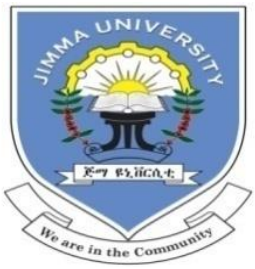

JIMMA UNIVERSITY

COLLEGE OF NATURAL SCIENCES

SCHOOL OF GRADUATE STUDIES

DEPARTMENT OF BIOLOGY

Indigenous knowledge of Plants used in veterinary practices in Metu District, Ilu Aba Bor Zone, Oromia Regional State, South west Ethiopia.

A Thesis Submitted to Department of Biology, College of Natural Sciences, and School of Graduate studies, Jimma University in Partial Fulfillment of the Requirement for the Degree of Masters of Science in Biology

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Acronym

MWCPANRO : Metu Woreda coffee production agriculture and natural resource office

ABSTRACT

Ethiopia is a country characterized by a wide range of climate and ecological conditions possesses enormous diversity of fauna and flora. The study of indigenous knowledge on utilization of native plants as source of traditional medicine is important to treat livestock ailments. However as a source of knowledge, this traditional medicine practice is not sufficiently documented. Accordingly this study was conducted with the objective of documenting ethno-veterinary medicinal plant species used in traditional livestock's healthcare practices and the associated indigenous knowledge of the people of Mettu district, South west Ethiopia. A purposive sampling technique was carried out using a semi-structured questionnaire and field observation to document indigenous knowledge of traditional healers and useful medicinal plants. Descriptive statistics were used to analyze and summarize the ethno-botanical data. 55 plant species, which have medicinal value against a total of 22 livestock diseases, were reported which belonging to 39 plant families. From the growth forms of medicinal plants herbs constitute the highest with 22(40.0%) and followed by Trees with 16 (29.09%). The most frequently used plant parts were leaves alone 13(23.63 %) followed by root alone 10(18.18%). The most widely used method of preparation was Pounding 42 (76.36%) followed by powdering and crushing 3(5.45%) each. The common route of administration recorded was oral 40 (72.72%) followed by dermal 7 (12.72%), optical 2(3.63), and nasal were the least with 1(1.81%) each. Fabaceae and Solanaceae families constituted the highest proportion followed by Asteraceae and Cucurbitaceae. Majority of the traditional healers transfer their indigenous knowledge while some of them kept the knowledge for the sake of secrecy. Most of the traditional healers were found to have poor knowledge on the dosage while prescribing the remedies. More than one medicinal plant species were used more frequently for remedy preparations. Metu District is rich in medicinal plant composition and the associated indigenous knowledge. Seasonal availability of the most herbaceous medicinal plants was the major threats to the indigenous knowledge on Ethno-veterinary practices of the local people. Further documentation of medicinal plants, Evaluation of their efficacy and possible toxicity would be very important.

Keywords: ethno-veterinary, efficacy, Indigenous knowledge, Livestock, Metu District

1 INTRODUCTION

1.1 Background of the study

Throughout the world, there is traditional knowledge practiced for centuries related to the health of humans and animals (Guluma *et al.,* 2017). In Africa, plants play an important role in health care made by traditional healers and remedies for the health of millions of people and animals, which is studied by ethno-veterinary medicine (Rukangira, 2001). Ethno-veterinary medicine studies traditional knowledge, people beliefs, skills, methods and practices used for the treatment of livestock ailments (Tabuti *et al*., 2003). This gives the people medicines which are cheap and locally available than pharmacotherapy. As a result, farmers can prepare this traditional medicine easily and use homemade remedies without expenditure (Yirga *et al*., 2012a).

