2023-04

Assesment of Husbandary Practice and Evaluation of Pre-Weaning Growth Performance and Survival Rate of Local Goat in Tegedie District, Centralgonder Zone, Amhara Region, Ethiopia

Semagn Atanaw

BAHIR DAR UNIVERSITY

COLLEGE OF AGRICULTURE AND ENVIRONMENTAL SCIENCES
SCHOOL OF ANIMAL SCIENCES AND VETERINARY MEDICINE

GRADUATE PROGRAM

ASSESMENT OF HUSBANDARY PRACTICE AND EVALUATION OF PRE-WEANING GROWTH PERFORMANCE AND SURVIVAL RATE OF LOCAL GOAT IN TEGEDIE DISTRICT, CENTRALGONDER ZONE, AMHARA REGION, ETHIOPIA

M.Sc. Thesis

By

Semagn Atanaw Zewdie

April, 2023

Bahir Dar, Ethiopia

BAHIR DAR UNIVERSITY

COLLEGE OF AGRICULTURE AND ENVIRONMENTAL SCIENCES SCHOOL OF ANIMAL SCIENCES AND VETERINARY MEDICINE

GRADUATE PROGRAM

ASSESMENT OF HUSBANDARY PRACTICE AND EVALUATION OF PRE-WEANING GROWTH PERFORMANCE AND SURVIVAL RATE OF LOCAL GOAT IN TEGEDIE DISTRICT, CENTRALGONDER ZONE, AMHARA REGION, ETHIOPIA

A Thesis Submitted to the College of Agriculture and Environmental Sciences Department of Animal Sciences in Partial Fulfilment of the Requirements for the Degree of Master of Science in Animal Production

M.Sc. Thesis

By

Semagn Atanaw Zewdie

Advisor: Damitie Kebede (MSc, Asst.Prof.)

April, 2023

Bahir Dar, Ethiopia

DECLARATION

iii

DECLARATION

This is to certify that this thesis entitled "Evaluation of Pre-weaning Growth Performance and Survival Rate of Indigenous Goat Types in Tegedie District, Central Gondar Zone, Amhara Region, Ethiopia". Submitted in partial fulfillment of the requirements for the award of the degree of Master of Science in **Animal Production**, Bahir Dar University, is a record of original work carried out by me and has never been submitted to this or any other institution to get any other degree or certificates. The assistance and help I received during this investigation have been duly acknowledged.

Semagn Atanaw Zewdie  April.17 /2023

Name of the candidate Signature Date

Approval of Thesis for Defence

iv

BAHIR DAR UNIVERSITY

COLLEGE OF AGRICULTURE AND ENVIRONMENTAL SCIENCES DEPARTMENT OF ANIMAL PRODUCTION AND TECHNOLOGY

Approval of Thesis for Defence

I hereby certify that I have supervised, read, and evaluated this thesis titled "evaluation of pre-weaning growth performance and survival rate of indigenous goat types in Tegedie district, central Gonder zone, Amhara region, Ethiopia" by Semagn Atanaw Zewdie prepared under my guidance. I recommend the thesis be submitted for oral defense.

Damitie Kebede (MSc, Asst.Prof.)		18/05/2023
Advisors name	Signature	Date
Esubalew Admasu		18/05/2023
Department Head	Signature	Date

Approval of Thesis Defence Result

v

BAHIR DAR UNIVERSITY

COLLEGE OF AGRICULTURE AND ENVIRONMENTAL SCIENCES DEPARTMENT OF ANIMAL PRODUCTION AND TECHNOLOGY

Approval of Thesis Defence Result

As members of the board of examiners, we examined this thesis entitled "Evaluation of Pre-weaning Growth Performance and Survival Rate of Indigenous Goat Types in Tegedie District, Central Gondar Zone, and Amhara Region, Ethiopia" by Semagn Atanaw Zewdie. We hereby certify that the thesis is accepted for fulfilling the requirements for the award of the degree of Master of Science (M.Sc.) in Animal Production.

Board of Examiners

Dr. Helen Aligusie		18/05/2023
External Examiner Name	Signature	Date
Dr Wossenie Shibabaw		18/05/2023
Internal Examiner Name	Signature	Date
Dr. Shashie		18/05/2023
Chairpersons Name	Signature	Date

ACKNOWLEDGEMENT

I would like to thank the almighty God, the most Gracious and the most Beneficent, who enabled me to reach this point and for kind-hearted help in all aspects of my life. I am grateful to my advisor: **Damitie Kebede** for his kind supports corrections, guidance, and advice starting from proposal preparation to this end.

I would like to thank Bahir Dar University, Department of Animal Sciences for a conducive learning program up to this end. I would like to thank Tegedie District and Tegedie District Agricultural office for providing different facilities for the fieldwork. I ndeed, their cooperation was crucial and this work would not have been possible without their willingness. Data collectors namely Maledu ferede, Berie Lulu(DVM), Monica Ayneshet, Azieb Asmare, Demoz(DVM) Rarto Teshale Gomeju Abate, Gonderit Sisay, Astede Fetalew(DVM), Aweke Alebachew, Abebe Mesganaw, Maru Abuhhay(DVM), Aragaw Gietachew, Abebech Adane, and Yeshewaytu Atenaw contributed a lot for the success of the study and I am grateful to them I am also thankful to goat owners in Tegedie District for providing their goats freely for monitoring work.

My father, Komoss Aba Atanaw Zewdie, I would not have reached this level had it not been for your uninterruptible love, care, encouragement, and prayer. Thank you.

I would like to thank for responsible offices of the study area for their significant contribution and cooperation and also I would like to thanks my friends Aweke Enyew, Tesfa Teferi, Serebe Adugna, Mikias Semachew, Fasil Nega, Abebe Mequant,Zelalem Anley(Msc.), Chalie Mulunhe, Lejalem Kurabachew, Daneaiel Arefeaynie(Msc.), Bemerew Terefe(Msc.), Teruneh Mossie(Msc.), Yeshanbel Alemnew(Msc.), Sewenet Kidanu(Msc.), Nigest Kidie, Andarg Asefa, Alemu Ayelo, Desie Negesse, Yerga Ayelgn, Fekadu Negusie Temesgien Aytegeb(DVM), Workie Berehanu(DVM), Mezgebe Maru (DVM), and Adugnaw Ewenetu(DVM), for their help during data collection.

Last but not least, I would like to express my sincere gratitude for the loving motivation and support of my family namely k/mikaaele Semagn, and kies Menberu Atanaw through my research.

ASSESMENT OF HUSBANDARY PRACTICE AND EVALUATION OF PRE-WEANING GROWTH PERFORMANCE AND SURVIVAL RATE OF INDIGENOUS GOAT TYPES TEGEDIE DISTRICT, CENTRAL GONDER ZONE, AMHARA REGION, ETHIOPIA

SemagnAtanawZewdie [1, 2] Damitie Kebede Mengesha [1]

[1] Centeral Gondar zone Tegedie District, Agricultural Office, Tegedie, Ethiopia.[2] Colleges of Agriculture and Environmental Sciences, Bahir Dar University, Department of Animal Sciences, P. O. Box 5501, Bahir Dar, Ethiopia

ABSTRACT

The study was conducted in Tegedie district Central Gondar Zone of Amhara Regional states to asses the husbandary practice and evaluate the pre-weaning growth performance and survival rate of local goat types in their production environment. Both primary and secondary data were collected from a semi- structured questionnaire, field observation, group discussions, and performance monitoring. The data collected from the questionnaire were described and analyzed using descriptive statistics procedures of Statistical Package for Social Sciences (SPSS) and data collected from performance monitoring were subject to GLM analysis by using SAS version 8. Mixed crop-livestock production was the predominant production system in the study area. Natural pasture was the major source of goat feed both in the dry and wet seasons with index value of 0.53 and 0.72 respectively. The most serious constraints hindering goat production in the study area were feed shortage, disease, and market infrastructure with index value of 0.29, 0.2 and 0.19 respectively . The prolificacy, low initial cost and increased meat demand were the first, second, and third opportunities. The overall least squares mean birth and weaning weight were 2.47±0.11 and 9.4±0.34 kg and the overall least squares mean average daily gain (in grams) from birth to 30, 60, and 90 days were 108±5.43, 88±4.14 and 75±3.02, respectively. Birth weight, pre-weaning weight, pre- weaning growth rate, and survival rate were significantly affected by agroecology, parity and birth type. Male kids birth weight were higher than female kids (2.56±0.10 vs. 2.10±0.10, $p<0.0001$). Parity one kids had significantly lower birth weight than the second, third,

fourth, fifth, and sixth parity (1.69±0.18 vs. 2.58±0.15, 2.63±0.13, 2.29±0.18, 2.46±0.26 and 2.46±0.26, P<0.0001). Similarly, single-born had higher than the twin and triple-born kids (2.67±0.11vs. 2.30±0.13 and 1.98±0.25, P< 0.0001). The overall survival rate from birth to 90 days was 15 %. In general, Local goat types under traditional management systems had lower *pre-weaning growth performance and survival rates in the current study.*

Keywords: Ethiopia, Indigenous goats, mortality rate, pre-weaning growth performances

LIST OF CONTENTS

Table of content **Page**

LIST OF TABLES

LIST OF FIGURE

LIST OF APPENDIX TABLES

LIST OF APPENDIX FIGURES

LIST OF ABBREVIATIONS/ACRONYMS

ADG	Average Daily Weight Gain
ATVET	Agricultural Technical Vocational Education and Training
AWW	Average weaning weight
BC	Before Century
BW	Birth weight
CCPP	Contagious Caprine Pleuropneumonia
CSA	Central Statistical Agency
DAs	Development Agents
DPC	District Plan Commission
FGD	Focus Group Discussion
GDS	Goat Dominant site
GLM	General Linear model
IBC	Institute of Biodiversity Conservation
IPMS	Improving the Productivity and Market Success of Ethiopian Farmers
MFS	Mixed flock site
PWGR	Pre-weaning growth performance
SAS	Statistical Analysis Software
SDS	Sheep Dominant site
SNNS	Southern, Nations, Nationalities, and People
SPSS	Statistical Package For Social Science
TDAO	Tegedie district agricultural office
USA	United States of America
WW	Weaning Weight

CHAPTER ONE: INTRODUCTION

1.1. Background and Justification

Livestock is an important and integral component of agriculture, which is the pillar of the Ethiopian economy and is believed to have the largest livestock population in Africa. The recent livestock population of Ethiopia that the country has estimated about 70 million cattle, 42.9 million sheep, 52.5 million goats, 2.15 million horses, 10.80 million donkeys,0.38 million mules, and 8.1 million camels, and 57 million chickens (CSA, 2021). These potentials make the country a prominent repository for animal genetic diversity (Galgalo Hussein et al., 2015). In Ethiopia, goats are accountable for about 25% of the domestic meat consumption and 58% of the national annual hide and skin production (Tatek Woldu, 2016). Goat production in Ethiopia contributes significantly to national export earnings and the livelihoods of producers, especially poor rural households. Across the whole country, goats provide meat, milk, cash, skins, manure and security (insurance), as well as banking and gifts (Adane Hirpa and Girma Abebe, 2008). In Ethiopia, goats are adapted to a wide range of agro- climatic conditions, have selective feeding behavior, fast reproduction, and low capital investment making them suitable for smallholder farmers and pastoralists. They are owned by the majority of smallholder rural farmers for whom this resource is critical for nutrition and income and important as a secure form of investment, which happens to be major farming activity on vast areas of natural grasslands in regions where crop production is impracticable (Belete Asefa et al., 2015) and they preferred attributed to their low cost of production, adaptability to the hot environment through their dynamic feeding behavior, high fertility and growth rates and fast reproduction cycle (Solomon Gizaw et al., 2010).

In Ethiopia, the average annual meat consumption per capita is estimated to be 8 kg/year which was lower than the consumption of meat in the Africa (12.7 kg) and USA (124 kg per capita per year) and the global average meat consumption (38 kg/year). Recent global meat consumption trends report an increase in goat meat consumption as a protein source; however, consumption is not popular in South Africa. Despite goat meat being a

nutritious and sustainable source, the willingness to consume goat meat as an acceptable protein source among young adults is not known (Unathi Kolanisi et al,. 2022)

The average carcass weight of Ethiopian goats is 10 kg, which is the second lowest in sub-Saharan Africa (Adane Hirpa and Girma Abebe, 2008). Ethiopian indigenous goats are genetically less productive as compared to exotic breeds. The Ethiopian livestock herd comprises 52.5 million goats, 42.9 million sheep, 70 million cattle, 57 million poultry, 8.1 million camels, 2.1 million horses, 10.8 million donkeys, 0.38 million mules, and 6.99 million hives (CSA, 2021). The CSA (2021) report also showed that from the national goat population, the indigenous, hybrid, and exotic breeds covered about 99.9, 0.05, and 0.05 million heads, respectively, indicating that the indigenous goat breeds have the highest share. These livestock populations are distributed across various agro-ecological zones and managed under mixed crop-livestock, pastoral and agro-pastoral, landless urban and per-urban, and commercial dairy and feedlot production systems (FOASTAT, 2019)

In Ethiopia, almost all goats are produced in mixed crop-livestock and pastoral and agro-pastoral systems. They are managed under extensive traditional systems and produced the lowest compared to other sub-Saharan African countries. Though the purpose of keeping goats varies from area to area due to economic, cultural, and ecological factors (Getahun Legesse, 2008), they are mainly maintained for fulfilling multiple roles, ranging from socio-cultural purposes to providing meat, milk, and manure (Dhaba Urgessa *et al.*, 2012). Flock sizes are larger in the lowland mixed crop-livestock and pastoral and agro-pastoral systems (Solomon Gizaw *et al.,* 2010). In the highlands, because of shrinking cultivated areas per household, reduced feed availability, and land degradation, goats are kept in small flock sizes. Goats in the lowlands of the country are kept both for milk and meat production, whereas in the highlands they are mainly kept for meat and income generation (Assen Ebrahim and Aklilu Hailemichael, 2012).

Goats contribute an estimated 14% of meat products, 10.5% of milk production, and 6% of all animals exported (Solomon Abegaz et al., 2014). though, their contribution for the national economy is still low. This might be due to poor nutrition, the prevalence of diseases, lack of appropriate breed and breeding strategies, and poor understanding of the

production system as a whole. However, the indigenous goat breeds have a relative advantage in their natural habitat (Tesfaye Tsegaye, 2009). Designing improvement programs will be successful if it is accompanys by a good understanding of farming systems and simultaneously addressing several constraints, e.g., feeding, health control, and management. Currently, there are different research works done on indigenous goats which can contribute to designing improvement programs. However, there is limited information on the huasbandary practice and growth performance of local goats.

Tegedie district is an area with 70% lowland, which is suitable for goat production and has a huge goat population. Even though the number of goats in the district is huge, their contribution to the rural population is low. In addition, the goat can typify by low productivity in terms of growth rate, meat production, and reproductive performance. Therefore, it is crucial to systematically describe the husbandry practice and pre-weaning growth performance of goats to plan and design appropriate research and development interventions that are relevant for better improvement.

1.2. Statement of the Problem

Birth weight and weaning weight are economically important traits in livestock production affecting the profitability of the farm. The economic value of a goat depends on its growth performance as it determines the meat-producing ability. Rapid growth during the early period can minimize the cost of rearing and thus provide more profit to the farmers. The birth weight and early growth rate of animals are determined not only by genetic potential but also by maternal and environmental factors (Belay Deribe and Mengistie Taye, 2008). Even though the district has a huge number of goats, the potential for goat production is challenged by poor management, limited feed resources, and high disease prevalance. Currently, there is a poor information to improve the husbandry practice and there is a knowledge gap on economically important traits like pre-weaning growth performance and survival rate of goats. In such circumstances, the production and growth performance of goats in the district is low and the owners does not exploit the maximum potential (DPC, 2021). Moreover, there is a limited information on-farm growth performance, survival rate evaluation and husbandry practices for indigenous goat production in the study area. There is a need to characterie husbandry practices, monitor

pre-weaning growth performance and survival rate of indigenous goat types in the district to characterize husbandry practices, and evaluate the growth performance and survival rate of the kids in the study area. The findings from this study was used to generate baseline information on husbandry practices and evaluation of pre weaning growth performance and survival rate of local goat ih the study area. Therefore, the present study is to assess the husbandary practice and evaluate the pre- weaning growth performance and survival rate of local goat types.

1.3. Objectives of the Study

1.3.1. General objective

The main objective of the study was to asses the husbanary practice, evaluation of pre-weaning growth performances and survival rates of local goat types in Tegedie District Central Gondar Zone Amhara Region, Ethiopia.

1.3.2. Specific objectives

- To assess goat husbandary practice in the study area.
- To evaluate the pre-weaning growth performance and survival rate of local goat types in the study area.
- To identify the major constraints and opportunities of goat production in the study area.

1.4. Research Questions

- What is the existing husbandry practice of goats in the district?
- What is the pre-weaning growth performance and survival rate of kids in the district?
- What are the major constraints and opportunities of goat production in the district?

1.5. Significance of the Study

The study result will be used by the livestock office, planners and researchers, and animal production experts for improving livestock production by solving major constraints that hinder goat production. The outcome of the study will have contributions to the livestock holder and those who are a participant in small ruminant production. Especially the livestock sector well used the finding of the studies showed that despite the large potential of goats in the country their productivity is low. Various factors contribute to the low productivity of goats such as feed shortage, disease, and market infrastructure, the study will be valuable to other people who wish to research related topics, just because they will use the result of the study as a reference when reviewing the literature. It helps agricultural transformation in agriculture, due to its advanced government policies that target the production and export of more live animals, meat or mutton, and livestock products like skins, hides, and leather.

CHAPTER TWO: LITERATURE REVIEW

2.1. Origin and Domestication of Goats

Domestication presents an extreme shift of physiological and behavioral stress for free-living animals(G. Larson, 2014). The domestic goat (*Capra hircus*) is an important livestock species throughout the entire Asian and African continents (Missohou *et al.*, 2006). They are the earliest domestic animal and probably the first ruminant livestock, after the wolf was domesticated (Zeder and Hasse, 2000). There are two reasons for this: firstly, the wild goat was reported to be present in the regions of southwest Asia during the time when agriculture was developing. Secondly, the goat is an extremely hardy animal, hence, could have withstood the rigors of being reduced to the state of domestication better than other ruminants.

It is commonly held that the earliest domestication was of the bezoar ibex in the Zagros Mountains (Taberlet, P, 2008). These earliest domesticated goats were used to produce meat and milk for Neolithic farmers, along with providing many of the materials required to build residences and tools. Following the domestication of goats over 300 breeds have been established for a variety of purpose,(Hirst, K, 2008), including for the maximation of milk production and for meat. Domestication and the selective breeding which resulted had a significant effect on the direction of goat evolution, with goats developing behaviour which is considered to have been influenced by consistent proximity to humans. Deamer Kacey, (2016) Selective breeding also significantly increased the physical diversity of modern goats, producing characteristics not seen in wild goats.

It is believed that by the 5th millennium B.C. goats had reached Egypt and by about 3500 BC goats with spiral or corkscrew horns entered Egypt from the Middle East. From Egypt the goats moved to the South and West part of the African continent.

Goats in Africa have traditionally been divided into three main families the Dwarf goats of West and Central Africa, the Savannah goats of sub-Saharan Africa and the Nubian type goat of Northern Africa (Epstein, 1971; Wilson, 1991). Generally, goats of sub-Saharan Africa are divided into three major types following their morphology; the long lop-eared

type in north east and southern Africa, the small short-eared type dominant in eastern Africa and the dwarf short-eared type of West Africa. Most tropical goats were not well characterized both by genotype and phenotype and can be called nondescript. It is assumed that the first wave of goats entered Ethiopia from the north between 2000 and 3000 B.C. The ancestors of Ethiopian goats are closely associated with goat types which migrated from the Middle East and North Africa.

