sheep? 1) Yes 2) No

25. If yes, when? 1) Dry season 2) Wet season 3) Both
26. If there is feed shortage in your locality, why? (Circle all options) 1) Shortage and decline in productivity of grazing lands 2) Increase of human population 3) Cultivation on grazing lands 4) Drought 5) others, specify-----
27. What coping strategy do you use when there is feed shortage? 1/ buying feeds from other sources 2/ selling animals 3/ conserving feeds 4/ feeding in lower amount
28. Do you provide water to your sheep? 1/ Yes 2/ No
29. If yes, what are the common water sources of sheep in the area? 1) River 2) Pond 3) Pipe 4) Deep well
30. If not, why? 1) Due to shortage of water 2) sickness 3) sheep not need water
31. At what intervals do you provide sheep with water?

s/no	Frequency	Season	
		During dry season	During wet season
1.	Any time needed		
2.	Once in 3 days		
3.	Twice a day		
4.	Once a week		
5.	Not provided		

32. Is there any water shortage/problem to sheep? 1) Yes 2) No
33. If yes, when? 1=Dry season 2=Wet season 3=both
34. Why shortage of water? 1) Drying of water sources 2) Far distant from water Sources 3/ pollution

C. Sheep health management

35. What are the common diseases and parasites that affect health and production of sheep?

s/no	Diseases name	Symptoms	Seasons/months
1.	Pasteurolosis		
2.	Fasciolosis/swelling around neck		
3.	FMD		
4.	Mastitis		

Parasites

1. Internal parasites
2. External parasites

36. Are you accessible to veterinary center? 1) Yes 2) No

37. What would you do when your sheep sick?

- 1) Treat with ethno veterinary practices
- 2) Takes to veterinary center

3) Treat with treatments from local traders 4) others, specify

38. Did your sheep get vaccine in last and current year? 1) Yes 2) No

39. If yes, how? 1) After report of disease cases 2) after certain animals died 3) before outbreaks

40. Where do you confine your sheep? 1) In main house 2/ In main house with separate barn 3) in separately constructed house

41. When do you house them? (Circle all) 1) At night only 2) during rain and sun 3) at any time

42. at what frequency do sheep house cleaned?

s/no	Frequency of leaning	Season	
		During dry season	During wet season
1.	Any time		
2.	Once a day		
3.	Twice a day		
4.	Once a week		

D. Reproductive performance of sheep

43. What is the reproductive performance of your sheep?

S/No	Sheep	Age at First Service	Age at First Lambin	Lambing Interval
1.	Sheep1			
2.	Sheep2			
3.	Sheep3			
4.	Sheep4			
	Average			

44. Do you practice selection when you buy sheep? 1/ Yes 2/ No

45. If yes, what criteria do you use to select? (Circle all options) 1/ color 2/ posture and size 3/ healthiness

46. Which colors are more preferred in your area? (Circle all options) 1/pure red 2/ pure black 3/ pure white 4/ mixed colors

47. Do you practice castration? 1/ Yes 2/ No

48. If your answer is yes, where do you castrate them? 1/ traditionally in village 2/ in vet service center

49. Why do you castrate? (Circle all options) 1/ to get higher price 2/ to control breeding 3/ other specify

50. Do you practice culling in your flock? 1/ Yes 2/ No

51. If your answer is yes, what are the reasons for culling? (Circle all options) 1/ poor production and reproductive performances 2/ physical problems 3/ sickness 4/ other-----

52. Do you practice fattening of sheep? 1/ yes 2/ no

53. What method do you use for fattening? 1/ stall feeding 2/ grazing with supplement 3/ grazing only

54. If yes, for how many months do you fatten your sheep? 1/ for 2 months 2/ for 3 months 3/ for above 3 months

55. Which sex do you prefer for fattening? 1/ male 2/ female 3/ both
56. When do you sell your fattened sheep? (Circle all options) 1/ at any time 2/ during holidays 3/ during wedding 4/ other specify
57. If not, What are the reasons for not fattening? (Circle all options) 1/ feed shortage 2/ unawareness 3/ limited market access 4/ other specify

E/ Breeding practices of sheep

58. What is your source of breeding ram? 1/ own 2/ from neighbor 3/ other specify
- 58.1. What is your breeding system? 1/ controlled 2/ uncontrolled/ natural
59. What criteria do you use when selecting breeding ram? (Circle all options) 1/ color 2/ posture 3/ health 4/ other specify
60. Which colors do you prefer for breeding ram? (Circle all options) 1/ red 2/ black 3/ white 4/ Mixed colors

F. Sheep milk consumption status

61. Do you measure the amount of milk that get from your sheep? 1/yes 2/ no
62. If yes, on average what amount of milk get from your sheep per day? (1) Less than 1 liter (2) 1-2 liters (3) 3-5 liters
63. In your family, do sheep milk consumed? (1) Yes (2) No
64. If the answer in the above question is no, why? (Circle all the options) 1) Unavailability 2) Un awareness 3) Traditional taboo 4) Nausea 5) Other (Specify) -----
65. If the answer in the above question 63 is no, in what form is the sheep milk consumed?
 (1) Raw (2) Fermented (3) boiled (4) mixing with coffee 5) mixing with cow milk
66. In your area, is there market access? 1) Yes 2) No
67. If the answer is no, where do you market your animals and their products? -----
68. What are the constraints of sheep production in your area? (Rank) 1) Land and Feed shortage 2) water shortage 3) diseases and parasites 4) market price 5) extension service 6) improved breed 7) other
69. What are the opportunities of sheep production in your area? (Circle all options) 1) Market demand increase for sheep 2) Urbanization 3) governments attention for sheep production 4) other-----

G. Extension linkages in sheep production

70. Did you receive any improved management training on sheep recently? 1) Yes 2) No
71. If yes, by whom did you obtain? 1) By Government 2) by NGOs 3) other, specify-----
72. Did you receive training on sheep milk importance and utilization? 1) Yes 2) No
73. If yes, by whom did you obtain? 1) By Government 2) by NGOs 3) other, specify-----