All over the world Millions of people have an inseparable relationship with their livestock. Accordingly, Ethiopia is the home of many nationalities and remarkably diverse flora, including numerous endemic species that are utilized in various traditional medical practices. So, Ethiopian people have been using both plant and animal species for medication of different animal and human diseases over centuries when there was no modern health service delivery (Ngeh *et al*., 2007). The knowledge about this traditional medicine is transferred through oral (word of mouth) from generation to generation with great secrecy (Yirga *et al*., 2012a) than in written form (Mesfin *et al*., 2009). However, it can be transferred to generation vertically through family members, horizontally by exchange through peers, or diagonally through traditional healers to student learners (Philander *et al*., 2008).

On the other hands, this Medicinal plants are the root for the development of new drug and the survival of all human kind as well as other livestock. Even though the traditional medical practitioners are the best sources of information about the knowledge of the medicinal plants, it is found very difficult to obtain their traditional medicinal information as they considered their indigenous knowledge as a professional secret, only to be delivered orally to their older son, at their oldest age (Jansen,1981).

By now, focus on plant research by people on all over the world increased and there is an extensive of belief that the plant remedies are healthful and harmless than the synthetic ones (Murthy *et al*., 2005). Plants are atypical sources for new, riskless decomposed and renewable

drugs. Plants are used as remedial agents and furthermore being used as food for centuries (Joy *et al*., 2012).

Medicinal plants were known for their ability to produce a wealth of secondary metabolites and mankind has been using many species for many years to treat various types of diseases (Kaur *et al*., 2013). Herbal medicines are synthesized from different parts of plant such as: leaves, stems, roots, barks, fruits, seeds, flowers and so on. This is because, they usually contain most of the biologically active ingredients and are used primarily for treating mild to chronic ailments. As the World Health Organization indicated that, about 80% of the people in developing countries to control and treat various diseases that affecting both human beings and their animals mainly depend on indigenous practices (Ngeh *et al*., 2007).

When there was no modern health service in Ethiopia people have been using both plant and animal species for medication of different animal and human diseases for centuries. However, the activities has been not becoming to end with introduction of the modern pharmacotherapy and plant remedies are still the most important and sometimes the only sources of therapeutics for nearly more than 90% livestock population (Tadeg *et al*., 2005; Giday *et al*., 2009).

In Ethiopia, medicinal plants have been used from ancient time to treat different human and livestock ailments (Haile *et al*., 2008b). More over in Ethiopia, plants of medicinal values are assumed to be over 700 species and most of them are located within bounds of the South western region of the country (Guluma *et al*., 2017). There is a great expectation of enormous traditional knowledge and use of medicinal plant species in Ethiopia due to the presence of diverse cultures, languages and beliefs among the people in the area. The use of traditional medicine in wide range in various places could be attributed to cultural acceptability, economic affordability and efficacy against certain type of diseases as compared to modern medicines. Thus, local communities in different countries across the world have indigenous experience in various medicinal plants where they use their perceptions and experience to differentiate plants and plant parts to be used when dealing with different ailments (Omoruyi et al., 2012)

However, this important local indigenous knowledge on medicinal plants has been lost at a faster rate with the increase of modern education, which has made the younger generation to under estimate its traditional values used for centuries. Although, the increase in population growth rate would result in accentuate of agriculture at the edge areas and for expansion of coffee production which in turn would lead to deforestation with decrease in number or loss of medicinal plants in the wild (Sori *et al.*, 2004).

1.2 Statement of the problem

Metu District is one of the known districts with livestock production in Ilu Aba Bor zone of Oromia Regional state. The area is known with natural forest found in the country. As a result livestock traditional medicine is highly practiced by different individuals in the District. Accordingly, various diseases that attack the health of livestock in the area are highly distributed across the District. Therefore, detailed study of ethno-veterinary study will be needed in the District as in different areas of the country.

Even though ethno-medicinal plant studies and documentations of indigenous knowledge have been done in certain localities in Ethiopia, but as far as we know there was no ethno-botanic study conducted, concerning Ethno-veterinary medicine studies with traditional knowledge in Metu District of Oromia Region. Therefore, this research will be focused on traditional knowledge of ethno-veterinary practices used for maintaining the health and treating diseases of livestock in Metu District Ilu Aba Bor Zone.