2.2. Goat Genetic Resources and their Geographical Distribution

Physical characteristics of the five goat populations studied are described below (Table 1). Gonda goat population: Gondar goat population is found mainly in the northern and southern highlands of Gondar in the Amhara region of Ethiopia. This goat is also partially found in the lowlands of North Gondar. In a previous report (Getinet Mequriaw *et al.,* 2016), he grouped the goat population found in this area together with the Ambo goat and named it the Central Highland Goat.

According to Alubel Alemu (2015) who morphologically studied the goats found in Lay-Armacheho area of Gondar, a majority of the goats are horned, males have ruff but not the females, and the adult animal body weight is estimated at 33.9 kg. Pure white and mixed coat colours describe the population. These coat colours equally describe both female and male animals.

Ambo goat population: Ambo goat, which was grouped under Central Highland goat in formerclassification (Getinet Mequriaw *et al.*, 2016) is distributed in West Showa of Oromia region. The majority of the goats (75.7%) have patchy coat colour patterns in both sexes, 20.3% plain and 4% spotted (Netsanet Zergaw, 2014). Among goats with plain coat colour pattern, 18.3% are brown, 1.7% white and 1.7% black. Fifteen per cent of the goats have brown coat with black patches and 10% of the goats have white coat with black patches. Most of the males (84.4%) have spiral horns while the rest have curved ones, whereas 61.2% and 38.8% of the females have curved and spiral horns, respectively. Orientation of the horns is backward in 93.3% and upward in 5.7% of the goats. All animals have concave head profile, pendulous (83.3%) and semi pendulous (16.7%) and ear orientation type, straight (76.3%) and dipped (23.7%) back profile.

Males have wattle (85%), beard (93.8%) and ruff (53.1%) while the majority of the females had no beard (57%) and ruff (96.3%). Woyto-Guji goat population: Woyto-Guji goat population is distributed in Gamu-Gofa and eastern Sidamo (Guji) including Jinka valley in SNNPR state. Woyto-Guji goats are characterized by curved and backward oriented horns, with 97.4% of both males and females being horned, concave head profile, semi-pendulous ear type, and straight back profile in 81.4% of the population and curved or dipped back profile in 18.6% of the goats. In addition, majority of the males have beard (65.8%) and ruff (68.4%) but no wattle while majority of sampled females had no beard (88.2%) and ruff (98.9%). Almost all (99.3%) sampled goats in both sexes had no wattle (Biruh 2013; Netsanet Zergaw, 2014).

Arsi-Bale (Highland and Lowland) goat populations: The goat populations are distributed in the highland and lowlands of Arsi and Bale, Oromia state. According to Hussein Hassen (2015), the goat. Population has a wide range of coat colours. Both highland and lowland goat populations can be explained dominantly by plain coat colour(black and white) pattern However, while patchy and spotted coat colours are the second and third dominant patterns in the Highland goat, spotted are the second and third dominant patterns in lowland goat population. The dominant colour identified by Hussein Hassen (2015). In the latter report, the dominant colours of the highland goat were found to be plain black, white, red-brown and grey and mixed colours of black and white with patches of other colours. This might be because of high level of population in-and- out migration among Arsi-Bale Highland goat and the nearby populations for the last few decades. This hypothesis is supported by Getinet Mequriaw *et al*, (2016) report of 42.5, 19.3, 28.8, 24.3, and 33.7 level of population migration per generation (Nm) among Arsi-Bale Highland goat with Hararghe Highland, Long-eared Somali, Short-eared Somali, Woyto-Guji, and Ambo goat populations, respectively. Hair size of the Arsi-Bale goat is the other unique feature of the highland goat population. It is covered with long wavy and glossy hair (mean hair length of 13.8 cm). However, the Arsi-Bale Lowland goat has smooth and short hair which is in agreement with other rift valley family goat types (woyto- Guji goat, Afargoat) Yaekob Lorato *et al*, (2015).

Table 1: Distribution of documented indigenous goat types in Ethiopia.

Goat types	Synonym	Distribution
Barka	Bellenay, Beni Amer	Northern and northwestern Ethiopia near the border with Eritrea and Sudan
Long-eared Somali	Digodi, Melebo, Boran Somali, Benadir, Gigwain	Rangeland of the southern Ogaden, Bale, Borana, and Southern Sidamo With the Somali and Borana Pastoralists
Short-eared Somali	Ogaden, Mudugh, Dighier,Abgal, Somali, Bimal	Northern and Eastern Ogaden and around Dire Dawa
Western Highland	Agew	Highlands of Western Ethiopia (Gonder, Gojjam, Wollega, and Shoa)
Western Low land	Gumuz	Lowlands of Western Ethiopia (Metekel, Assosa, and Gambella)
Woyto – Guji	Woyto, Guji, Konso	North Omo, South Omo, Sidamo, Borana
Abergele	Na	Southern Tigray, North Wollo, and South Gonder
Afar	Adal, Assaorta, Denakil	Afar region and parts of Eritrea and Djibouti with the Afar Pastoralists
Central Highland	Brown Goat, Kaye	Highland of Central Ethiopia from Tigray through Wollo, Gonder to Shoa
Hararghe Highland	Kotu-Oromo	Highlands of Eastern and Western Hararghe
Keffa	NA	Keffa and adjoining parts of Kembata and Hadiya
Arsi-Bale	Gishe, Sidama	Arsi and Bale, higher altitudes of Sidamo and West Shewa

Getinet Mequriaw *et al.,* 2016.

2.3. Socio-Economic Importance of Goats

Goats are important in resource-poor communities because they provide tangible benefits such as cash income from animal sales, meat for home consumption, manure, skins, and fiber (Hussein Hassen, 2014).

They are also a source of intangible benefits, e.g. savings, insurance, and for socio-cultural purposes (Dereje Tadesse, 2014). An estimated 39% of households in Uganda are known to own goats, which further demonstrates the importance of goats in the livelihoods of the people (MAAIF, 2013).

The total income share from small ruminants tends to be inversely related to size of land holding, suggesting that small ruminants are of particular importance for landless people especially for rural women (Oluwatayo *et al.,* 2012).

As a result, crop production provides seasonal employment; hence, rearing of small ruminants would provide an employment opportunity and income throughout the year.

Sale of goats and goat products (meat, skin and milk) by farming communities is the major source of cash (Mahilet Dawit *et al.,* 2012). In addition, goats are raised mostly to safeguard against crop failure and unfavorable crop prices in intensive cropping areas. In Ethiopia, the purpose of keeping goats by smallholder farmers is to generate income, for labor, wage payment followed by food crop purchase, input purchase, school fee and as means of tax in that order (Deribe Gemiyu and Tesfaye Tsegaye, 2009).

2.4. Goat Production System

Goat production in Ethiopia is described under low input production system and is operated by smallholder farmers. This production system accommodates almost all of the goat population of the country (Solomon Gizaw *et al.,* 2008). In Ethiopia, sheep and goats are maintained in two broad production systems namely mixed and pastoral and agro-pastoral farming systems (Metawork Milkias, 2016). Extensive systems of production share common characteristics, such as small flock sizes, communally shared grazing, uncontrolled mating, absence of recording, low productivity per animal, relatively limited use of improved technology and use of on-farm by products rather than purchased inputs (Girma Abebe, 2008).

2.4.1. Mixed crop-livestock production system

Crop–livestock diversification refers to the process of increasing the variety and scale of production of these crops and livestock within the framework of a mixed farming

system. Crop–livestock diversification is thus the production of different crop(s) and livestock(s) on available land space (Wuletaw Mekuria *et al.,* 2018).

Mixed agriculture, according to Wuletaw Mekuria (2018) is the simultaneous process by which farmers grow crops and rear farm animals to maintain sustainable agriculture. In a mixed farming system, livestock manure is used to fertilize crop farmlands while the animals provide traction for farming. Several empirical studies have concluded that mixed farming is the most important farming system for developing economies, particularly in Sub-Saharan Africa (SSA), home to over 166 million agro-pastoralists (Iiyama M *et al.,* 2008). Mixed farming also allows farmers to diversify their resources to balance crop and animal production.

2.4.2. The pastoral and agro-pastoral production system

In pastoral and agro-pastoral areas sheep and goats are important components of the farming system, which benefit small holder farmers in generating cash income as well as milk. Under Ethiopian conditions, pastoral systems of production are found at altitudes below 1500 m.a.s.l. and where the annual precipitation is less than 500 mm., in this system Livestock are maintained as a principal activity and rangeland is the main land resource. This system is characterized by less integration with crop production as compared to the crop–livestock production systems. Producers under this system have a permanent residence and their movement is limited in terms of both distance and duration (Markoss Tibbo, 2006). In pastoral systems, extensive livestock production is mostly the sole source of livelihood with little or no cropping. In the sub moist/moist lowlands, agro pastoralism is the main mode of production. Crop and livestock production are both important activities (Tsegaye D *et al.,* 2013).

2.4.3. Urban and peri-urban production system

Despite there being goat production in towns all over the country this system has got little research attention. There is no reliable quantitative data available on urban and peri-urban goat production but it is not uncommon to observe goats in urban areas including the capital city of Addis Ababa. With the expansion of khat (*Cata edulis*) in

almost all parts of the country, goats frequently serve as 'cleaners' of the left over's. The population and contribution of goats in urban and peri-urban areas need to be quantified and associated value chains studied. The environmental impacts of these production systems also need to be investigated (Solomon Abegaz *et al*., 2008).

Differently from the above classification, Getahun Legesse (2008) classified the small ruminant production systems of the country into four sub-systems based on the dominant agricultural activities: Small ruminants in annual crop-based systems located in Northern, Northwestern, and central highlands; small ruminant perennial crop-based, mostly found in Southern and Southwestern highlands; Small ruminants in cattle based systems, these systems usually exist in agro-pastoral and semi-arid areas; small ruminant dominated systems; found in pastoral and arid areas of Eastern and Northeastern Ethiopia, where sheep and goats are the dominant livestock species.

2.5. Goat Production Performance

2.5.1. Growth traits performances

Birth weight

According to Dereje Tsegaye *et al*, (2015) funding birth weights of kids from indigenous goats of Ethiopia range between 2.2 and 2.9 kg. Birth weight between 3 and 3.5 kg is recorded for Begait and Abergelle goats (Berhane Gebreyohannes and Lars Olav Eik, 2006) and Somali goats (Zeleke Mekuriaw, 2007) under improved management conditions. According to Tesfaye Alemu *et al*. (2000), the birth weight of Borana and Somali kids averaged 2.3 kg. This is similar to the BW of kids from central highland goats. According to Tesfaye Alemu *et al.* (2000), birth weights of male and female kids were 2.28 ±0.54 and 2.36 ± 0.51 kg for Borana Somali goats and 2.00 and 1.00 kg for Mid Rift Valley goat types, respectively. In the same study, the mean birth weight of single and twin births was reported to be 1.69 ± 0.43 and 1.23 ± 0.37 kg for mid rift valley goats, respectively. Birth weights influenced the survival rate. Kid mortality decreased as the birth weight of kids increased. The highest mortality rate was recorded from birth weight 1.00 - 1.90 kg and 2.00 - 2.90 kg with the rate of 50.0% and 52.9% respectively. According to Girma Abebe *et al.* (2013), Kid mortality decreased with the

increase in birth weight. Birth weight is a critical factor in prenatal mortality. Heavier kids have enough energy to maintain their body heat and get up to be suckled quickly. Lightweight kids usually die of starvation or hypothermia (Fernandez, 2014).

Thirty-day weight

The overall 30 day weight of Bati and Borana goat kids was significant difference 6.15 vs. 5.39 kg respectively (Getaw Tadesse et al., 2019). Sex had also significant 5.77 vs. 5.14 kg in Borana and 6.82 vs. 6.26 kg in Bati goat kids in male and female kids respectively. Birth type had also significant in Borana and Bati goat kids 5.71 vs. 5.2 kg in Borana and 6.28 vs. 5.79 kg in Bati goat kids for single and twin respectively, (Hulunim Gatew, 2019). According to Deribe Gemiyu and Tolera, 2017 Single born kids were heavier ($P<0.05$) birth weight as compared to multiple counterparts and they maintained their superiority (4.75 vs.4.06 kg) . In Bati goat kids parity had also significant effect on 30 day weight in which parity two had lowest weight as compared to the first, third, fourth and fifth parity 5.55 vs. 5.8, 6.15 , 6.31and 6.38kg (Hulunim Gatew, 2019). But non- significant effect of parity in Borana goat kids (5.02 vs. 5.39, 5.54. 5.5 and 5.84 kg).

Sixty-day weight

Adilo Kids born at the MFS had significantly ($P<0.05$) higher weights 7.11kg at 60 days compared to the GDS 6.27kg while non–significant ($P>0.05$) compared to the SDS 6.82 kg (Deribe Gemiyu, 2017). The effect of sex is significant at 60 day 6.95 vs. 6.27 kg in male and female respectively. Type of birth is also an important source of variation. Single born kids were heavier ($P<0.05$) as compared to multiple counterparts and they maintained their superiority (7.05 vs. 6.12). Parity effect was significant ($P<0.05$). In adilo kids, parity one had higher weight at 60 day compared to parity two and five , 7.16 vs. 5.86 and 6.27 (Deribe Gemiyu, 2017).

Ninety-day weight

Despite their significant ($p < 0.05$) difference in average birth weight, Bati and Borana goat kids had nearly equal overall average live weight at 90 days of age 10.44 vs. 10.34 kg respectively (Getaw Tadesse et al., 2019). Sex had also significant 11.01 vs. 10.28 kg in

Borana and 10.58 vs. 9.56kg in Bati goat kids in male and female respectively. Birth type had also significant effect in Bati 10.57 vs. 9.57 kg for single and twin. However, non-significant effect of birth type in Borana goat kids 10.67 vs. 10.62 kg for single and twin respectively. According to Deribe Gemiyu and Tolera, 2017 Single born Adilo kids were heavier ($P<0.05$) birth weight compared to multiple counterparts and they maintained their superiority (10.4 vs. 9.15kg) .

In Bati goat kids parity had also significant effect on 90 day weight in which parity one had lowest weight as compared to the second, third, fourth and fifth parity (9.46 vs. 9.81, 10.5, 9.48 and 11.08kg). But non-significant effect of parity in Borana goat kids (10.68 vs. 10.89, 9.86, 11.22 and 10.57 kg). However, in Adilo kids, parity had no significant effect on 90 day weight (Deribe Gemiyu, 2017). Average weaning weights (WW) of Abergelle and Begait goats at the age of three months are found to be in the range of 9 and 10 kg.

Result showed that in different Boer goat crosses kid sex significantly influence 15.02 ($P < 0.01$) weaning weight as compaired to Boerja 13.67. The male kids are always heavier than female. This is because the rate of prenatal growth of male. The male kids always grew faster than female, this indicates that the male sex more quickly adaptable to the environment 14.19 vs 13.31kg (T Nugroho,. 2018).

Average daily weaght gain

According to Deribe Gemiyu and Tolera (2017), the overall mean ADG of Adilo kids from birth to 90 days 82.3g/ day was lower than that of Getaw Tadesse *et al.* (2019) who reported that 86.22 and 89.88 g/day Bati and Borana kids respectively.

According to Getaw Tadesse *et al. (*2019), the non-significant effect of ($p > 0.05$) sex on daily weight gain was 94.95 vs. 90.41 g/day in male and female kids respectively, before 90 days of age. But in Bati kids where sex exerted a significant effect on daily weight gain 86.82 vs. 78.17 g/day in males and female kids respectively. The birth type had also a non-significant 86.5 vs. 78.48 g/day in Bati and 91.08 vs. 94.26 g/day in Borana kids for single and twins respectively. Parity had no significant effect on daily weight gain in Borana kids in which parity three had the lowest daily weight gain as compared to the first, second, fourth, and fifth parity (83.26 vs. 98.53, 92.87, 97.06, and 91.67 g/day). But

in Bati kids parity had a significant effect on daily weight gain parity four had the lowest daily weight gain as compared to the first, second, third, and fifth parity(73.51vs. 77.61, 80.61, 87.08, and 93.63 g/day).

2.5.2. Kid Survival rate

Poor goat health can cause economic losses for goat producers. Disease awareness and preventive management practices can reduce economic losses associated with poor goat health. Certain physiological symptoms are suggestive of disease in goats. According to Tesema Alemayehu *et al,* (2020) the mortality rates of kids were 62.9%. Kid survival rate were affected by birth weight, Breed, dam parity, sex, birth type and season of birth.

2.5.3. Factor affecting the performance factors

Dam parity

Kid survival due to dam parity coincide with the report of Ershaduzzaman *et al* (2007) but, disagrees with the report of Chowdhury *et al.* (2002) who found that kid mortality decreased linearly with increase in parity. Awemu *et al.* (1999) reported linear increase in survival rate with parity and observed maximum survival at the highest parity (parity 6). *Girma et al.* (2013) also found that the highest survival rate was observed in the 8^{th} parity. Kid survival decreased with increase in litter size, which coincides with findings of (Girma Abebe *et al.,* 2013). This was probably because of the maternal effect since less milk was available per kid. Small and weak kids could not resist the harsh environment.

Litter size

There were differences in kid survival between sizes of litters, mortality increased with number of kids per parturition. Kids from twin and larger litters do not suckle as long as singleton kids. This means they probably get less colostrum than kids from single births because of competition for a limited supply (Fernandez, 2014).

Sex

There were differences in kid survival between sexes. According to (Aleminew Enyiew *et al.,* 2018) higher mortality was recorded for females which coincide with reports of Ershaduzzaman *et al.* (2007). Research results on the influence of sex of kid on survival

are mixed. Some studies show males are more likely to die than female kids. Other studies show males survive better because of their higher birth weights.

Table 2: Factors that affect the kid survival rate

Risk factors	Wt range	Kids born	Kids died	$\chi 2$	P value
Birth weight	1.00 - 1.90 kg	26	13(50%)		
	2.00 - 2.90 kg	140	74(52.9%)	15.7	< 0.01
	3.00 - 3.90 kg	107	33(30.8%)		
	>= 4.00 kg	27	7(25.9%)		
Birth Type	Single	114	30(26.3%)		
	Twin	180	93(51.7%)	19.9	< 0.01
	Triple	6	4(66.7%)		
Round of Parity	First	63	17(27%)		
	Second	52	22(42.3%)		
	Third	67	29(43.4%)	9.34	0.16
	Fourth	64	33(51.6%)		
	Fifth	39	18(46.2%)		
Sex	Male	150	55(36.7%)	3.95	0.04
	Female	150	72(48%)		

Source: Aleminew Enyiew *et al*., 2018.

2.6. Constraints and Opportunities of Goat Production

2.6.1. Constraints of goat production

Different studies showed that despite the large potential of goat in the country their productivity is low. There are various factors that contribute for low productivity of goat such as health constraints, feed shortage both in quality and quantity, poor feeding and health management. According to Yenesew Abebe *et al.,* 2013, the major constraints of goat production were Lack of adequate vet service, diseases, feed shortage, theft, labour shortage, shortage of capital, water shortage and marketing problem in Burie District, North Western Ethiopia. In generally, the major constraints that hinder the production performance of goat

production are feed and water scarcity, disease and predator, lack of infrastructures and long marketing channels and climatic condition.

Feed and Water Shortage

According to Yenesew Abebe *et al.* (2013) in Burie District, North Western Ethiopia), and Azage Tegegn *et al*. (2015) in Shebedino District, Sidama Zone of Southern, Ethiopia reported that lack of adequate feed resources is the main constraint of livestock production across different agro ecology in different parts of the country mainly in mixed crop livestock production system and being serious in high human population and animal population areas where land size is diminishing due to intensive crop cultivation and soil degradation. Water is the most critical of all nutrients required by goats. but it is yet often received a little attention. Inadequate water supply will dramatically decrease the production of livestock.

In low land areas, relatively higher proportion of households reported the problem of rainfall shortage as a limitation for low fodder production. This may be due to low and erratic nature of rainfall in lowlands than in relatively wetter highlands (Sisay Fikru and Kefyalew Gebeyew, 2015). The availability of water was not consistent particularly in the dry season (Hulunim Gatew *et al.,* 2017).

Disease and predators

Constraints hindering goat's production and productivity diseases reported were anthrax, liver fluke, orf (disease like Footand-mouth disease), pneumonia and internal parasites (Girma Debele et al., 2013). In the pastiorial area the main diseases reported were mange, mastitis, pasteurellosis and some tick-borne diseases. On the other hand according to (Mola M *et al.,* 2018) internal and external parasites are the first and second ranking diseases and parasites which affect the small ruminants. Microbial caused diseases are PPR, goat pox, Orf, Actinomycosis and Pasteurellosis (Leuelseged Kassa *et al.,* 2020) reported the parasitic diseases are Menge, Lice, Coenurosis and Moniezia expansa

According to Gurmesa Umeta *et al.* (2011) and Assen Ebrahim and Akililu Hailemichael (2012); predators are also the main constraints of small ruminant production in East Showa Zone and different agroecological Zones in Tigray, Ethiopia and also Belete Shenkute

(2009) reported that Predators such as foxes and hyenas are also contributing for the losses of young stocks.

Lack of infrastructure and long marketing channels

The animal health workers do not have transport services such as car, motor bicycle and mule used to travel from the health post to kebeles and villages to provide veterinary service (Getachew Leges, 2016). In order to deliver goats purchased from producers to consumers in differen t areas; traders use two modes of transportation viz, trucking and trekking. Larger traders who collect in bulk use ISUZU trucks for transportation.The mortality rate is on average two goats per one ISUZU truck load. One truck load is 70- 100 goats (Getachew Leges , 2016).

Climatic conditions

Climate change was affecting and challenging the life of farmers. The pasture production potential was declining because of climate change (Ajebu Nurfeta and Haile Welearegay, 2015). The major challenges of goat rearing include feed and water shortage, disease incidence and recurrent drought with different order of prioritization (Hulunim Gatew *et al.*, 2017).

2.6.2. Opportunities for goat production

The major opportunity of goat production is that they require short generation interval, high market demand smaller space and capital investment with index of 0.26, 0.24 and 0.23 respectively (Mola M, 2018 . High demand of the goat in the local market as a result of population increase, urbanization, and the increment in price of goats (even within a district) can be considered as an opportunity for the goat producers (Demissie Chanie et *al.,* 2016). Analysis of data from the Ethiopian Revenue and Customs Authority shows that Middle East countries (12 countries) are the major market outlet for meat and live animals exported from Ethiopia (Getachew Legese *et al.,* 2016) . In any case, processing hides and skins is a lucrative business in Ethiopia and there appears to be significant opportunities for investment in more tanneries given the growing numbers of animals and the opportunity to do a better job in collection of hides and skins (Mechale. H *et al.,* 2017) . Therefore, the existence of large unmanaged land, their high turnover rate, easy to be managed by children and women can be taken as a great opportunity of goat

production in the area if the extension system supports forage development (specifically feed conservation during excess time) and, the land is managed properly (Demissie Chanie *et al.*, 2016).

CHAPTER THREE: MATERIALS AND METHODS

3.1. Description of the Study Area

The study was conducted in Tegedie district, Amhara region, Northwest Ethiopia which has an area of 167,420.26 ha. The borders of district are in North, Tsegedie district, in South, Tach Armachiho district, in West, west Armachiho and on East Dabate (DPC, 2021). The study area is located at 36^0 to $37^0$70′E longitude and 13^0 0′0″ to 13^0 30′N latitudes. The elevation of the district ranges from 500m to 2850 meters above sea level and the physiographic setting of the study area is characterized by 50% (83,710.5ha) plain, 16% (2,677.36 ha) mountainous, 21% (35,158.4ha) hills and 13% (21,764ha) valley (TDAO, 2022).

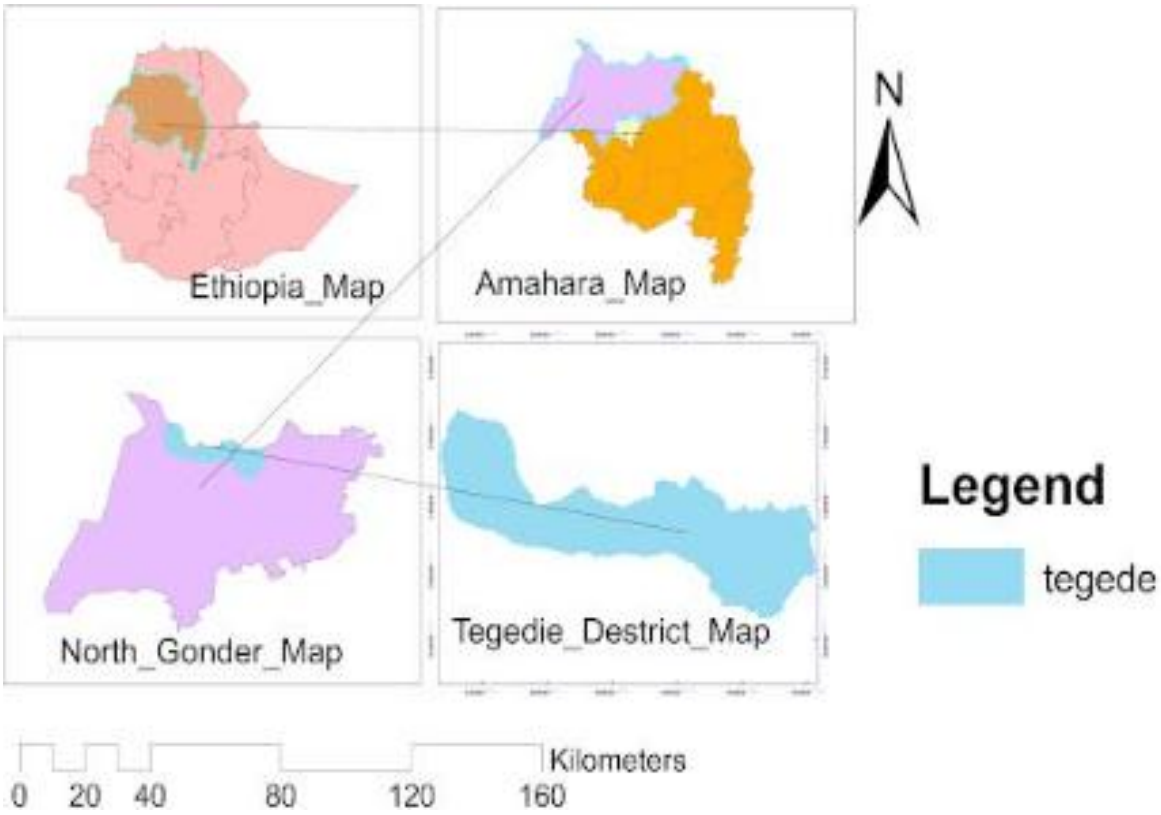

Figure 1: Geographical location of the study areas.

The study area is characterized by tropical and warm-to-cold climates. The district is divided into three agroecological zones, 5% highland, 25% midland, and 70% lowland. The district is majorly covered with lowland and has an annual rainfall amount of 700mm

to 1800mm and a mean annual temperature wich range from 13^{o}c -37^{o}c. Major soils of the Tegedie district are red soil 65%, black soil 21 %, and loam 14 %. The district consists of 17 rural and 2 urban Kebeles. According to the population and housing census by CSA (2007), the total population of the District is 90191. The rural population is 96.6 % and the urban population is 3.4%. This shows the majority of the population lives in rural areas, depending on mixed farming. A large number of people are settled, and the population is more evenly distributed. The majority of the inhabitants practiced Ethiopian Orthodox Christianity, with 97.9% reporting that as their religion, while 2.1% of the population said they were Muslim (CSA, 2007).

Livestock production is one of the major economic bases of the area. The total livestock population in the district is estimated to be 767428 heads out of which 31.6% are cattle, 10.4% sheep, 42% goats, 1.3% equines and 14.7% are poultry. The number of livestock per household is about 2.67, 0.88, 3.57, 0.11, and 1.25 heads for cattle, sheep, goats, equines, and poultry, respectively (TDAO,2022).

3.2. Sampling Methods and Sample Size Determination

A multistage sampling technique (purposive, stratified, and simple random sampling method) was used to gather information on husbandry practices, growth performances, and the survival rate of goats. Tegedie district was purposively selected because of its highest goat production potential. Goat production is the important for household asset building in the district. The study district was stratified into three kebeles based on agro ecology. Of nineteen *Kebeles*, four kebeles were highland, seven kebeles were midland and eight kebeles were lowland. For the study purpose, one kebele from the highland (Gulqa), two kebeles from the midland (Dawchena & Adisalm kulako), and two kebeles from the lowland (Seroka & Kisha) were selected purposively based on goat population potential and availability of infrastructures. The number of households for survey purposes was determined by using Yamane's formula (1967).

$$n = N/1+N (e2)$$

Where,

n = sample size

N = total population = 2017

e = is the level of precision (e = 0.05).

From the above formula, the number of interview households was 334 and selected by using simple random sampling methods. Therefore, to identify husbandry practice and growth performance of goats from five kebeles, a total of 334 households were selected. The interviewee household was taken proportionally from each selected kebele.

Table 3: Number of selected households

Agroecological zone	Selected Kebele	Total number of household	Number of interview household
Highland	Gulqa	240	40
Midland	Dawchena	563	93
	Adisalm-Kulako	497	82
Lowland	Seroka	398	66
	Kish	319	53
Total	5	2017	334

The number of surveying and monitoring households from each selected kebeles was determined according to proportionate sampling technique as follows:

$$W = [A/B] \times No$$

Where,

W= Number of households to be calculated from a single selected kebele

A=Total number of households per kebele

B= Total number of households in all five kebeles

No = Calculated sample size

For the monitoring data, households that have late pregnant goats were identified, purposively. To undertake the monitoring work, 16 households from each agro_ecology (a total of 48) that had late pregnant goats were selected, purposively with the help of development agents, and the pregnant goat was given an identification number. From highland 32 (2 late pregnant goats per household), midland 32 (2 late pregnant goats per household), and lowland 32 (2 late pregnant goats per household) a total of 96 late pregnant does was considered. The subsequent weight of the kids was taken at 30 days intervals until 90 days of age (Aemero yiheyis *et al.*, 2012).

3.3. Data Collection Methods

3.3.1. Survey data

Both primary and secondary data were used on various aspects of husbandry practices and the pre-weaning growth performance of goats. The primary data were collected from sample respondents through semi-structured questionnaires. The semi-structured questioners held on the following parameters: socio-economic characteristics of the household, opportunities, and constraints of goats production, the purpose of keeping goat, marketing, health management, disease, breeding practice, and growth performance of goat, feeds, and feed resource, housing, input in goat production, labor requirement, the composition of livestock mixture, and through monitoring on pre-weaning growth performance and survival rate of kids. The questionnaire covers various aspects of all species of livestock with more details on goat husbandry practice and the growth performance of the goat. In addition to this the data collected from respondents that participate in a focus group discussion (FGD),10 members per FGD were selected and the conducted five focus group discussions with farmers, elders, community leaders, women representatives, model farmers, youths, animal health technicians and development agents were targeted for the FGD.

Secondary data were collected from the district Agricultural Development Office, and other published and unpublished sources. Data collection was done by the researcher supported by DAs who worked in the district and who intensively trained about the questionnaire.

3.3.2. Monitoring data

Primary data was also collected from monitoring activity. The monitoring data were birth weight, pre-weaning growth performances, and survival rate under a traditional management system and performed in five kebeles for 3 months during the dry season. The birth weight of the kid was taken as soon as they were born within 24 hours. The subsequent weight of kids was taken at monthly intervals until 90 days. The kid's birth date, sex, parity of dam, birth type, and birth weight of monitored kids was collected. The live weight measurement was taken early in the morning before the kids were allowed to suckle their dams using a portable weighing balance (25kg capacity with 200-gram precision) for three months.

3.4. Statistical Analysis

Data were organized and analyzed by using Microsoft Excel, SPSS, and SAS software. The data on general socioeconomic characteristics, family size, land, livestock holding, source and frequency of watering, housing system, disease, castration practice, and methods, flock structure, weaning age, newborn kid separation practice, and source of breeding buck were analyzed by descriptive statistics SPSS statistical package (SPSS ver.26,). An index was used to calculate the overall ranking for qualitative data such as the objective of keeping an indigenous goat, trait preference, major available feed both in the dry and wet season, major goat production constraints and opportunities, reasons for goat buying methods, sale of a goat by age and sex group and season of selling goat. The index was calculated according to the following formula: Index = Σ of [3*Number of respondents for rank 1 + 2 * Number of respondents for rank 2 + 1* Number of respondents for rank 3] given for particular qualitative variables divided by Σ of [3* Number of respondents for rank 1 + 2* Number of respondents for rank 2 + 1* Number of respondents for rank 3] for all qualitative variables considered (Kossgey, 2004).

Pre-weaning growth performance of kids was analyzed by using the GLM (General Linear Model) procedure of SAS (version 9.1.3). For kids, the sex, parity, birth type, age of doess, and agro-ecology of the monitored goat were fitted as fixed independent variables, while birth weight and pre-weaning weight were fitted as dependent variables.

The survival rate of kids was recorded starting from their birth until 90 days and analyzed by using the following formula

$$\text{Kid mortality rate (\%)} = \frac{\text{Number of offspring died at a given age} * 100}{\text{Number of offspring produced}}$$

The average daily weight gain (ADG) in gm was calculated by using the following formula Kinder, C.A. & Williams, S. (2013)

$$ADG = \frac{(W2 - W1) * 1000}{D}$$

Where,

ADG = Average Daily Gain in gram

W1 = Weight at the preceding age

W2 = Weight at a given age

D = Number of days between the weighing date

For analysis of the pre-weaning growth of kids, the following model was used:-

$Yqjkz = \mu + Sq + Bj + Pk + Xz + eqjk$ where:

Yjkz = the observation on (birth weight and average daily weight gain on the nth kids of the qth agroecology, jth birth type, the kth parity, zth sex.

μ =the overall mean common to all animals in the study

Sq =fixed effect of the qth agroecology (1= highland, 2= lowland, 1= midland).

Bj = fixed effect of the jth birth type (1=single, 2=twin 3= triple).

Pk = fixed effect of the kth parity (k=1, 2, 3, 4, and above).

Xz = fixed effect of the zth sex (1=male, 2=female).

Eqjkz = is the random error.

CHAPTER FOUR: RESULTS AND DISCUSSIONS

4.1. Socio-economic Characteristics

The results of socioeconomic characteristics across the three Agro ecology zone is presented in Table 4. From the total of 334 household heads that participated in the survey, male-headed households accounted for the largest proportion of the studied samples (respondents) throughout the three Agro ecological zones. Thus, the proportions of male and female-headed households were 94.9 % and 5.1 %, respectively.

The majority of household heads in the age group were 31 - 40 years, with 29% male headed and 50% female headed. This finding is in agreement with the findings of Alubel Alemu (2015), who reported that the age group of 31 - 40 years in Ziquala district and Lay Armachiho districts were 44.3%. Interviewed households in the study area had different educational backgrounds. The educational level of household heads showed that 34%, 53.9%, 8.1% and 4 % were illiterate, elementary, primary and secondary, respectively. The largest proportion (55%, 54.3% and 52.9 %) of household heads in the three agro ecology zones, respectively were attained their elementary education. Educated female is by far less than that of males in the community.

This is an expected because families in most developing countries are reluctant to send their female children to school. However, this situation has been improving in recent years. During the time of the survey, all children of the interviewed household that reached school age (> 5years) were sent to school and therefore no illiterate children were encountered. This indicates that, the communities in the studied area are quite aware of the benefits of sending children (including girls) to school. The availability of schools within a reasonable distance from homestead (a school within Kebele) is the other encouraging factor for children's education. This reflects good sense for transfer of technology and extension service in goat production in the future.

Table 4: General socioeconomic characteristics of household

	Agro-ecology							
	Highland		Midland		Lowland		Total	
Gender of houeshold headed	N	%	N	%	N	%	N	%
	40	12	175	52.4	119	35.6	334	100
Male headed	38	11.4	175	52.4	104	31.1	317	94.9
Female-headed	2	0.6	_	_	15	4.5	17	5.1
Male headed age group								
< 20	2	5	-	-	-	-	7	2
21 – 30	7	17.5	27	15.4	23	22.1	57	18
31 – 40	12	30	44	25.1	33	31.7	89	29
41 – 50	5	12.5	49	28	30	28.8	84	23
51 – 60	6	15	44	25.1	11	10.6	61	17
> 60	8	20	11	6.3	7	6.7	26	11
Female-headed age group								
< 20								
21 – 30								
31 – 40	_	_	_	_	6	60	6	50
41 – 50	_	_	_	_	2	20	2	17
51 – 60	_	_	_	_	2	20	2	17
> 60								
The educational level of household								
Illiterate	9	22.5	64	36.6	41	34.5	114	34
Elementary	22	55	95	54.3	63	52.9	180	53.9
Primary	9	22.5	11	6.3	8	6.7	28	8.1
Secondary								
Religion	_	_	5	2.9	7	5.9	12	4
Marital status of household heads								
Single	16	4.8	16	4.8	15	4.5	47	14
Married	22	6.6	159	47.6	96	28.7	277	82.9
Divorced	2	6	_	_	8	2.4	10	3

HL = Highland ML = Midland LL = Lowland NHH = No of household GHHH = Gender of household heads MH = Male headed FH = Female headed MHAG= Male headed age group FHAG= Female headed age group ELHH = Educational level of household MSHHH = Marital status of household heads

4.2. Family size, land, and livestock holding

The results on family size, land and livestock holding is presented in table 5. There was highly significant difference ($p < 0.000$) among male and female member of the family and total family size. In the present study, the total family size was 2.75. This result is lower than the average family size of Alubel Alemu (2015), who reported that the average family size was 7.1 in Ziquala district and Lay Armachiho districts of Amhara Regional State and the average family size at national level 4.8 (CSA, 2021). The significance of goat production to ownership is associated with landless peasants and labourers to whom ownership of goats provides a definite means of livelihood and its sustainability.

Average flock size and livestock composition are presented in Table 5. Respondents in midland had significantly higher number of goat, cattle, chicken and hive holding ($P<0.001$) than highland and lowland. The goat per household were highest 12.66 (6.38) in midland and lowest 4.48(3) in highland areas. The difference in the average goat / household in highland, midland and lowland was highly significant ($p<0.000$). The possible reason for higher number of goat / households in the midland agro ecology zones (present study areas) as compared to highland areas may be due their favourable weather condition and accessibility of feed resource for goat rearing. In the present study the overall numbers of goats / household 9.05(5.02) were highest than Alubel Alemu (2015), who reported that the over number of indigenous goat was 7.78±2.76 in Ziquala district and Lay Armachiho districts of Amhara Regional State.

The differences in the average goat and sheep per household among all pairs of comparison were highly significant ($p < 0.000$). The contrast in the trend of number of sheep (highest in highland but absent in midland and lowland) and goat (highest in midland and lowland and lowest in highland) per household was observed. The possible reason may be due to the differences in adoptive behavior of these two species to climatic conditions in high, midland and lowland agro-ecologies. According to the FGD, goats are more comfortable when fed on browses than other feeds.