1.3 Objective of the Study

1.3.1 General objective

- To assess indigenous knowledge of plants used in veterinary practice in Metu district.

1.3.2 Specific Objectives

To identify plant species used for medicinal purposes in treating livestock health problems in Metu district.

To classify plant parts used to treat diseases of livestock, habit, method of preparation and route of administration, dosage used, collection site, gear used, adverse effect, restriction of use, efficacy of the remedies and disease treated as implemented by the local people in Metu district.

To sort livestock diseases mostly treated with ethno-veterinary medicine in the District;

To distinguish threats to ethno-veterinary medicinal plants and conservation activities undertaken by the local community in the study area;

1.4 Research Questions

1. What is/are the ethno-veterinary medicinal plants that are used to treat livestock ailments in the study area?

2. What is /are the most common disease treated with ethno-veterinary medicinal plants by indigenous people of Metu District?

3. Which parts and which species of plants are used for ethno-veterinary practices in the study area?

4. How the ethno-veterinary medicinal plants will be prepared and administered for each identified livestock ailments?

5. What are the threats to ethno-veterinary medicinal plants?

1.5 Significance of the study

In the area there is a high production of domestic animals as well as there is health problem of livestock as the area was highly covered with forest and suitable for the reproduction of microorganisms which cause animal diseases. In addition there was indigenous knowledge of people on traditional medicinal plants for managing and treating livestock ailments. Therefore, this research is very important to search the traditional ethno-veterinary medicine; to document the result for future use and transferring the knowledge for the next generation also used to

develop awareness in the society to use and conserve medicinally important plants. On other hands, the output will be very important for individuals, government organization or private organization whose need is to carry out the study on traditional ethno-veterinary medicine knowledge and documentation.

2 LITERATURE REVIEW

2.1 Overview of Ethno-veterinary medicine

Based on geographical variation throughout the world, there are different human and livestock diseases which affect health care systems. In Africa there were different geographical variations which are suitable for different animal life. Ethiopia is one of the African countries known with diverse fauna and flora species. According to the study of Ensermu and Sebsebe (2014) the flora of Ethiopia encompasses about 6,027 vascular species which is 10% endemic and part of these species used as traditional ethno-veterinary medicine. As a result Ethiopia is one of the six centers of biodiversity in the world with several topographies, climatic conditions and various ethnic cultures. Ethno-botanical study is a real and encourage able in rich biological resource areas for medicinal plant identification, documentation, ranking, conservation and sustainable usages. The purpose of Ethno-veterinary study was to identify the most effective medicinal plants for specific treatment through priority ranking and to assess the status of the transfer of Traditional Botanical Knowledge (TBK) based on age groups and educational levels. Accordingly, from fauna species Ethiopia is the richest country in livestock population. However, as great number of livestock population exists there were different diseases which attack the life of these livestock.

To overcome this problem many studies have been done throughout different countries of the world including Ethiopia. Accordingly, several authors have been strived to study Ethno veterinary medicine which is a traditional knowledge, folk beliefs, skills, methods and practices used for the treatment of livestock ailments (Vesna *et al*., 2009). According to Moabiemang *et al*., (2013), EVM is the community-based local or indigenous knowledge and methods of caring for, healing and managing livestock. This also includes social practices and the ways in which livestock are incorporated into farming systems. As a result, the EVM knowledge has been developed through trial and error and deliberate experimentation. Therefore, with their high quality of breeding of livestock's in Africa, Ethiopians have used traditional veterinary medicines to treat human and livestock ailments since ancient time. Plants comprise the largest component of the diverse therapeutic elements of traditional livestock health care practices. Livestock disease is one of the principal causes of poor livestock performance in Ethiopia, leading to an ever increasing gap between the supply of, and the demand for, livestock

products (Fitsum and Amere, 2017). About 85% of world population uses herbal medicines for prevention and treatment of diseases, and the demand is increasing in developed and developing countries. Some 25% of drugs contain compounds obtained from higher plants.