Table 5: Average flock size and livestock composition

Description		Highland	Midland	Lowland	Overall	P value
Family size	Mean(SD)		Mean(SD)	Mean(SD)	Mean(SD)	
	Male	2.4(1.42)	3.09(1.22)	2.85(1.36)	2.78(1.33)	0.000
	Female	2.53(1.219)	2.97(1.085)	2.68(1.16)	2.72(1.15)	0.000
	Total	2.46(1.324)	3.03(1.155)	2.76(1.26)	2.75(1.25)	0.000
Livestock						
	Cattle	3.5(2.41)	14.13(13.9)	9.29(8.19)	8.97(8.19)	0.000
	Goat	4.48(3)	12.66(6.38)	6.03(5.66)	9.05(5.02)	0.000
	Sheep	3.96(3.30)	3.56(0.89)	2.73(1.28)	3.39(3.30)	0.000
	Donkey	1.55(.67)	1.00(0.00)	1.16(0.31)	1.23(0.49)	0.000
	Chicken	4.76(3.83)	11.1(7.15)	6.03(3.21)	7.29(4.73)	0.000
	Hive	2(.00)	4.55(3.01)	2.86(2.31)	3.13(2.66)	0.000
Land						
	Cultivated	2.1(1.5)	2.9(2.0)	0.19(0.13)	0.24(0.17)	0.004
	Grazing	0.5(0.4)	0.6(0.5)	0.9(0.8)	0.7(0.6)	0.038

N= number of the respondent, SD= standard deviation, Same superscript indicate nonsignificant differences, Different superscript indicate significant differences Least squares means with different superscripts within the same column, and class are statistically different.

The total grassland also showed significant ($p < 0.05$) difference among three Agro ecology zones. The highest (0.9 hectare.) and lowest (0.5 hectare.) average grass land was found in lowland and 29 highland agro ecology zones, respectively. The highland areas encountered scarcity of grassland whereas lowland areas were faced with shortage of cultivated land in the study areas. The current results were comparable with earlier reports of Gamo gofa Zone SNNP regional state (Fsahatsion Haile Mariam, 2013). The possible reasons could be human population growth rate, land degradation and soil erosion resulting in declining of landholding per household across the three agro-ecologies of the districts.

4.3. Flock Structure of goat

The flock structure by age and sex of goat in the three agro ecology zones are presented in Table 6. The current result showed that all age groups were significantly affected by agro ecology zones except male and female 6 months to 1 year. The comparison of mean showed significant differences among HL with ML and LL agro ecology zones in male / female kids aged < 6 months; LL with HL and ML agro ecological zones in male goat groups > 1 year and HL with ML and LL agro ecology

zones in females goat > 1 year. The overall mean of goat per household were lower in female aged 6 months to 1 year (0.08), male aged 6 months to 1 year (0.15) and male > 1 year (0.36) compared to other groups. The possible reason for lower mean numbers of female aged from 6 months to 1 year (0.08), male aged from 6 months to 1 year (0.15) and male > 1 year (0.36) may be due to the sale of these animals. The overall means number of goat per household were highest in adult females aged > 1 year. The current results were lower than the reports of Solomon Abegaz (2014) who reported 4.2 (2.32), 3.1 (2.58), 0.6 (0.92) and 25.9 (36.29), 9.5(14.29), 2.8(2.94) for breeding does, kids and breeding buck in lowland Metema district and highland Abergelle goat of the Amhara National Regional State of Ethiopia respectively.

Table 6: Average goat flock size per household and structure (Mean±SD) in each agro-ecologies of the study area

Particular	HL Mean (SD)	MLMean(SD)	LL Mean(SD)	Overall Mean(SD)	P value
Male kids < 6 months	0.04(0.03) a	1.04(0.18) b	1.05(0.22)b	0.66(0.09)	0.000
Female kids	0.04(0.03) a	0.96(0.18) b	1.08(0.23)b	0.63(0.09)	0.000
Male 6 months to 1 year	0.03(0.02)	0.18(0.05)	0.32(0.17)	0.15(0.04)	0.053
Female 6 months to 1 year	0.01(0.01)	0.1(0.4)	0.14(0.07)	0.08(0.02)	0.162
Male > 1 year	0.03(0.02) a	0.35(0.08) a	1.00(0.24)b	0.36(0.06)	0.000
Female > 1 year	0.39(0.15) a	2.62(0.29) b	3.65(0.48)b	1.98(0.19)	0.000
Castrate		0.23(0.07)	0.27(0.16)	0.15(0.04)	0.042

HL = Highland ML = Midland LL = Lowland SD= standard deviation, N= number of respondent, SD= standard deviation, a, b = horizontaly Same superscript indicate nonsignificant differences and horizontaly different superscript indicate significant differences

4.4. Goat Husbandry Practice

4.4.1. Major Feed Sources

Index values of major goat feed sources in the current study during dry and wet season is presented in Table 7. Communal natural pasture was the major source of goat feed both in dry and wet seasons with index value of 0.59, 0.67 and 0.9 in wet season and 0.47, 0.54 and 0.54 in dry season in highland, midland and lowland Agro ecological zones, respectively. The current survey result is in agreement with Alubel Alemu (2015) who reported that natural pasture was the major source of goat feed both in dry and wet seasons with index value of 0.68, 0.69 and 0.58 in dry season and 0.66, 0.50 and 0.83 in wet season in Ziquala, Tanqua Abergelle and Lay Armachiho districts, respectively. The corresponding values of fallow land in wet season were 0.41, 0.33 and 0.1 in highland, midland and lowland agro ecological zones, respectively. In dry season crop residues and crop after math were ranked as second and third feed resource next to communal natural pasture with index value of 0.31, 0.26 and 0.26 for crop residues and 0.22, 0.2 and 0.2 for crop aftermath in highland, midland and lowland agro ecology zones, respectively. T he current result disagreement with Tesfay Atsbha (2020) who reported that in dry season feed resources accessible for goat in all agro-ecologies distinguished were: crop-residue, grass feed, crop aftermaths, and grazing lands But agreement with in rainy season, who reported that communal grazing lands provide the key source of feed for animals in south Tigray, North Ethiopia.

The current result in both season is similar with in traditional production system because natural pasture is the major feed resource in this production system. But the result is differ from semi intensive and intensive production system because agro industrial by product is the major source of feed source (Wuletaw Mekuria *et al.*, 2018).

Table 7: Types of major goat feed sources as reported by respondents

Feed sources and season	Highland				Midland				Lowland				Overall	
Wet season	R1	R2	R3	I	R1	R2	R3	I	R1	R2	R3	I	N	I
Natural pasture	36	3	1	0.59	158	6	11	0.67	117	1	1	0.9	966	0.72
Fallow land	4	18	32	0.41	17	35	123	0.33	2	8	19	0.1	365	0.28
Dry season														
Natural pasture	20	21	13	0.47	116	53	49	0.54	72	55	17	0.54	961	0.53
Crop residues	11	16	12	0.31	33	40	60	0.26	27	35	18	0.26	485	0.26
Crop aftermath	9	10	7	0.22	26	36	44	0.2	20	29	12	0.2	378	0.21

| Crop aftermath | 9 | 10 | 7 | 0.22 | 26 | 36 | 44 | 0.2 | 20 | 29 | 12 | 0.2 | 378 | 0.21 |

Browsing is the common feed source for goats in the study area. Private browsing, Communal browsing land and rented land are the major types of browsing for goats. From the interviewed households, 100, 53 and 8.7% of them utilize private browsing, communal browsing and rented land browsing, respectively. Although there is difference in utilization across months of the years, communal browsing ng lands are utilized throughout the year. Natural pasture is the main feed resource for goats. The availability and quality of forages are not favorable and uniform in nutrient quality all year round. As a result, goats are not supplemented the gains made in the wet season is totally or partially lost in the dry season. Especially Indigenous browses are other sources of feed in the study area while concentrates are not common. In this study area, goats spent most of (95.6%) their time browsing. On average they only spent about 12 hour in days browsing during the day time. They are under close supervision throughout the day and in all seasons of the year to protect them from predators. In lowlands areas, the respondents keep their goats are dominating and browsing lands are relatively larger they are also protected from wild animals. Whereas, in the highlands where sheep are dominant there is small browsing time; small ruminants are protected from cropland and from predators. From the interviewed households 70.6, 2.1, 15.6 and 12.3% graze goat alone, goat and sheep, goat with the other livestock and goat and sheep with the other

livestock respectively. In the present study the majority of respondent browse goat alone and this result is similar with Acta, (2021) who reported that majority of respondent graze/ browsing sheep and goat in different ways but disagree with Yadeta Neme (2016) who reported that the majority 18.9% of respondent graze goat with the other livestock but not sheep in Adabarga and Ejere District of West Shoa Zone, Ethiopia.

The tendency of keeping small ruminants with large ruminant is lower, this because of their feeding behavior. According to key informant, respondents prefer feeding goat alone instead of gazing/browsing them with the sheep. This may be due to the fact that sheep are slow grazer and goats have the ability to browsing many plant species within short period and less time is required to fill their gut than sheep. During dry season the browsing practice of all respondents in the three agro ecological zones were free browsing While, during wet season free browsing covers 0.1, 20.6 and 100% in highland, midland and lowland areas. During dry season this result is not comparable to Sisay Fikru and Kefyalew Gebeyew (2015) who reported that 89.9 and 11.1% of respondent utilized free browsing system and during wet season all respondents utilize free browsing system in Degehabur Zone, Eastern Ethiopia.

Table 8: Major available feeds and their utilization as reported by respondents

Feed sources	Highland		Midland		Lowland		Overall	
Brousing land	N	%	N	%	N	%	N	%
Own land	40	100	175	100	119	100	334	100
Communal land	37	92.5	89	50.8	52	43.7	178	53
Rented land	3	7.5	18	10.2	8	6.7	29	8.7
Brousing system								
Goat alone	6	15	165	94.2	65	54.6	236	71
Goat and sheep	_	_	_	_	7	5.9	7	2.1
Goat with the other livestock			5	2.8	47	39.5	52	16
Goat and sheep with the other livestock	36	85	5	2.8	_	_	41	12
Brousing practice during the dry season								
Free Brousing	40	100	175	100	119	100	334	100
Tethered Grazing	_	_	_	_	_	_	_	_
Brousing Practice during the wet season								
Free Brousing	4	0.1	36	20.5	119	100	159	48
Tethered Brousing	36	0.9	139	79.4	_	_	145	52

N= number of respondent, %= Percentage

Although the practice of supplementing goats with concentrates is not common, certain interviewed households supplement their goats with some feed supplements. 46.4% of the respondent did not provide supplement for their goat. The result is lower than Sisay Fikru and Kefyalew Gebeyew (2015) who reported that 55.6% of respondent did not provide supplement for their goats in Degehabur Zone, Eastern Ethiopia. The majority of respondents usually provide supplements breeding does to enhance milk production and fertility rate. In the current study, supplement salt, cultivated fodder leaves, maize Stover, and wheat bran for all age. Majority of the farmers supplemented goat during dry season (46.1%) followed by both seasons (7.5%) and no supplementation in the wet season. Becouse, better feeds availability in this season. In most cases, the farmers supplement goats daily, whenever available and twice a day 28.7, 16.8 and 9% respectively (Table 8).

Table 9: Feed supplementing practice as reported by respondents

	Highland		Midland		Lowland		Total	
Seasonof supplementation	N	%	N	%	N	%	N	%
Dry	16	40	104	59.4	34	29	154	46.1
Wet	_	_	_	_	_	_	_	_
Both	5	1.3	18	10.3	2	1.7	25	7.5
Frequencyof supplementation								
Daily	11	28	67	38.3	18	15	96	28.7
Twice	3	7.5	20	11.4	7	5.9	30	9
Whenever available	7	1.8	35	20	11	9.2	53	16.8

The results of farming activities in the study area are presented (Table 9). The result of this table showed that all respondents across agro ecology zones of the study area were following mixed crop-livestock farming system. The current results were in conformity with respect to highland and lowland Agro ecology zones with the earlier report of Solomon Abegaz (2014), who found that mixed crop-livestock farming system was followed in the altitude between 1500 to 3000 masl in Metema and Abergelle districts of the Amhara National Regional State of Ethiopia.

4.4.2. Housing and confining system

Housing is one of the major goat husbandry activities which protect them from extreme temperature, rain, wind, predators and theft. The findings in the present study are presented in table. Majority of household in highland (65%), midland (68%) and lowland (45.6 %) of agro ecology zones were confining their goats in separate house (Table 10). According to the interviewed respondents 59.6, 26 and 14.4% of respondents shelter their goat in separate, ad joint and main house, respectively. The current study was disagreement with reports of Alubel Alemu (2015) who found that majority (83.82%) of confine their goats without roof and small proportion (18.18%) of farmer confine their goats in family house in Ziquala districts. But it is in agreement with the report of Sisay

Fikru and Kefyalew Gebeyew (2015) who reported that the majority of respondent 64.4% confine their goat in separate house in Degehabur Zone, Eastern Ethiopia. Flocks are kept in house at night and during the day when the heat intensity is high. Young animals are kept around the homestead until weaning to avoid walking long distances in search of feed and water and to minimize exposure to predators. From the interviewed households, 59.6%, 26% and 14.4% of households shelter their animals in separately constructed, ad joint house and main house, respectively.

The majority of respondents in highland, midland and lowland agro ecological zones (45, 45.1 and 46.4%, respectively) reported that goat and sheep were confined together. The overall value of confining system of goat in the current study area was 46.4, 39.2 and 14.4% of respondent confined their goat together with sheep, Goat alone and with all other animal, respectively. The present finding in lowland area was in agreement with Yadeta Neme Bergaga (2016) who reported that the majority of respondents in highland and midland (28.9%, 14.4%, respectively) reported that sheep and goat were confined together and Alubel Alemu (2015) who reported 61.02% of respondents in Lay Armachiho district housed their goat together with other animals.

Table 10: Types of Goat housing and confining system as reported by respondents

	Highland		Midland		Lowland		Overall	
Types of goat house	N	%	N	%	N	%	N	%
Ad joint house	9	22.5	43	24.6	35	29.4	87	26
Separate house	26	65	119	68	54	45.4	199	59.6
Main house	5	12	13	7.4	30	25.2	48	14.4
Confining system								
Goat alone	17	42.5	63	36	34	28.6	131	39.2
Goat and sheep	18	45	79	45.1	75	63	155	46.4
With all other animals	5	12.5	33	18.9	10	8.4	48	14.4

N= number of respondent, %= Percentage

4.4.3. Source and Frequency of Water

Provision of water is the prime importance in all animal production systems. Water availability is an issue in the present study. The results of source of water and frequency of watering are presented in Table 11. According to the respondents, during wet season, river water (50%), rain water (26%) and spring water (24%) water was the main source of water for goat in the study area. However, during dry season river water 83%, followed by spring11% and ground water 6% were the main sources of water. The current study result agree with the report of Alubel Alemu (2015) who reported that rivers were an important source of water during dry (68.6%) and wet (58.1%) seasons respectively in crop livestock system households.

The watering frequency in the study area was different from season to season (Table11). The frequency of watering during rainy season showed that 40.4%, 55.4% and 4.2% of respondent had free available, once a day and twice a day (Table 11). During dry season the majority of the farmers allowed their flock to take water once a day 42.9% and freely available 30.5%.

Table 11: Source of water and frequency as reported by respondents

	Highland		Midland		Lowland		Total	
Source of water during the wet season	N	%	N	%	N	%	N	%
River water	18	45	47	26.9	102	85.7	167	50
Spring water	10	25	69	39.4	_	_	79	24
Rainwater	12	30	59	33.7	17	14.3	88	26
Source of water during the dry season								
River	40	100	127	72.6	110	92.4	277	83
Spring	_	_	37	21.1			37	11
Groundwater	_	_	11	6.3	9	7.6	20	6
Frequency of water during the wet season								
Freely available	40	100	65	37.1	30	25.2	135	40.4
Once a day	_	_	110	62.9	75	63	185	55.4
Twice a day	_	_	_	_	14	11.8	14	11.8
Once in 2 days								
Frequency of water during the dry season								
Freely available	31	77.5	57	32.6	14	11.8	102	30.5
Once a day	9	22.5	91	52	43	36.1	143	42.9
Twice a day	_	_	27	15.4	27	22.7	54	16.2
Once in 2 days	_	_	_	_	35	29.4	35	10.4

4.5. Breeding practice

4.5.1. Selection of breeding does

The criteria to select breeding doe were showed in Table 12. In highland body size, color and kidding interval was the first, second and third criteria for selecting breeding doe with index value of 0.38, 0.3 and 0.13, respectively. In mid land agro ecology body size, color and twining ability were the first, second and third criteria for selecting with index value of 0.28, 0.21 and 0.18, respectively. In lowland color, kid survival and body size were the first, second and third criteria for selecting with index

value of 0.3, 0.29 and 0.25, respectively. The overall value for selection of breeding doe for the next generation was body size, color and kid survival which were the first, second and the third selection criteria with index value of 0.28, 0.24 and 0.19, respectively. The current finding with respect to the first and second criteria was in agree with Yadeta Neme (2016) who reported that body size and color were the first and second criteria for selection of breeding doe with index value of 0.41 and 0.31, respectively. According to Aynalem Haile (2023) who reported that the first criteria for selection of breeding doe was body size with index value of 0.39 agree with the current result but disagree with the second criteria who reported that twining ability was the second criteria for selection of breeding doe was body size with index value of 0.27.

Table 12 : Selection criteria of breeding doe as reported by respondents

	Highland				Midland				Lowland				Overall	
Criteria	R1	R2	R3	Index	R1	R2	R3	Index	R1	R2	R3	Index	N	Index
Body size	20	11	9	0.38	55	49	36	0.28	25	30	41	0.25	276	0.28
Color	10	15	12	0.3	32	46	31	0.21	40	35	27	0.3	242	0.24
Twining ability	5	2	6	0.1	29	36	33	0.18	9	9	10	0.08	139	0.14
Kidding interval	3	10	2	0.13	24	30	42	0.16	7	10	17	0.08	145	0.15
Kid survival	2	2	11	0.09	35	24	23	0.17	38	35	24	0.29	194	0.19

Index= sum of (3 X number of households ranked first + 2 X number of households ranked second + 1 X number of households ranked third) given for each selected trait divided by the sum of(3 X number of households ranked first + 2 X number of households ranked second + 1 X number of households ranked third) for all selected traits

4.5.2. Selection of Breeding Buck

The criteria to select breeding buck were showed in Table 13. The respondents ranked color as number one for selecting a breeding buck in highland and lowland agro_ecology zones with index values of 0.37and 0.4, respectively (Table 9). Whoever, in midland agro_ecology zones body size is the first criteria for selecting breeding buck with index value of 0.33. Body size and lamb survival were considered as the second and third criteria with index value of 0.3 and 0.2 in highland agro_ecology zones and 0.26 and 0.18 in lowland agro_ecology zones, respectively. But in midland area color and age

at first maturity were considered as the second and third criteria with index value of 0.27 and 0.23 (Table 13). The overall value for selection of breeding buck for the next generation was body size, color and kid survival were the first second and third criteria for selecting breeding buck with an index value of 0.31, 0.29 and 0.2, respectively. The current finding was in agreement with Yadeta Neme (2016) who reported that body size and color were the first and second selection criteria of breeding bucks with the index values of 0.48 and 0.33 , respectively in Adabarga and Ejere district of west shewa zone, Ethiopia. The possible reason maight be body size was an important selection criteria for beeding bucks. But disagree with Aynalem Haile (2023) who reported that growth rate was the second criteria with index value of 0.24. The body size of buck associated with high carcass output and premium price across all the production systems, included wide chest, conformation and long body size. Color was also one of the three selection criteria and it was observed that red, white or mixed colors were more preferred for breeding purpose in the current study area. However black coat color was not preferred possibly due to less market value across all agro ecology zones.

Table 13 : Selection criteria of breeding buck as reported by respondents

	Highland				Midland				Lowland				Overall	
Criteria	R 1	R 2	R 3	Index	R 1	R 2	R 3	Index	R 1	R 2	R 3	Index	N	Index
Body size	11	15	9	0.3	66	50	37	0.33	40	46	25	0.26	299	0.31
Color	17	10	17	0.37	44	54	36	0.27	29	32	39	0.4	278	0.29
Kidding interval	4	6	7	0.13	37	46	28	0.23	30	18	16	0.16	192	0.2
Kid survival	8	9	7	0.2	28	25	30	0.16	25	23	39	0.18	194	0.19

All Index= sum of (3 X number of households ranked first + 2 X number of households ranked second + 1 X number of households ranked third) given for each selected trait divided by the sum of(3 X number of households ranked first + 2 X number of households ranked second + 1 X number of households ranked third) for all selected traits

4.5.3 Objectives of Goat Production

The primary purpose of keeping goat was income, meat for household consumption and saving in theis study area (Table 14). The primary purpose of goat production were income generation, household consumption and saving with index value of 0.35, 0.27 and 0.25 for highland and 0.33, 0.24 and 0.23 for midland, respectively. But in lowland, the primary purpose of goat production were household consumption, income generation and saving with index value of 0.32, 0.27 and 0.26, respectively. The overall objective of goat production in the current study area was income generation, household consumption and saving with index value of 0.3, 0.26 and 0.24, respectively (Table 14). These findings were in agreement with reports of Yadeta Neme (2016) who reported that the overall primary, secondary and third objectives of goat production is to generate income, meat for household consumption and saving with index value of 0.5, 0.21 and 0.12, respectively. The FGD revealed that sale of goat generates cash income to the farmer which may be used to buy clothing and food items, pay taxes, purchase fertilizers and other household goods. These findings were in agreement with reports of earlier workers Hundie Demissu and Geleta Gobena (2015) who reported that the primary purpose of keeping goat was income generation.

Table 14 : Objectives of goat production as reported by respondents

Parametrs	Highland				Midland				Lowland				Overall	
	R1	R2	R3	Index	R1	R2	R3	Index	R1	R2	R3	Index	N	Index
Saving	11	9	10	0.25	49	28	25	0.23	21	45	20	0.26	218	0.24
Income	15	13	12	0.35	68	52	23	0.33	31	21	39	0.27	274	0.3
Manure	3	2	3	0.07	11	24	31	0.11	2	15	12	0.07	103	0.11
Meat	9	14	10	0.27	36	41	46	0.24	45	34	10	0.32	245	0.26
Social	1	1	2	0.03	9	12	13	0.07	2	5	6	0.03	51	0.06
Milk	1	1	3	0.03	2	4	4	0.02	2	10	7	0.05	34	0.03

4.6. Castration Practice and Weaning Age

Castration of goat is an important activity for successful production and management system in the study area. All respondents reported that they do practice castration of goat in the agro ecological zone (Table 15) for fattening purpose. Similarly, Yadeta Neme Bergaga (2016) who reported that farmers are more interested to fatten and sell buck at higher price for pressing cash need instead of maintaining for breeding.

The majority of respondents carried castration at the age of 12 months. This is because the farmers believed that the buck will mature and finish growth at this age. Similar findings were reported by Yadeta Neme Bergaga (2016). Castration might become more difficult and painful with age and the chances of complications increase. It might increase unwanted breed and delay fattening time of goat in the area.

The castration method followed was traditional 44.4% (repeatedly crushing the cord above the testes using rounded stone locally known as ‘allelo’), modern method 10.5% (Burdizzo) and 45.1% uses both traditional and modern methods. The reasons for castration (overall) were to fatten (81.1 %), to reduce aggressiveness (13.3 %) and to manage easily (5.1%). Similar findings were reported by Yadeta Neme Bergaga (2016) who reported that the reasons for castration enumerated by the respondents were to fetch more prices, to avoid mating and to reduce aggressiveness. The abave finding also agree with Demissie Chanie et al,. (2014) who reported that the majority (80.7%) of farmers in the study area practice castration of goats for the purpose of fattening and selling in Enebse Sar Midir district of East Gojjam Zone, Ethiopia.

In the present study, there is no defined time of weaning kids. According to focus group discussion the reason of less practicing of weaning in the district was due to their poor knowledge on weaning. When suckling is prolonged and the doe is able to mate, then separating the young from their dams and smearing the teat with dung are common methods of weaning in all agro ecological zones. This is mostly done after three months of age.

Table 15 :Castration practice, season and methods as reported by respondents

	Highland		Midland		Lowland		Total	
Castration Practice	N	%	N	%	N	%	N	%
Yes	40	100	175	100	119	100	334	100
No	–	–	–	–	–	–	–	–
Castration methods								
Traditional			59	33.7	89	74.8	148	44.4
Modern					35	20	35	10.5
Both	40	100	81	46.7	30	25.2	151	45.1
Reason of castration								
To fatten	40	100	142	81.1	89	74.8	271	81.1
To reduce aggresivence			25	14.3	21	17	46	13
To manage undisairable beeriding			8	4.6	9	7.6	17	5.1

4.7. Source of Buck

The sources of buck in the present study area is presented in Table 16. The present result showed that there were only two sources of buck for mating that is owned and neighboring buck for selecting breeding buck in the three agro ecological zones. The overall value was 55.7% of respondents were used their own buck and the other 44.3% used Neighbor buck. The majority of respondent 65.5 and 61.1% in hight and midland agro ecological zone, were used buck from their neighborhood. Where as in lowland area the majority of respondent was using their own buck 88.2% (Table 16). The current results were in disagreement with that of Yadeta Neme Bargaga (2016) who reported that the majority of respondents were using neighbors buck for mating and the values were 26.7 and 21.1%, respectively.

Table 16 : Sources of breeding buck as reported by respondents

	Highland		Midland		Lowland		Overall	
Source	N	%	N	%	N	%	N	%
Own	13	32.5	68	38.9	105	88.2	186	55.7
Neighbor	27	65.5	107	61.1	14	11.8	148	44.3

4. 8. Way of acusition of Goats

The reason for acusition of goat in the study area is presented in Table 17. The interviewed respondents were reported that three reasons of acusition of goat (replacement, house-hold consumption and selling). The overall index value of acusition of goat was replacement, household consumption and trading with the total value of 0.35, 0.34 and 0.32, respectively (Table 17).

The replacement was the first reason for buying goat with index value of 0.45, 0.37 and 0.41 in highland, midland and lowland Agro ecological zones, respectively. The house-hold consumption 0.35 and 0.33 and trading 0.28 and 0.26 was second and third reasons of acusition of goat in midland and lowland agro ecological zones, respectively. However, trading trading 0.32 and household consumption 0.23 was the second and third reason for acusition of goat in highland agro ecological zones.

The current study result was in agreement with Berhan Tamir *et al.* (2015) who reported that in highland of Ethiopia 62% of farmers buy small ruminants for replacement purpose, 14.4% for house-hold consumption and 64 13.8% for trading for Hararghe highland goats. Most of the small ruminants that are bought for replacement purposes are ewes and does.

Table 17 : Way of acusition of goats as reported by respondents

	Highland				Midland				Lowland				Total	
Reason	R1	R2	R3	Index	R1	R2	R3	Index	R1	R2	R3	Index	N	Index
Replace_ment	21	16	3	0.5	81	64	30	0.37	68	28	23	0.41	334	0.35
Consump_tion	7	17	16	0.2	62	83	30	0.35	31	52	26	0.33	324	0.34
Trading	12	7	21	0.3	32	69	74	0.28	20	33	49	0.26	307	0.32

Index= sum of (3 X number of households ranked first + 2 X number of households ranked second + 1 X number of households ranked third) give for each reason of buying divided by the sum of (3 X number of households ranked first + 2 X number of households ranked second + 1 X number of households ranked third) for all reason of buying.

4. 9. Mode of disposal of Goats

The various mode of disposal of goat from the flock is presented in Table 18. The farmers dispose their animals for a number of mode. In the present study the overall index value for disposal of goat was cash need (0.36), disease (0.21) and feed scarcity(0.2) Table 18. The overall index value for cash need (0.36 and 0.4) feed scarcity (0.23 and 0.25) and disease (0.22 and 0.15) was first, second and third mode of disposal of goat in highland and midland agro ecological zones, respectively. In lowland area the first, second and third mode for disposal of goat was disease (0.36), cash need (0.23) and feed scarcity (0.17). Focus group disscusstions also stated that cash need, disease and feed scarcity were the first, second and third mode for disposal of goat in the three agro ecological zones. These results indicated that goats have an important role in meeting the income needs of the farmers and thus serve as a buffer from hard ship. The current results were in agreement with Belete Shenkutie (2009) who reported that 80.7% of farmers in western Ethiopia sold their animals for cash need in Goma District of Jimma Zone.

Table 18 : Mode of disposal of goat as reported by respondents

	High land				Midland				Lowland				Overall	
Reason	R1	R2	R3	Index	R1	R2	R3	Index	R1	R2	R3	Index	N	Index
Cash need	18	12	10	0.36	81	69	25	0.4	31	26	19	0.23	291	0.3
Old age	1	6	9	0.1	5	13	7	3	0.11	4	14	8	0.09	153	0.16
Disease	7	9	13	0.22	30	28	17	5	0.15	51	39	27	0.36	211	0.21
Feed scarcity	11	8	5	0.23	51	46	21	5	0.25	24	19	14	0.17	199	0.2
Productivity problem	3	5	3	0.09	8	19	30	9	0.09	9	21	31	0.14	129	0.13

Index= sum of (3 X number of households ranked first + 2 X number of households ranked second + 1 X number of households ranked third) given for each selling method divided by the sum of (3 X number of households ranked first + 2 X number of households ranked second + 1 X number of households ranked third) for all selling method.

4. 10. Mode of disposal of Goats by Sex and Age Groups

The results of preference of respondents for disposal of goat by sex and age groups in the present study were presented in Table 19. The majority of respondent ranked goat aged from 06 months – 01 year, < 6 month and adult > 01 year in both sexes (male and female) were the first, second and the third rank with index value of 0.35, 0.28 and 0.19 in male and 0.38, 0.34 and 0.28 in female, respectively. The reason for disposal of goat in both sexes (6 month – 1 year) for the first rank was for their immediate use. Growing male and females regularly or purposively dispos from the population disposal. This indicates that farmers have more practice in kid production for their immediate cash need. This activity greatly affected future improvement and thus narrowed the inbreeding practice in both sexes. The current finding were in agreement with Alubel Alemu (2015) who also arrived growing male and females regularly or purposively dispose from the population in lay armachiho district.

Table 19 : Mode of disposal of goat by sex and age group

Sex and Age group	Highland				Midland				Lowland				Overall	
Male	R1	R2	R3	I	R1	R2	R3	I	R	R2	R3	I	N	I
A	7	11	10	0.22	26	39	45	0.19	14	27	18	0.16	187	0.19
B	18	13	9	0.37	87	57	40	0.4	56	40	31	0.39	351	0.38
C	11	9	15	0.28	40	48	57	0.27	37	31	28	0.28	276	0.28
AC	4	7	6	0.13	22	31	33	0.14	12	21	42	0.17	178	0.18
Female														
A	6	14	14	0.25	31	40	63	0.23	22	29	46	0.25	265	0.28
B	21	12	10	0.35	94	71	10	0.35	31	52	33	0.33	334	0.34
C	13	14	16	0.4	50	64	88	0.42	66	38	15	0.42	364	0.35

A=< 06 months B = 06 months – 01Year C = Adult (> 01 years) AC= Castrated

4. 11. Season of Marketing Goat in the study area

The results of season of marketing goat are presented in Table 20. In the study areas, goats are sold more often to earn income for regular expenses throughout the year and peaks during religious festivals. The present results showed that majority of respondents sold their goat at the time of April (Ethiopian Ester), December to January (Ethiopian Christmas) and August to September (Ethiopian New year) with index value of 0.29, 0.28 and 0.23, respectively. During these seasons the demand for meat becomes high and resulted in higher price of goat. The remaining proportions of goat sale was occurred during the period October to November aiming to exploit better condition of the goat due to the availability of pasture grown by the main rainy season and May to July due to pressing cash need for the purchase of inputs for crop production like fertilizer and seed. Generally, income obtained from goat was spent for expenses related to education for children, for the purchase of food and clothing for the family, and for the purchase of fertilizer, seed and other inputs for crop production. This result indicates that during the time of April (Ethiopian Ester), December to January (Ethiopian Christmas) and August to September (Ethiopian New year) major cultural and religious holidays, especially after long fasting by orthodox Christian believers (during this fasting period consumption of animal products is strictly banned), there is a sharp increase in demand for meat. Thus, farmers take advantage of this opportunity as they get more returns. The present results

were in agreement with earlier findings by Yedata Neme (2016), who reported that the majority of respondents sold their small ruminants at the time of Easter, Christmas, and Ethiopian New Year with overall value of 33.3, 26.1 and 20.6% respectively.

Table 20 : Season of marketing goat in the study area as reported by respondent

	Highland				Midland				Lowland				Overall	
Selling time	R1	R2	R3	Index	R1	R2	R3	Index	R1	R2	R3	Index	N	Index
New year	7	9	10	0.2	24	32	41	0.18	37	36	30	0.3	226	0.23
Christ-mass	9	11	5	0.22	43	58	61	0.25	42	28	23	0.29	280	0.28
Easter	18	10	6	0.34	76	61	38	0.39	23	27	34	0.22	293	0.29
Meskel	4	6	10	0.14	21	15	20	0.11	12	17	26	0.13	131	0.13
Others	2	4	9	0.1	11	9	15	0.07	5	11	6	0.06	72	0.07

Index= sum of (3 X number of households ranked first + 2 X number of households ranked second + 1 X number of households ranked third) given for each season of selling divided by the sum of (3 X number of households ranked first + 2 X number of households ranked second + 1 X number of households ranked third) for all season of selling.

4.12. Major Constraints of Goat Production

The major constraints of goat production in the study area was presented in Table 21. The identification of major constraints for a given farm animal production system in a given area is a prerequisite to plan appropriate intervention strategies for improving productivity. The overall result shows that feed shortage, disease and absence of market infrastructure ranked the first, second and third constraints with index values of 0.29, 0.2 and 0.19, respectively Table 21. Feed shortage and disease was ranked as the first and second constraint in highland and midland agro ecological zones with index values of 0.46 and 0.22 in highland and 0.43 and 0.23 in midland agro ecological zones, respectively. The possible reason might be due to the expansion of high population growth rate, climate change (Sunil Soni, 2020) and lack of experience of interviewed farmers to vaccinate healthy animals.

In lowland, water shortage, absence of market infrastructure and predator was considered as the first, second and third constraint with an index value of 0.34, 0.24 and 0.18, respectively. Water shortage was the third rank in highland and midland agro ecological zones s with index value of 0.14 and 0.1, respectively. This finding agrees with Sisay

Fikru and Kefyalew Gebeyew (2015) who reported that feed shortage were limiting constraint in goat production in Degehabur Zone, Eastern Ethiopia. Feed shortage in both seasons (dry and wet) limits productivity of goats and it was further worsened due to the absence of awareness and practice of feed conservation techniques. But disagree with Yenesew Abebe *et al.,* 2013, who reported that the major constraints of goat production were lack of adequate vet service in Burie District, North Western Ethiopia and Yedata Neme Bargaga (2016) who reported that disease was ranked as first constraint in all the three agro ecologies with index values of 0.40, 0.42 and 0.23 in highland, midland and lowland, respectively.

Table 21 : Goat production constraints in the study area as reported by respondents

	Highland				Midland				Lowland				Overall	
	R1	R2	R3	Index	R1	R2	R3	Inde	R1	R2	R3	Index	N	Index
Disease	7	8	14	0.22	28	41	70	0.23	5	19	6	0.08	198	0.2
Predator	2	4	6	0.08	12	21	33	0.1	21	21	20	0.18	140	0.14
Market	1	7	7	0.1	19	27	41	0.14	25	29	39	0.24	195	0.19
Feed shortage	25	10	12	0.46	103	70	2	0.43	17	15	33	0.16	287	0.29
Water shortage	5	6	6	0.14	13	16	29	0.1	51	35	21	0.34	182	0.18

HL = Highland ML = Midland LL = Lowland OA = Over All Index= sum of (3 X number of households ranked first + 2 X number of households ranked second + 1 X number of households ranked third) given for each constraint divided by the sum of (3 X number of households ranked first + 2 X number of households ranked second + 1 X number of households ranked third) for all constraints.

4. 13. Major opportunities of goat production

The opportunity of goat production in the study area, as reported is shown in table 22. Despite there were many constraints that affect goat production in the study area, there were also four opportunities to improve goat production such as low initial cost, prolificacy, increased meat demand and favorable agro-ecology (Table 22).

low initial cost, prolificacy and favorable agro_ecology was the first, second and third opportunities of goat production in highland with index value of 0.41, 0.38 and 0.12, respectively. But in midland and lowland, prolificacy, low initial cost and increased meat demand was considered as the first, second and third opportunity of goat production with

index value of 0.42, 0.29 and 0.2 in midland and 0.36, 0.31 and 0.18 in midland agro ecological zones, respectively. The overall value of the opportunity of goat production in the current study is prolificacy, low initial cost and increased meat demand were the first, second and third opportunity with an index value of 0.34, 0.32 and 0.2 respectively. The current is in agreement with (Girma Abebe, 2008) who reported that a mature doe can be breed and successfully give birth three times every two years.

Table 22 : Opportunities of goat production in the study area as reported by respondents

	Highland				Midland				Lowland				Total	
OPP	R1	R2	R3	Index	R1	R2	R3	Index	R1	R2	R3	Index	N	Index
LSC	19	11	9	0.41	45	48	76	0.29	39	32	47	0.31	315	0.32
Pro	11	16	19	0.38	89	76	10	0.41	44	49	26	0.36	340	0.34
FAE	3	6	6	0.12	11	13	39	0.09	16	18	21	0.15	133	0.13
MDI	7	7	6	0.09	30	38	45	0.2	20	20	25	0.18	198	0.2

Index= sum of (3 X number of households ranked first + 2 X number of households ranked second + 1 X number of households ranked third) given for each opportunity divided by the sum of (3 X number of households ranked first + 2 X number of households ranked second + 1 X number of households ranked third) for all opportunity. OPP= Opportunity LSC= Low startup cost Pro = Prolificacy FAE= Favorable Agro ecology MDI= Meat demand increase

4. 14. Marketing Channels of goat in the study area

The major marketing channels to link producers with end users were identified in the present study. These different channels represent the full range of available outlets through which goats move from the different collection points in major production areas to terminal markets to meet end-users needs.

Channel 1. Producer ⇒ small trader ⇒ hotels

Channel 2 Producer ⇒ small trade ⇒ general consumer

Channel 3 Producer ⇒ general consumer

Channel 4 Producer ⇒ large trader ⇒ general consumer

Channel 5 Producer ⇒ small trader ⇒ large trader

Channel 6 Producer ⇒ small trader ⇒ large trader ⇒ general consumer

4. 15. Birth weight of local kid in the study area

The overall least square means (LSM±SE) birth weight of 121 kids was 2.47±0.11 kg (Table 23). The analysis of variance (Appendix Table 1) showed that all factors significantly affected birth weight of kids. Kids at midland and lowland agro_ecology zones have significantly heavier birth weight than highland kids (2.48 ± 0.13 and 2.94± 0.12vs. 1.99 ± 0.13, $p < 0.0001$), respectively. Similarly, kids born from doe that gave birth for the first time have significantly lower birth weight than those from does that gave birth for second, third, fourth fifth and six parity (1.69±0.18 vs. 2.58±0.15, 2.63±0.13, 2.29±0.18, 2.46± 0.26 and 2.46±0.26, $P<0.0001$). The overall least squares mean birth weight of goat obtained in the current study was lower than central highland goat 2.68±0.04 kg but it is heavier than Woyto-Guji goat 2.03±0.04 kg Netsanet Zergaw (2016) in Meta-Robi and konso districts.

Table 23 : Pre weaning birth weight of local goat in the study area

Source of variation		Day after birth							
		BW		30 Day		60 Day		90 Day	
		N	LSM±+SE	N	LSM±SE	N	LSM±SE	N	LSM±SE
Overall		121	2.47±0.11	108	5.63±0.26	103	7.66±0.25	103	9.4±0.34
CV		121	26.39	108	20.93	103	18.97	103	16.72
AEZs			****		NS		*		*
	Highland	39	1.99±0.13	34	5.32±0.27	33	7.04±0.25	33	8.33±0.34
	Midland	41	2.48±0.13	37	5.68±0.25	36	7.90±0.24	36	9.54±0.33
	Lowland	41	2.94±0.12	37	5.89±0.26	34	8.04±0.25	34	10.26±0.34
Parity			****		*		NS		NS
	1	17	1.69±0.18	13	4.68±0.49	12	7.00±0.52	12	8.05±0.71
	2	25	2.58±0.15	24	5.92±0.36	24	8.11±0.36	24	9.67±0.0.5
	3	38	2.63±0.13	36	5.56±0.30	34	8.28±0.30	34	9.82±0.42
	4	20	2.29±0.18	18	5.45±0.43	17	7.21±0.42	17	9.00±0.58
	5	10	2.46±0.26	10	5.78±0.58	10	7.46±0.57	10	9.00±0.78
	6	11	2.46±0.24	7	6.03±0.74	6	7.36±0.73	6	11.00±1.00
Birth type			****		*		*		*
	Single	63	2.67±0.11	58	5.98±0.18	55	8.2±0.23	55	9.92±0.30
	Twin	46	2.30±0.13	40	5.42±0.21	40	7.44±0.28	40	9.16±0.34
	Triple	12	1.98±0.25	10	4.02±0.43	8	6.3±0.63	8	8.33±0.89
Sex			**		**		**		***
	Male	71	2.56±0.10	66	6.04±0.16	64	8.21±0.34	64	10.04±0.28
	Female	50	2.10±0.10	42	5.21±0.21	39	6.91±0.32	39	8.19±0.36

*= p<0.05 **= p<0.01 ***= p< 0.001 ****= p<0.0001 NS= Not significant LSM= Least Squares Mean SE= Standard Error LSM±SE= Least Squares Mean± Standard Error CV= Coefficient of Variation AEZ=Agro-ecological zone

The significant effects of kids heavier birth weight at midland and lowland agro_ecological zone might be due to environmental difference (nutrition of dam and climatic condition). Kids born from doe that gave birth for the first time have significantly lower birth weight than those from does that gave birth for second, third, fourth fifth and six parity (Table 23). This might be due competition of nutrients between the growth of young does and fetus, and not favorable uterine environment provided by the younger does (S. M. Robertson, 2020). Does with second and third parity gave heavier kids than does with fourth, fifth and six parity but except parity one ($p<0.0001$) there is no significant difference among parity ($p > 0.05$). The lower birth weight of kids from does that gave birth for the first time is similar with that of Borana breeds by Hulunim Gatew (2019) who reported that Borana, kids from the first parity had relatively lower birth weights than kids in other parities (1.87 ± 0.17vs. 2.54 ± 0.1, 2.44 ± 0.11, 2.67 ± 0.15 and 2.47 ± 0.12) because of the fact that the reproductive organs of the first parity does were less developed to bear large fetus(Hulunim Gatew , 2019) in Ethiopian goat ecotypes under smallholder management systems.

.Birth type was also a significant source of variation in which the birth weights of single born kids were higher than the twin and triple born kids (2.67±0.11vs. 2.30±0.13 and 1.98±0.25, $P < 0.0001$). This might be due to the competition for nutrient and space from their doe before birth in the case of twin and triple births. The current finding is in agreement with Netsanet Zergaw (2016)who reported that single born kids were heavier than twin and triple birth (2.7±0.06 vs. 2.66±0.07 and 1.82±1.55) in centeral highlands of woyto- guji breeds. Sex was also a significant source of variation in which the birth weight of male kids was higher than that of female kids (2.56±0.10 vs. 2.10±0.10, $p<0.01$). This might be due to the presence of androgen hormone in males, which stimulates skeletal growth. In addition to this male fetus induced longer gestation period that contribute heavier weight at birth. This finding is higher than Hulunim Gatew (2019) who reported that 2.27±0.16 vs. 1.7±0.17 for male and female kids respectively in Ethiopian goat ecotypes under smallholder management systems.

4. 16. Pre weaning weight of goat at different age intervals

The overall pre-weaning weights at different ages and at weaning are summarized in Table 24. In the current study, it depends on agro ecology, sex, parity and birth type. The overall pre-weaning weights at 30, 60 and 90 day weights of kids were 5.63±0.26, 7.66±0.25 and 9.4±0.34 Kg, respectively. The 30 and 90 day weight obtained current result 5.63±0.26and 9.4±0.34 kg was lower than Hulunim Gatew (2019) who obtained 6.15±0.09 and 10.44±0.18kg for Bati goat breed in Ethiopian goat ecotypes under smallholder management systems. The analysis of variance for the weights at specific ages showed that the effect of fixed effects was different at different ages. The difference in weight of kids due to agro ecology was not significant ($p>0.05$) at 30 day but significant ($p<0.05$) at 60 and 90 day age. Midland and lowland kids weighed heavier than highland kids (9.54±0.33 and 10.26±0.34Kg vs. 8.33±0.34.

In the present study, sex of does had significant influence on the pre weaning growth of the kids ($P<0.001$) at 30, 60 and 90 day weight. Male kids males were heavier than female kids at there respective age. The current result is in agreement with Hulunim Gatew (2019) who reported that higher body weight for male (11.01±0.28 kg) than female kids (10.28±0.34 kg) in Borana under smallholder management systems..

In the present study parity of does had a significant influence on the pre weaning growth of the kids. The effect of parity on kid body weight was significant ($p<0.0001$) at 30, 60 and 90 day. Similarly, kids born from doe that gave birth for the first time have significantly lower weight than those from does that gave birth for second, third, fourth fifth and six parity ($P<0.0001$).Single born lambs were significantly ($P< 0.0001$) heavier than that of twins and triple at 30, 60and 90 days, respectively. The current finding was lower than (Hulunim Gatew 2019) who reported 6.28±0.17 and 10.57±0.36 for single and 5.79±0.13 and 9.57±0.29 for twin at 30 and 90 day respectively in Ethiopian goat ecotypes under smallholder management systems.

4. 17. Average Daily Weight Gains of local Goats

The average daily weight gain for goat kids are summarized in Table 24. The overall least squares mean average daily gain (in grams) from birth to 30, 60 and 90 days weight obtained in the present study was 108±5.43, 88±4.14 and 75±3.02, respectively (Table 24). The current result obtained from birth to 90 day were (75±3.02) lower than Bati, Borana and Short-eared Somali under smallholder management systems Hulunim Gatew et al., (2019) who reported that the overall least squares mean average daily gain from birth to 90 days was 86.22±2.02. Least square means of average daily weight gain showed a significant effect for all factors in Ethiopian goat ecotypes under smallholder management systems.

Table 24 : Least square mean and standared error of pre weaning average daily weight gain of local goats in the study area

Source of variation		Days after birth					
		30 Day		60 Day		90 Day	
		N	LSM±SE	N	LSM±SE	N	LSM±SE
Overall		108	108±5.53	103	88±4.14	103	75±3.02
CV		108	20.93	103	18.97	103	16.72
AEZs			NS		*		*
	Highland	39	106±5.59	33	77.8±4.33	33	69±3.16
	Midland	41	110±5.29	36	93±4.1	36	77±2.99
	Lowland	41	108±5.43	34	94±3.99	34	81±2.92
Parity			*		NS		NS
	1	13	100±8.00	12	82±5.37	12	69±4.75
	2	24	114±7.49	24	92±3.94	24	77±3.49
	3	36	119±4.99	34	91±3.44	34	78±+3.05
	4	18	99±7.18	17	75±7.1	17	70±4.19
	5	10	104±8.65	10	97±5.8	10	75±5.13
	6	7	120±10.5	6	94±6.3	6	75±5.62
Birth type			*		*		*
	Single	58	113±3.8	55	95±2.55	55	83±2.0
	Twin	40	111±4.68	40	85±3.1	40	73±2.74
	Triple	10	84±10.7	8	74±8.2	8	67±7.4
Sex			**		**		***
	Male	66	117±3.9	64	98±2.94	64	81±1.72
	Female	42	104±4.74	39	83±3.74	39	70±2.15

*= p<0.05 **= p<0.01 ***= p< 0.001 ****= p<0.0001 NS= Not significant LSM= Least Squares Mean SE= Standard Error LSM±SE= Least Squares Mean± Standard Error CV= Coefficient of Variation AEZ=Agro-ecological zone

The effect of agro ecological zone from birth to 30 day weight was not significant (P> 0.05) but its effect was significant from birth to 60 and 90 days (p< 0.05).

Parity had effect on pre-weaning growth rate at 30 day (P<0.05) but there is no significant difference (p>0.05) at 60 and 90 days after birth. This result is not consistent with Netsanet Zergaw *et al.* (2016) who reported that the effect of parity was significant (p< 0.000) from birth to 90 days in Meta-Robi and Konso districts woyto- guji goat breed.

Birth type was a significant source of variation in kid pre-weaning growth rate p<0.01 from birth up to 30, 60 and 90 days. Single born kids grew faster than twins and triple (113±3.8 vs. 111±4.68 and 84 ±10.7 from birth to 30 day, 95±2.55 vs. 85±3.1, 74±8.2 from birth to 60 day and 83±2.vs. 73±2.74 vs.67±7.4 from birth to 90 day. This result is not consistent with Hulunim Gatew *et al.,* (2019 who reported that no significant effect of birth type form birth to 90 days (86.5±3.81 vs. 78.48±3.08) for single and twins, respectively for three Ethiopian goat ecotypes under smallholder management systems.

According to Netsanet Zergaw *et al.* (2016) who reported that the effect of birth type was significant from birth to 90 day (p<0.0001) in Meta-Robi and Konso districts woyto- guji goat breed.

Sex had significant effect on kid pre-weaning growth rates. Males grew faster than females from birth to 30, 60 and 90 days (117.±3.9 vs.104±4.74, 98±2.94 vs.83±3.74 and 81±1.72 vs.70±2.15 respectively). This result is This result is not consistent with Netsanet Zergaw *et al.,* (2016) who reported that no significant effect of sex (74.29±3.02 vs. 70.91±3.1) from birth to 90 day weight in Meta-Robi and Konso districts woyto- guji goat breed.

4. 18. Survival Rate of Kids

Factors that affect survival rate of kids are presented in (Table 25). The overall survival rate of kids from birth to 30, 60 and 90 days were 89, 85 and 85%, respectively. This result is higher than Grum Gebreyesus (2010) who reported that 74.6% survival rate for different indigenous goats in Ethiopia. But this is comparable with the average survival rate of 88.6 % in the central part of Tigray (Assen Ebrahimand Aklilu Haile Michael, 2012) in the highland agro ecological zones. The higher survival rate in the present study might be due to breed difference and better management practices of

farmers in the study areas such as keeping newborn lambs at home in the first two week of life and giving them special care.

Table 25 : Survival rate of local kids in the study area

		Days affter birth					
		30 D		60 D		90 D	
		N	%	N	%	N	%
Over all		108	89	103	85	103	85
AEZ							
	Highland	39	87	33	84.6	33	84.6
	Midland	41	90	36	87.8	36	87.8
	Lowland	41	90	34	82.9	34	82.9
Parity							
	1	13	76.4	12	70.5	12	70.5
	2	24	96	24	96	24	96
	3	36	94.7	34	89.4	34	89.4
	4	18	90	17	85	17	85
	5	10	100	10	100	10	100
	6	7	63.6	6	54.5	6	54.5
Birth type							
	Single	58	92	55	87.3	55	77.3
	Twin	40	87.9	40	86.9	40	86.9
	Triple	10	83	8	76.6	8	66.6
Sex							
	Male	66	92.9	64	90	64	90
	Female	42	84	39	78	39	78

AEZ=Agro-ecological zone D=Day

Birth type, agro_ecology and parity of birth influenceed kid survival. Kids born in highland and midland agro ecological zones had higher pre-weaning survival rate than lowland agro ecological zone (84.6 and 87.8% vs.82.9%). This result were in agreement with Esmael Tessema, (2020) who reported that the effects of disease in pastural area were high in afar region.

Low survival rate of kids in lowland might be due to environmental factors (differences in feed availability, watering, housing and ambient temperature). This finding also similar with (Esmael Tessema, 2020).

Kids born from first and six parity had lowest survival rate than second, third, fourth and fifth party of does (70.5 and54.5% vs. 96, 89.4, 85 and 100%), respectively. This might be due to low milk production of doe during the first and six parity to nurse their kids.

Similarly single and twin born kids had higher survival rate than triple (87.3 and 86.9 % vs. 66.6 %). This might be due to low completion for milk among kids born single and twin and they had better body weight as compared to triple. Male kids had higher survival rate than females (90 vs. 78%).This might be due to better birth weight (Enyiew Alemnew, 2022).

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

The production system in the study area was mixed crop-livestock production system. Communal bush speciouse was the major source of goat feed both in dry and wet seasons. River water, rain water and spring water were the main sources of water during wet season. However, river water, followed by spring and ground water were the main sources of water in dry season . Majority of household heads were confining their goats in separate house. The overall value for selection of breeding buck and doe for the next generation was body size and color. Cash need, disease and feed scarcity were the the major mode for disposal of goat. The most serious constraint hindering goat production in the study area was feed shortage, disease and market infrastructure. The opportunity of goat production in the current study were prolificacy, low initial cost and increased meat demand. All factors significantly affect birth weight of kids. Kids born from doe that gave birth for the first time had significantly lower birth weight than those from does that gave birth for second, third, fourth, fifth and six parity. Similarly single born kids had higher birth weight than the twin and triples. In addition male kids was higher than female kids. Parity had effect on pre-weaning growth rate from birth to 30 day, but the effect is not significant from birth to 60 and 90 day weight. Birth type was a significant pre-weaning growth rate from birth up to 30, 60 and 90 days. Single born kids grew faster than twins and triple from birth to 30 and 60 day. Sex had significant effect on kid pre-weaning growth rates. Males grew faster than females from birth to 30, 60 and 90 days. Birth type, agro-ecology and parity of birth influence kid survival. Kids born in highland and midland had higher pre-weaning survival rate than lowland agro-ecological. Kids born from first and six parity had lower survival rate than second, third, fourth and fifth party of does, respectively. Single and twin born kids had higher survival rate than triple.

5.2. Recommendation

Based on the conclusion of the study the following recommendations were suggested;

- The overall pre-weaning growth performance of kids in the study areas were lower. This might be due to shortage of feed resource and high disease prevalence. Therefore, feed Shortage intervention, disease prevention and treatment should regularly be available.

- The most serious constraint hindering goat production in the study area was feed shortage and disease. This might be due to luck of awarness of communities for feed conservation and vaccination practice. Therefore, communities follow feed conservation technique and vaccination of healthy animal regularly should be done.

- Male kids have more promising pre-weaning growth performance than female kids. Hence, the communities should give more management emphasis to female kids for replacement purpose.

- The survival rate from birth to 60 and 90 days in lowland agroecologycal zone were low. Therefore, communities in lowland agroecology should be given a priority management attention.

- Further on-station aspects of studies on pre-weaning growth performance evaluation should be done.

7. REFERENCES

Abegaz Beyene, Alilo AA, Mola M. (2018). Assessment of Sheep and Goat (Small Ruminants) Production System in Esera District, Dawro Zone, Southern Ethiopia. J Adv Dairy Res, 6:215.

Acta. (2021). Review of Sheep and goat feeding behavior profile in grazing systems Sci., Anim. Sci. 43 • 2021 • https://doi.org/10.4025/actascianimsci.v43i1.51265.

Adane Hirpa, Girma Abebe. (2008). The economic significance of sheep and goats. In Sheep and Goat, Production Handbook for Ethiopia. ESGPIP, Addis Ababa, Ethiopia. Pp. 2-4.

AemeroYiheyis, Firew Tegegn, M. H.Melekot, and Mengistie Taye. (2012). "Pre-weaning growth performance of Sekota sheep breed in Waghimra Zone, Ethiopia." *Online Journal of Animal and Feed Research* 2, no. 4 340-343

Alemnew Enyiew, Erdachew Yitagesu, Shenkute Goshme and Derib Aydefruhim. (2018). A retrospective study on kid mortality and associated risk factors of kid survival of newly introduced Boer goat breed in North Shewa Ethiopia.

AlemuYami and Merkel, R.C. (2008). Nutrition and feeding of sheep and goats. *Sheep and Goat Production Hand Book*.

Alubel Alemu. (2015). Evaluation of Production System and Husbandry practice of Ethiopian indigenous goat in Ziquala district and Lay Armachiho districts of Amhara Regional State.

Ameha Sebsibe. (2008). Sheep and goat meat characteristics and goat production handbook for Ethiopia. Ethiopian sheep and goats productivity improvement program (ESGPIP), Addis Ababa. pp. 323-328.

Ameha Sebsibe. (2011). Export requirements for meat and live small ruminants. AlemuYami, R.C. Merkel and T. A.Gipson (eds). In 47th technical bulletin. March, Addis Ababa, Ethiopia. Pp. 2-3

Anwar seid Hassen and Yayneshet Tesfaye. (2014). Sheep and goat production objectives in pastoral and agro-pastoral production systems in Chifra district of Afar,

Ethiopia, Tropical Animal Health and Production, Vol. 46, Issue 8, 1467-1474, 2014.

Arse Gebeyehu, Feyisa Hundessa,Gurmessa, Umeta,Merga Muleta and Girma Debele. (2013). Assessment on challenges and opportunities of goat farming system in Adami Tulu, Arsi Negelle and Fantale districts of Oromia Regional State, Ethiopia. African Journal of Agricultural Research, Vol. 8(1), pp. 26-31.

Assen Ebrahim and Aklilu Hailemichael. (2012). Sheep and goat production and utilization in different agro ecological zones in Tigray, Ethiopia. Livestock Research for Rural Development. *24*(1), p.2012.

Awemu, E. M., L. N. Nwakolar, B. Y. Abubakar. (1999). Environmental influences on pre-weaning mortality and reproductive performance of Red Sakoto does. *Small Rumin. Res*., 34: 161-165.

Belachew Hurisa. and Jemberu, Eshetu. (2003). Challenges and opportunities of livestock marketing in Ethiopia. Yilma Jobre and Getachew Gebru (eds). In 10thprocee

Belay Derebe. (2008). Growth, Reproductive Performance and Carcass Characteristics of Abergelle and Central Highland Goat types under Traditional and Slightly Improved Management in Sekota Woreda. An MSc Thesis Presented to the School of Graduate Studies of Haramaya University. pp.77.

Belete Asefa, Kefelegn Kebede and Kefena Effa. (2015). Assessment of production and reproduction system of indigenous goat types in Bale Zone, Oromia, Ethiopia, 3(12): 348-360

Belete Shenkute. (2009). Production and Marketing Systems of Small Ruminants in Goma District of Jimma Zone, Western Ethiopia. MSc. thesis Submitted to School of Graduate Studies. Hawassa University, Awasa, Ethiopia. 144p.

Berhan Tamir and Awuk Asnakew. (2015)."Live weight gain and carcass yield characteristics of intact male Hararghe highland goats fed varying levels of hay to concentrate ratios." *Scholarly Journal of Agricultural Sciences* 5, no. 5, 175-182.

Biruh Tesfahun. (2013). Phenotypic and production system characterization of Woyto Guji Goats in lowland areas of south Omo zone.

Central Statistical Agency, 2012. An agricultural sample survey of 2011/12.Volume II. Report on livestock and livestock characteristics (private peasant holdings), CSA, Addis Ababa, Ethiopia.

Central Statistical Agency, 2013. Ethiopian agricultural sample survey. Volume II. Report on livestock and livestock characteristics. Statistical Bulletin 570.CSA, Addis Ababa, Ethiopia.

Central Statistical Agency, 2021. Agricultural sample survey. Livestock and livestock characteristic report (Private Peasant Holdings). April, Addis Ababa, Ethiopia.

Central Statistical Agency. (2012). An agricultural sample survey of 2011/12.Volume II. Report on livestock and livestock characteristics (private peasant holdings), CSA, Addis Ababa, Ethiopia.

Central Statistical Agency. (2013). Ethiopian agricultural sample survey. Volume II. Report on livestock and livestock characteristics. Statistical Bulletin 570.CSA, Addis Ababa, Ethiopia.

Central Statistical Agency. (2021). Agricultural sample survey. Livestock and livestock characteristic report (Private Peasant Holdings). April, Addis Ababa, Ethiopia.

Central Statistics Agency. (2007). Ethiopian Mapping Agency, and EMoND Employing Remote Sensing Technology for the Population and Housing Census in Ethiopia. Project Proposal. Addis Ababa, August 2006.

Deamer, Kacey (July 15, 2016), *Man's New Best Friend Is a Goat?*, Live Science.

Demissie Chanie , Zeleke Mekuriaw and Mengistie Taye (2014). Farmers in the study area practice castration of goats for the purpose of fattening and selling in Enebse Sar Midir district of East Gojjam Zone, Ethiopia.

Dereje Tadesse, M. Urge, G. Animut, Y. Mekasha. (2014). Perceptions of households on purpose of keeping, trait preference, and production constraints for selected goat types in Ethiopia, Tropical Animal Health and Production, 46, Issue 2, 363-370.

Dereje Tsegaye, Assefa Fasil, Gebrekidan Heluf, and Keneni Gemechu. (2015)."Nutritional, eco-physiological, and symbiotic characteristics of rhizobia nodulatingfaba bean (Viciafaba L.) collected from acidic soils of

Ethiopia." *African Journal of Environmental Science and Technology* 9, no. 7: 646-654.

Dereje Tsegaye. (2011). Herd husbandry and breeding practices of goat in different agro ecologies of Western Hararghe, Ethiopia. MSc thesis. Jimma, Ethiopia: Jimma University.

Dereje Tsegaye. (2011). Herd husbandry and breeding practices of goat in different agro ecologies of Western Hararghe, Ethiopia. MSc thesis. Jimma, Ethiopia: Jimma University.

Deribe Gemiyu, Talore, Girma Abebe , Azage Tegegne. (2017). Early Growth of Adilo Kids under Smallholder Management Systems, Southern Ethiopia: Influences of Non–Genetic Factors

Deribe Gemiyu. (2009). On-Farm Performance Evaluation of Indigenous Sheep and Goats in Alaba, Southern Ethiopia. MSc thesis, Submitted to the School of Graduate Studies of Haramaya University, Ethiopia. 163p.

Devendra, C. and Burns, M. (1983). Goat Production in the Tropics, Commonwealth Agricultural Bureaux :Farnham Royal, United Kingdom, viii + 183 pp.

Dhaba Urgessa, Belay Duguma, Solomon Demeke and Taye Tolamariam. (2012). Sheep and Goat Production Systems in Ilu Abba Bora Zone of Oromia Regional State, Ethiopia: Feeding and Management Strategies, 9(4): 421-429

District Plan Commission. (2021).

Endashaw Assefa. (2007). Assessment of production system and marketing of goats at Dale district (Sidama Zone). *Unpublished M. Sc Thesis. University of Hawassa, Awassa, Ethiopia*.

Enyiew Alemnew. (2022). Mortality rate of Boer, Central Highland goat and their crosses in Ethiopia: Nonparametric survival analysis and piecewise exponential model.

Epstein, H. (1971). The origin of the domestic animals of Africa.

ErshaduzzamanM, Rahman M M, Roy B K. and Chowdhury S A. (2007). Studies on the diseases and mortality pattern of goats under farm Conditions and some factors affecting mortality and survival rates in Black bengal kids. Goat and Sheep Production Research Division, Bangladesh Livestock Research Institute, Savar, Dhaka-1341, Bangladesh Journal of Veterinary Medicine 2007; 5 (1 & 2): 71–76

Esmael Tessema. (2020). Pastoralist knowledge of sheep and goat disease and implications for peste des petits ruminants virus control in the Afar Region of Ethiopia.

Feki M. (2013). Community-based characterization of Afar goat breed around Aysaita district of Afar region. MSc thesis. Jimma, Ethiopia: Jimma University.

FOASTAT. (2019). Food and Agriculture Organization of the United Nations STAT http://www.fao.org/faostat

Geleta Gobena and Demissu Hundie. (2015)."Assessment on production situation and breeding practices of Horro sheep under traditional management in Horro Guduru and East Wollega Zones, West Ethiopia." *Global Journal of Animal Breeding and Genetics* 3, no. 3: 146-152.

Getahun Legesse. (2008). Productive and Economic performance of Small Ruminant production in the production system of the Highlands of Ethiopia. Ph.D. dissertation. University of Hohenheim, Stuttgart-Hoheinheim, Germany.

Getaw Tadesse and Tadiwos Zewdie. (2019). "Grants vs. credits for improving the livelihoods of ultra-poor: Evidence from Ethiopia." *World Development* 113: 320-329.

Getinet Mequriaw Joram,M.M., Kassahun, T., Tadelle, D., Mwai, O., Djikeng, A., Liu, B., Osama, S., Grossen, C. and Zhang. (2016). Molecular characterization of ethiopian indigenous goat Populations: genetic diversity and structure, demographic Dynamics and assessment of the kisspeptin gene polymorphism Degree of Doctor of Philosophy in Applied Genetics Addis Ababa University

Getnet Kindie Hegde, B.P., Bekele T., Enyew N. and Workneh A. (2005). Phenotypic characterization of goat types in northwestern Ethiopia. *Ethiopian Journal of Animal Production* 5:13–32.

Giridhar, K. and Samireddypalle, A. (2015). Impact of climate change on forage availability for livestock. In: Climate change Impact on livestock: adaptation and mitigation. Sejian, V,Gaughan, J., Baumgard, L., Prasad, C. S. (Eds), Springer-VerlagGMbH Publisher, New Delhi, India, pp 97-112

Girma Abebe. (2008). Reproduction in sheep and goats. Alemu Yami and R.C. Merkel (Eds.).pp. 57-72. In: Sheep and goat Production Hand Book for Ethiopia. Ethiopia Sheep and Goats Productivity Improvement Program (ESGPIP), Addis Ababa, Ethiopia.

Girma Debele, Mieso guru, Feyisa Hundessa and Misgana Duguma. (2013). Assessment of farmers' management practices and factors affecting goats' production system in Adami Tulu Jido kombolcha district of East Shewa Zone, Ethiopia. Agric. Biol. J. N. Am., 2013, 4(5): 520-526.

Girma Debele, Misgana Duguma, Feyisa Hundessa, Firhowet Messele, Tesfaye Kebede and Mohammed Negash. (2013). Study on major causes of kid mortality in Adami Tulu Jido Kombolcha District of Oromia, Ethiopia. Agricultural and Biology Journal North America, 2013, 4(2): 110-115

Grum Gebreyesus. (2010). Community-Based Participatory Characterization of the Short-Eared Somali Goat Population around Dire Dawa.MSc thesis, Submitted to the School of Graduate Studies of Haramaya University, Ethiopia: 129p.

Hailemariam, Fsahatsion, Aberra Melesse, and Sandip Banerjee. (2013)."Traditional sheep production and breeding practice in Gamogofa Zone, Southern Ethiopia." *International Journal of Livestock Production Research* 1, no. 3: 26-43.

Halima Hassen, Samer Lababidi, Barbara Rischkowsky, Michael Baum, and Markos Tibbo M. (2012b). Molecular characterization of Ethiopian indigenous goat populations. *Tropical Animal Health Production*44(6):1239–1246.

Halima Hassen., Michael Baum, Barbara Rischkowsky and Markos Tibbo. (2012a). Phenotypic characterization of Ethiopian indigenous goat populations. *African Journal of Biotechnology* 11(73):13838– 13846.

Hirst, K. Kris. "The History of the Domestication of Goats". *About.com*. Accessed August 18, 2008.

Hulunim Gatew, Halima Hassen , Kefelegn Kebede, Aynalem Haile , Raimundo Nonato Braga Lobo and Barbara Rischkowsky. (2019). Early growth trend and performance of three Ethiopian goat ecotypes under smallholder management systems

Hulunim Gatew. (2019). Early growth trend and performance of three Ethiopian goat ecotypes under smallholder management systems.

Hussein Galgalo. (2015)."a study on livestock marketing in borena zone pastoral districts Oromia regional state, ethiopia." phd diss., st. Mary's university.

Hussein Hassen (2015). Phenotypic characterization and breeding practices of Arsi-Bale goat population in selected districts of Arsi and Bale zones, Oromia regional state, Ethiopia. MSc thesis. Bahir Dar University, Bahir Dar, Ethiopia.

Iiyama M, Kariuki P, Kristjanson P, Kaitibie S, Maitima J. (2008). Livelihood diversification strategies, incomes and soil management strategies: a case study from Kerio Valley, Kenya. J Int Dev.;20(3): 380–97.

Improving Productivity and Market Success (IPMS) of Ethiopian Farmers Project. (2010).

Institute of Biodiversity Conservation. (2004). The state of Ethiopia's farm animal genetic resources: Country Report. A contribution to the first report on the state of the world's animal genetic resources, IBC. Addis Ababa, Ethiopia.

Karina Palmer, Ashika Naicker and Unathi Kolanisi. (2022). The Potential of Goat Meat Acceptance by Young Adults in South Africa. African Journal of Inter Volume 4(1): 406-418 | DOI: https://doi.org/10.51415/ajims.v4i1.1043

Kassahun Awgichew . (2008). Sheep and Goat flock health. In Sheep and Goat Production Handbook for Girma Abebe. 2008. Reproduction in sheep and goats. Alemu Yami and R.C. MERKEL(eds.). IN: Sheep and goat Production Hand Book for Ethiopia. Ethiopia. ESGPIP. Pp 213-272.

Kidus Nigussie. (2010). Goat breeds utilization and productivity of crossbred goats in eastern and southern Ethiopia and biophysical model. MSc thesis. Addis Ababa, Ethiopia: Addis Ababa University.

Kinder, C.A. & Williams, S. (2013). Livestock Science Experiment. Average Daily Gain (ADG) Market Weight, Feed Conversion. The University of Idaho Extension. Retrieved from https://www.uidaho.edu/~/media/UIdaho-Responsive/Files/Exten - sion /county/Gooding/4-H/animal-science/Experiment-Topics-for-club-work.ashx

Kosgey, I.S., Rowlands, G.J., van Arendonk, J.A. and Baker, R.L. (2008). Small ruminant production in smallholder and pastoral/extensive farming systems in Kenya. *Small Ruminant Research*, *77*(1), pp.11-24.

Kosgey, IS. (2004). Breeding objective and breeding strategies for small ruminants in the tropics.

Mahilet Dawit. (2012). Characterization of Hararghe Highland goat and their production system in eastern Hararghe. MSc. Thesis Haramaya University.pp89.

Markos Tibbo. (2006). Productivity and health of indigenous sheep breeds and crossbreds in the central Ethiopian highlands. Doctoral Thesis, Swedish University of Agricultural Sciences. Uppsala, Sweden

Matawork Milkias Gobena. (2016). Review on Small Ruminant Production, Marketing and Constraints in Ethiopia, pp: 48

Missohou, A., Talaki, E. and Laminou, I.M. (2006). Diversity and genetic relationships among seven West African goat breeds. *Asian-Australasian journal of animal sciences, 19*(9), pp.1245-1251.

Netsanet Zergaw. (2014). On-farm phenotypic characterizations and performance evaluation of Central highland goat and Woyto- Guji goat types for designing community-based breeding strategies. MSc thesis. Haramaya University, Haramaya, Ethiopia.

Netsanet Zergaw. (2016). Using morph metric traits for live body weight estimation and multivariate analysis in Central Highland and Woyto-Guji Goat Breeds, Ethiopia.

Okpebholo, F. and Kahan, T. (2007). Opportunities and Challenges for Developing Small Ruminant Production Systems. Cooperative Extension Program, College of Engineering Sciences, Technology and Agriculture, Florida A&M University, Tallahassee, Florida. The Caprine Chronicle,22: 1-4.open access environments of Sub-Saharan Africa.

Oluwatayo, I.B. and Oluwatayo, T.B. (2012). Small ruminants as a source of financial security: a case study of women in rural Southwest Nigeria. *Institute for Money, Technology and Financial Inclusion (IMTFI), Working Paper, 1*.

Quisumbing, A. R., E. Payongayong, J. B. Aidoo, and K. Otsuka. (2001). Women's land rights in the transition to individualized ownership: implications for the management of tree resources in western Ghana. *Econ. Devel. and Cult. Change,* 50: 157-182.

S. M. Robertson. (2020). Reproductive performance in goats and causes of perinatal mortality: a review. Animal Production Science, 2020, 60, 1669–1680 Review https://doi.org/10.1071/AN20161

Shapiro, B.I., Gebru, G., Desta, S., Negassa, A., Nigussie, K., Aboset G. and Mechale H. (2017). Ethiopia livestock sector analysis.ILRI Project Report. Nairobi, Kenya: International Livestock Research Institute (ILRI)

sion /county/Gooding/4-H/animal-science/Experiment-Topics-for-club-work.ashx

Sisay Fikru and Kefyalew Gebeyew. (2015). Sheep and Goat Production Systems in Degehabur Zone, Eastern Ethiopia: Challenge and Opportunities.

Solomon Abegaz, Kassahun Awgichew and Girma Abebe Yami. (2008). Sheep and goat production systems in Ethiopia. In: Alemu Yami and Merkel, R.C. (eds), *Sheep*

and goat production handbook for Ethiopia. Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP). pp. 27–32.

Solomon Gizaw, Azage Tegegne, Berhanu Gebremedhin and Dirk Hoekstra. (2010). Sheep and goat production and marketing systems in Ethiopia: Characteristics and strategies for improvement. IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project Working Paper 23.ILRI (International Livestock Research Institute), Nairobi, Kenya, 58p.

Solomon Gizaw, Komen, H., Hanotte, O. and Van Arendonk, J.A. (2008). Indigenous sheep resources of Ethiopia: types, production systems and farmers preferences. *Animal Genetic Resources/Resources génétiquesanimales/Recursosgenéticosanimales*, *43*, pp.25-39.

Solomon Abegaz. (2014). Design of community-based breeding programs for two indigenous goat breeds of Ethiopia.

Steinfeld, H., T. Wassenaar and S. Jutzi. (2006). Livestock production systems in developing countries: status, drivers, trends. *Rev. Sci. Tech. Off. Int. Epiz.* 25 (2):505-516.

Sunil Soni. (2020). Review on impacts of climate on forage production and pasture production and strategies for its mitigation.

T Nugroho. (2018). Birth and weaning weight of kids from different Boer goat crosses, Earth Environ. Sci. 142 012010.

Taberlet, P. (2008). "The goat domestication process inferred from large-scale mitochondrial DNA analysis of wild and domestic individuals". Proceedings of the National Academy of Sciences. 105 (46): 17659

Takyi, A.K. (2008). Perceived versus realized benefits of crossbred goats in the Kedida Gamela district of southern Ethiopia. MSc thesis. Hohenheim, Germany: University. Faculty of Agricultural Sciences.

Tatek Woldu. (2016). Optimising contributions of goat farming to household economic success and food security in three production systems in Ethiopia.

Tegedie District Agricultural Office. (2022).

Tesfaye Agajie. (2004). Ethiopian Institute of Agricultural Research In mixed farming system

Tesfaye Alemu, Alemu Regassa and Lemma Fita. (2000). Preliminary production and reproduction of performance evaluation of Mid Rift Valley and Boran goats. Proceeding of a conference held at Debub University, Ethiopia.

Tesfaye Tsegaye. (2009). Characterization of goat production systems and on–farm evaluation of the growth performance of grazing goats supplemented with different protein sources in Metema woreda, Amhara region. MSc thesis. Haramaya University, Ethiopia.

Tewodros Alemu, Lijalem Abebaw and Leuelseged Kassa. (2020). Production Practices, Constraints and Opportunities of Abergelle Goat Breed, Northern Ethiopia. Journal of Animal Research: v.10 n.5, p. 677- 684.

Tsedeke Kocho. (2007). Production and marketing systems of sheep and goats in Alaba, Southern Ethiopia. An MSc Thesis, Hawassa University, Ethiopia.

Tsedey Azeze, Zelalem Yilma, Ajebu Nurfeta and Haile Welearegay. (2015) .Utilization and quality of goat milk in Hadiya zone, Southern Ethiopia. Global Journal of Food Science and Technology, Vol. 3 (6), pp. 197-203.

Tsegahun Aschalew, Sisay Lemma, Ameha Sebsbie, Abebe Mekoya, and ZinashSileshi. (2000). "National goat research strategy in Ethiopia." In *The opportunities and challenges of enhancing goat production in East Africa. Proceedings of a conference held at Debub University, Awassa, Ethiopia from November*, vol. 10, pp. 1-5.

Tsegaye, D., B. Belay and A. Haile. (2013). Prevalence of Major Goat Diseases and Mortality of Goat in Daro-Labu District of West Hararghe, Eastern Ethiopia. J. Sci. Innovative Rese., 2(3): 665-672

Umeta, G., Feyisa, H., Misgana, D. and Merga, M. (2011). Analysis of goat production situation at Arsi Negele Woreda,Ethiopia. *Journal of Stored Products and Postharvest Research*, 2(8):156–163.

Wilson R Trevor. (1991). Small Ruminant Production and Small Ruminant Genetic Resources in Tropical Africa. FAO. J. Animal Production and Health. No.88. FAO, Rome.

Workneh Ayalew , Rischkowsky B, King J M and Bruns E. (2003). Crossbreds did not create more net benefits than indigenous goats in Ethiopian smallholdings. Agricultural Systems, 76, 1137-1156

Workneh Ayalew and Peacock, C.P. (1993). The goat is an important milk producer in Southern Ethiopia. In: Proceedings of the fourth National Livestock Improvement Conference, 13–15 November 1991, Addis Ababa, Ethiopia. Addis Ababa, Ethiopia: IAR (Institute of Agricultural Research). pp. 165–170.

Workneh Ayalew. (2000). Do smallholder farmers benefit more from crossbred (Somali × Anglo-Nubian) than from indigenous goats? PhD thesis. Goettingen, Germany: Faculty of Agricultural Sciences, George-August University of Goettingen.

Wuletaw Mekuria, Mekonnen Kindu. (2018). Determinants of crop–livestock diversification in the mixed farming systems: evidence from central highlands of Ethiopia. Agric Food Secur;7(1):1–15.

Yacob, HailuTolossa. (2014)."Ectoparasitism: the threat to Ethiopian small ruminant population and tanning industry." *Journal of Veterinary Medicine and Animal Health* 6, no. 1: 25-33.

Yaekob Lorato., Kirman, M.A. and Birhanu Belay. (2015). MorphologicalCharacterization of Indigenous Woyto-Guji Goat Breed in Loma District, Southern Ethiopia. Jimma, Ethiopia: Jimma University, College of Agriculture and Veterinary Medicine.

Yamane, Taro. (1967). Statistics, An IntroductoryAnalysis,2nded.,NewYork:Harper and Row

Yedata Neme Bagaga. (2016). Production and reproduction performances, producers' trait preferences and marketing system of small ruminant in Ada Barga and Ejere district of west shewa zone, Ethiopia.

Yenesewu Abebe, Solomon Melaku, Azage Tegegne and Firew Tegegne. (2013). Assessment of sheep production system in Burie District, northwestern Ethiopia. Global Journal of Agricultural Research, 1(2), pp.29-47.

Zeder MA, Hesse B. (2000). The initial domestication of goats (Capra hircus) in the Zagros Mountain 10,000 years ago. Science 287, 2254-2257.

Zeleke Mekuriaw. (2007). Environmental influences on pre-weaning growth performances and mortality rates of extensively managed Somali goats in Eastern Ethiopia. Livestock Research for Rural Development.

Zewudu Edea, Aynalem Haile, Markos Tibbo, Sharma, A.K. Solkner, J. and Wurzinger, M. (2012). Sheep production systems and breeding practices of smallholders in western and southwestern Ethiopia: Implications for designing community-based breeding strategies. Livestock Research for Rural Development, 24(7).

Zewudu Edea, Aynalem Haile, Markos Tibbo, Sharma, A.K. Solkner, J. and Wurzinger, M. (2012). Sheep production systems and breeding practices of smallholders in western and southwestern Ethiopia: Implications for designing community-based breeding strategies. Livestock Research for Rural Development, 24(7).

8. APPENDICES

8.1. Appendix Tables

Appendix Table 1: Goat production constraints

	Highland				Midland				Lowland				Overall	
Constraints	R1	R 2	R 3	Index	R1	R 2	R 3	Index	R 1	R 2	R 3	Index	N	Index
Disease	7	8	14	0.22	28	41	70	0.23	5	19	6	0.08	198	0.2
Predator	2	4	6	0.08	12	21	33	0.1	21	21	20	0.18	140	0.14
Market	1	7	7	0.1	19	27	41	0.14	25	29	39	0.24	195	0.19
Feed shortage	25	10	12	0.46	103	70	2	0.43	17	15	33	0.16	287	0.29
Water shortage	5	6	6	0.14	13	16	29	0.1	51	35	21	0.34	182	0.18

, Index= sum of (3 X number of households ranked first + 2 X number of households ranked second + 1 X number of households ranked third) give for each constraints divided by sum of (3 X number of households ranked first + 2 X number of households ranked second + 1 X number of households ranked third) for all constraints.

Appendix Table 2: opportunities for goat production

	Highland				Midland				Lowland				Total	
Opportunity	R 1	R 2	R 3	Index	R 1	R 2	R 3	Index	R 1	R 2	R 3	Index	N	Index
Low startup cost	19	11	9	0.41	45	48	76	0.29	39	32	47	0.31	315	0.32
Prolificacy	11	16	19	0.38	89	76	10	0.41	44	49	26	0.36	340	0.34
Favorable agro_ecology	3	6	6	0.12	11	13	39	0.09	16	18	21	0.15	133	0.13
Meat demand increase	7	7	6	0.09	30	38	45	0.2	20	20	25	0.18	198	0.2

Index= sum of (3 X number of households ranked first + 2 X number of households ranked second + 1 X number of households ranked third) given for each opportunity divided by the sum of (3 X number of households ranked first + 2 X number of households ranked second + 1 X number of households ranked third) for all opportunity.

Appendix Table 3: Least squares mean and standard error of pre-weaning average daily weight gain

Source of variation	Average daily weight gain from birth to					
	30 Day		60 Day		90 Day	
	N	LSM±SE	N	LSM±SE	N	LSM±SE
Overall	108	108±5.53	103	88±4.14	103	75±3.02
CV	108	20.93	103	18.97	103	16.72
AEZs		NS		*		*
Highland	39	106±5.59	33	77.8±4.33	33	69±3.16
Midland	41	110±5.29	36	93±4.1	36	77±2.99
Lowland	41	108±5.43	34	94±3.99	34	81±2.92
Parity		*		NS		NS
1	13	100±8.00	12	82±5.37	12	69±4.75
2	24	114±7.49	24	92±3.94	24	77±3.49
3	36	119±4.99	34	91±3.44	34	78±+3.05
4	18	99±7.18	17	75±7.1	17	70±4.19
5	10	104±8.65	10	97±5.8	10	75±5.13
6	7	120±10.5	6	94±6.3	6	75±5.62
Birth type		*		*		*
Single	58	113±3.8	55	95±2.55	55	83±2.0
Twin	40	111±4.68	40	85±3.1	40	73±2.74
Triple	10	84±10.7	8	74±8.2	8	67±7.4
Sex		**		**		***
Male	66	117±3.9	64	98±2.94	64	81±1.72
Female	42	104±4.74	39	83±3.74	39	70±2.15

*= $p<0.05$ **= $p<0.01$ ***= $p<0.001$ NS= Not significant LSM= Least Squares Mean SE= Standard Error LSM±SE= Least Squares Mean ± Standard Error CV= Coefficient of Variation AEZ=Agro-ecological zone

8.2. Appendix Figures

Appendix Figure 1: Training of kebele expert on how to assess respondents and monitor kids

Appendix Figure 2: Monitoring of kid's weight in different age.

8.3. Appendix questionnaire

SECTION ONE GENERAL INFORMATION

I. General Information

1. Place of data collection (kebele) _____Agro-ecology 1.Highland 2.Midland 3. Lowland

2. Enumerator Name _____Date_____/_____/_____ 3. Date of data collection _____

II. Household data

1. Name of respondent Male___ Female _____

2. Age: 1. 10-15yrs 2. 15-20yrs 3. 20-25yrs 4. 25-30yrs 5. 30 and above

2. Marital status 1.married 2. Non- married 3.divorced 4. Widowed

3. Level of education codes: 1=None 2= primary 3=secondary 4 =higher education

4. Position in House hold: 1.male head 2.female head 3.relative 4.son

5. Religion: 1.orthodox 2.Muslim3. Catholic 4. Protestant

6. Family size: Females _____Males _____Total_____

7. What is your farming activity?

1. Livestock production 2.crop production 3.crop livestock production 4.Other specify…….

III. Land holding

1. Do you have land? a. yes b. no

2. If your answer is yes, how much land do you own? Own _____ha,

Rented in _____ha, Rented out _____ha

3. Do you have private grazing land? 1. Yes 2. No

4. If your answer is yes how much is the area of your private grazing land? (ha) _____.

5. What type of crops do you grow in your own land, please specify?

IV. Livestock Population

1. Please tell us species of livestock you have and their numbers

Species	Number
Cattle	
Goat	
Sheep	
Donkey	
Mule	
Horse	
Poultry	
Bee hive	

2. Please tell us the number of goats you have at different age?

Class	Number
Male > 1 years	
Female > 1 years	
Female 6 month to1 years	
Male 6 month to 1 years	
Male lambs < 6 months	
Female lambs < 6 months	
Castrated	

1. What are the major objectives of goat production in your family? (Give rank in order of their importance)

Major objectives	Tick	Rank (Top three)
Income		
Home consumption (Meat)		
Saving		
Social (cultural function)		
Manure		
Risk/benefit distribution with other animals		
Other (specify)		

2. Household Income contribution of different farming activities (in ranking order)

Farming activities	Rank
Goat production	
Cattle production	
Field crop production	
Sheep production	
Apiculture	
Vegetable production	

SECTION TWO GOAT HUSBANDRY PRACTICE

1. Feeding system

1. Tick (√) the most available feed resource in wet and dry season and rank them.

Types of feed sources	Wet season	Rank	Dry season	Rank
Natural pasture				
Established pasture				
Hay				
Crop residues				
Concentrates				

2. Most common grazing land of goat

Most common grazing land	Tick
On the own land	
On the rented land	
On the communal land	

3.Grazing management of goat

Grazing ways	Tick
Goatalone	
Mixed Sheep and goat	
Goat with other livestock but not sheep	
Sheep and goats with other livestock	
Grazing / browsing Practices in dry season	
Free grazing	
Tethered grazing	
Herded	
Roaming and tethered grazing	
Herded and tethered	
Grazing / browsing practices in wet season	
Tethered grazing	
Herded	
Herded and tethered	

4. Is there feed shortage or constraint for your goat? 1=Yes 2=No If yes what are the major constraints of feed?

1=low availability of fodder 2=Low quality of feed 3= Increase of human population

4= Drought 5=others_____

2. Water Resources and Watering

1. What are the common water sources of goat in this area?

Sources of water	During rainy season	During dry season
River		
Spring		
Rain water		
Ground water		

2. Distance to watering point

Distance	Rainy season	Dry season
Watered at home		
<0.5km		
0.5 – 1km		
1km		
1-5 km		

3. Are kids watered with adults? 1= yes 2= No

If no how are they watered? 1= at home 2=we not water them

3. Frequency of watering goat

Frequency	Rainy season	Dry season
Freely available		
Once a day		
Once in 2 days		
Once in 3 days		

3. Housing system

1. Where do you confine your goat?

1=Main house 2=Adjoin house (in the house) 3=Separate constructed house

4=Grazing area (open kraals) 5=others, specify _____

2. Housing materials

Type	Roof	Wall	Floor
Earth/mud			
Grass/sheet			
Wood			
Stone/bricks			
Concrete			

3. How do you confine goat?

1=Goat alone 2=Sheep and goats alone 3=Sheep, goats and all other animals together 4=others, specify _____

4. Are new born kids housed with adults? 1. Yes 2. No

5. Do you separate new born kids from their mother? 1. Yes 2. No

If yes for how many days you separate kids from their mother?

4. Rank Goat culling practice

Reason of culling goat	Tick
Old age	
Sickness	
Productivity problem	
Physical defect	
Predator	
Feed scarcity	

5. Health management system

1. Ranking of goat disease

Local name	Common name	Rank

2. What would you do when your goat is sick?

1=Treat with local medicine 2=Sale immediately 3=Slaughter immediately 4=Take to veterinary center 5= others, specify_____

3. Are you accessible to veterinary services in your locality/near distance? 1=Yes 2=No

If yes how far? A. < 1km b. 1-5km c. 6-10km

4. Where do you usually obtain veterinary services?

1=Government 2=DA offices 3=NGOs 4=Private institutions 5=Open markets

5. How you obtain services in these institutions?

1=Free of charge 2=Payment 3=Credit 4=others, specify

6. Did your goat vaccinated? 1=Yes 2=No

If yes how? 1=after report of disease cases 2=after certain animals died3=others, specify___

7. Did you use traditional treatment when your goat got sick? 1. Yes 2. No

If yes what is the type of sickness (symptoms of the disease)? And how?

_____

8. What are the major health constraints of goats in your area?

Major health constraints	Rank
1. Distance to reach government clinics	
2. High prevalence of diseases and parasites	
3. Lack/shortage of drugs and medicines	
4. Others	

9. Has there been any death of goat over the last 12 months? 1=yes 2=No

If yes, rank in the following table.

Age	Rank goat died
1. < 3months	
2. 3-6 months	
3. Doe	
4. bulk	
5. Castrates/fattening	

10. If Majority of death occurs on new born kids (<3months), what is/are the reasons?

1=lack of separation of kid from their dose 2=insufficient ingestion of colostrum 3=Running with their mother or other flock before mature 4= others_____

6. Castration

1. Do you practice castration of goat? 1=Yes 2=No

If yes why? 1=to fetch more price (by fattening) 2=to avoid mating with flock members 3=others, specify _____

2. At what age do you castrate bulk? _____ Months

3. Thick (√) the most castration months ofgoat among them rank the top 2 months.

Species	Most Castration month											
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Goat												

4. For how long do you keep castrated goat? _____ Year.

5. What method you use to castrate your goat? a. Modern b. Traditional

If you castrate traditionally, what type of materials do you use for castration?

7. Goat marketing system

1. When in the year you prefer to sale or purchase goat?

Season of selling	rank sale season of goat
1. During festivals	
2. during Easter	
3.During New Year	
4. During Christmas	

2. What are the Reasons of selling and buying of goat and rank them?

Reason of selling goat	Rank
Cash need	
Difficult in management	
Time of crop failure or drought	
Sell for replacement	
Reason of buying goat	
Trading	
Replacement	
Household consumption	

3. Rank the preference of households for sale of goat by sex and age groups

Sex	Age group	Rank
Male	< 06 months	
	06 months – 01 year	
	Adult (> 01 year)	
	Castrated	
Female	< 06 months	
	06 months – 01 year	
	Adult (> 01 year)	

4. On average how many goats you sell per year _____?

5. Rank the major market problems in the following table.

Major market problem of goat	Rank
Price determine by visual (lack of weighing)	
No public market information	
Long transportation	
Price determined by brokers	
Others_____	

6. Who buys your goat?

Participants	Rank
1.Farmers	
2.Traders	
3.Hotels	
4. Civil servants	
5.Others	

7. How do you sale or purchase your animals? 1= Live weight basis 2= 'Eye ball' Estimation 3=both

8. Did you ever get animal price and market information? 1= Yes 2= No

If yes, from where? 1= DAs 2= Governmental organizations, 3= NGOs 4= others, specify

5. Goat breeding managements

1. Tick (√) the most traits you prefer for breeding does and bulk criteria.

Phenotypic traits	Breeding bulks	Rank
For breeding bulks		
Body size		
Color		
Age at first maturity		
Kid survival		
Adaptability		
For breeding does		
Body size		
Color		
Twining ability		
Kid interval		
Adaptability		
Kid survival		
Tail type		

2. Rank the adaptability of goat

Adaptability traits	Adaptability of goat at
Disease	
Internal parasite	
External parasite	
Heat	
Drought	
Feed shortage	
Water shortage	

3. What are the common sources of breeding males for your flocks?

Source of breeding male	Ram	Remark
Own		
Neighbors		
Others specify		

4. What are the Service or conception constraints that hinder fertility and reproduction of goat

1. In adequate feed and water supply 2. Inconvenient climatic conditions

3. Diseases and parasite burdens 4. lack/shortage of breeding male
5.othres specify

6. Rank entry and exit of goat flock

Entry methods	Rank
Home born	
Purchase	
Receive share	
Gift	
Exit methods	
Sale	
Death	
Slaughter	
Predators	
Theft	
Share out	

7. Opportunities of goat breeding

Particulars	Rank
Low start up cost	
Multispecies grazing	
Meat demand increase	
Minimal labor requirements	

9. The major constraints for goat production?

Rank the following major constraints for goat production

Constraints	Rank
1. Lack of feed	
2. Lack of water	
3. Disease	
4. Predators	
5. Lack of improved goat	
6. Long dry season	
7. Shortage of capitals	
8. Market	

SECTION THREE: EXTENSION SERVICE IN GOAT PRODUCTION

1. Have you received training on any improved management practices on goat?

1=Yes 2=No

2. If yes, where did you obtained? 1. Development agents 2. Community leaders 3. Market participant farmers 4. Neighbors 5. Relatives and friends 6. Radio, television, newsletter

7. Others (specify)____

3. If you say from DAs in what aspects? 1. Feeding (specify): feed production, feed conservation, feeding management 2. Health management 3. Genetic improvements 4

Castration and fattening 5. Kids rearing techniques 6. Housing of flock 7. Skin production (flaying, slaughter cares, preservation, storage, transportation) 9. Others(specify)_____

4. Did you apply the trainings/advices received? 1. Yes 2. No

5. If you applied the trainings/advices, did you achieve any improvements in your flocks? 1. Yes 2. No

6. If not, why? 1. Not affordable 2. Not simple to apply (not understood) 3. Not accessible (not found in my areas) 4.socially and culturally not acceptable in my area 5.Not relevant to problems of my flock 6.Labor shortage 7.others (specify)_____

7. Do you get health service technologies? 1. Yes 2. No

SECTION FOURE: INSTITUTIONS AND INNOVATIONS IN GOAT PRODUCTION AND MARKETING

1. Did you receive credit in recent years? 1. Yes 2. No

2. If yes, in what form? 1. Cash 2. Kind (specify)_____ 3. Both

3. If you received with credit, what was the source? 1. Governmental banks 2. Private banks 3. Credit institutions 4. Governmental offices 5. NGOs 6. Cooperatives 7. Others (specify)_____

4. If received credit for what major purposes? 1. Crop production (improved seeds, fertilizer) 2. Pett trade 3. Cattle and small ruminants fattening 4. Others (specify)_____

5. Who received the credit in your family? 1. Husband 2. Wife 3. Boys <18 years old 4. Girls < 18 years old 4. Others (specify)_____

6. How you made credit arrangements? _____

7. Are you satisfied with the lending regulations and terms to repay the credit? 1. Yes 2. No

8. Did you receive goat from any sources? 1.Yes 2. No

9. If yes, from which sources? 1. Credit 2. Gift from NGOs 3. Gift from GOs (safety net gift) 5. Share arrangements 6. Exchange (crop, other livestock, and inputs)

10. If you received goat from share arrangements, why? 1. To Fatten 2.To Breed 3. Others (specify)_____

11. How you made the share agreements? 1. Share incomes from sale of animals received 2. Share new born animals 3. Share the original animals after certain years 4. Others (specify)_____

12. Is there any cooperative in your area to which you are a member? 1. Yes 2. No

13. If yes, in what sector and what services it renders? 1. Crop production (storage, marketing, deliver inputs to members, etc) 2. Livestock (Marketing, deliver inputs, assemble products, etc) 3. Inputs and credits (deliver different inputs, credits, insurance, etc 4. Others (specify)_____

SECTION FIVE QUESTIONS FOR FOCUS GROUP DISCUSSION

1. What is the unique characteristic of Indigenous goat type ? Discuss?
   _____
   _____
   _____

2. Discuss goat growth performance_____
_____
_____

3. What are main feed resource and feed management of goat?

3.1 Feed resources

_____
_____
_____
_____

3.2 Feed management

_____
_____
_____
_____

4. What are constraints of goat production?

_____
_____
_____
_____

4.1 How do these constraints be solved?

_____
_____

5. What are the opportunity and strategies for improvement of goat production?

5.1 Opportunities

_____
_____
_____
_____

5.2 Strategies

_____
_____
_____
_____

6. How do you perform goat marketing?

_____
_____
_____
_____

7. What are the types of materials for house construction and how is it constructed?

7.1 Why

_____
_____
_____
_____

7.2 How

_____
___
_____
_____

7.3 Type of materials

_____
_____
_____
_____

8. What is the economic importance of goat?

_____
_____
_____
_____

SECTION SIX GOAT PRE-WEANING GROWTH AND SURVIVAL RATE MONITORING CHECKLIST

1. Birth data record sheet at Tsegedie district in different ago-ecologies
   kebele---------- Agro-ecology classification----------

NO	Owner name	DIDN	KIDN	AGE	KBD	DWT	KBW	S	BT	P	Remark

DIDN = Does ID No, KIDN =Kids ID No, KBD = Kids birth date, DWT = Date weight taken, KBW = Kids birth weight, BT = Birth type, P = Parity, S = Sex, CD = cause of death, NK = No of Kids and AGE = Agro-ecology.

2. Body weight change record sheet of Kid in Tsegedie district at different agro ecologies

NO	Owner name	kid information						kid body weight				Remark
		DIDN	KID	AG	S	BT	P	KBW	D30	D60	D90	

D 30- body weight at 30 day, , D60- body weight at 60 day, D90- body weight at day 90

3. Average daily weight gain record sheet of Kid in Tsegedie district at different agro ecologies

NO	Owner name	Kid information									
		DIDN	KIDN	AGE	S	BT	P	BW-30D	30-60D	60-90D	Remark

2. Survival rate record sheet of Kids

NO	Owner name	Kid information										
		DIDN	KIDN	AGE		BT	P	D30	D60	D90	CD	Remark
Total Died												

BIOGRAPHICAL SKETCH

The author, Semagn Atanaw Zewdie was born on March 16, 1987, in Tegedie District, Amhara Region. He completed his elementary education at Keraker Primary school and completed his secondary school education at Limatber in Lay Armachiho District Tikildegay town. In August 2006, he received an honors diploma in Animal Science from Mertulemariam ATVET College. Soon after graduating, he joined the Department of Agriculture office and worked as an Animal production expert for ten years in Tegedie district, Central Gondar Zone, Amhara region. Also, in June 2013 he entered the University of Debretabor and in July 2017 received a bachelor's degree in animal production. Finally, he the Department of Agriculture office and worked as an Animal production expert for four years in Tegedie district, Central Gondar Zone, Amhara region. He then returned to Bahir Dar University in 2020 to complete his M.Sc. study in the field of Animal Production and Technology.