Farmers in various developing regions still use medicinal plants for treatment of livestock diseases due to lack of access to modern veterinarians and price of modern medicines. Ethno-veterinary traditional practices are continuing since farmers believe that medicinal plants are more efficacious for treatment of livestock ailments than modern medicines (Zank and Hanazaki, 2017).

2.2 Traditional knowledge of veterinary medicine

Some studies in Ethiopia indicated that many rural people are endowed with deep knowledge on how to use plant resources as a medicine. This is particularly true with regard to the use of medicinal plants (Tariku and Eyayu, 2017).The knowledge of traditional veterinary medicine may be lost due to rapid socioeconomic, environmental, and technological changes (Nnadi *et al*., 2012; Taiwo *et al*., 2012; Muhammad *et al*., 2015).The knowledge is transferred from generation to generation through the word of mouth with great secrecy. This suggests documenting and conserving ethno-veterinary studies before it is lost. The documentation of traditional knowledge on medicinal uses of plants has provided many important drugs of modern day (Guerrini and Sacchetti, 2012). The aim of Ethno-veterinary is to study how and why people use and conceptualize plants in their local environments. Plant remedies are the most important in therapeutics to treat livestock disease through transferred knowledge of ethno-veterinary. Medicinal plants are declining to debilitation due to oral passage of herbal heritages verbally (Tadese and Dereje, 2015).

For more than many centuries, indigenous people of the world in different localities have developed their own specific knowledge on plant resource, use, management and conservation (Cotton, 1996).Therefore, one precondition for making ethno-veterinary work effective is to be aware of the range of methods and approaches and to be able to choose the most appropriate ones for the problem at hand. Equally one has to be aware of the work already done. But this is not an easy task due to its multidisciplinary nature, thus the approaches should focus on the active substances, a pharmacognostical, on the type of pathology to be treated, chemical

composition, a laboratory approach concerned with the isolation and identification of active principles (Mengistu, 2010).

For example, traditional healers and local farmer's (traditional health practitioners) have made remedies from plants that play an important role in treating both animals and human diseases. Ethno-veterinary medicine studies traditional knowledge, folk, believes, skills, methods and practices used for the treatment of livestock ailments (Tabuti *et a*l., 2003).

According to various studies traditional veterinary medicine is very important in developing countries where conventional remedies for animal health care are inaccessible or unaffordable to poor rural farmers (McGaw *et al*., 2007). About 80% of people in the world today rely on folk (or traditional) medicine for treating both human and animal diseases (Iqbal *et al*., 2003). According to the United Nations Food and Agricultural Organization (FAO), the lack of drugs to treat diseases and infections results in losses of 30–35% in the breeding sector of many developing countries including Ethiopia, where poor animal health remains the major constraint to increase production (FAO 2002). Additionally, problems of service delivery to such groups are often exacerbated by a multitude of other factors (Muhammad *et al*., 2005).

On the other hands, these factors have helped to maintain traditional treatment practices in these countries and fostered research on this subject (Muhammad *et al*., 2005). The extension of conventional medical/veterinary services is particularly difficult and expensive in developing world nations where the necessary infrastructure (roads, clinics, labs, cold chains, etc.) is poorly developed and where much of the people and its livestock reside in remote, rural areas or may be nomadic (McCorkle and Green, 1998).

Therefore, Ethiopia as it is the first known country in Africa with livestock production highly experienced in ethno-veterinary practices. In many native and local stock raising communities, if not all, a considerable proportion of useful ethno-knowledge and traditional animal health care practices remain unknown to date, albeit their increased demand to be integrated into primary animal health care delivery systems for a wider use by rural and per urban communities (Wanzala *et al*., 2005). Because traditional, native, medical practices have been in most cases either discontinued or greatly modified, there is much about them that will never be known (Lawrence, 1998).

In different area of the country, like other countries of the world animal species have been medicinally used by indigenous society for millennia and by descendants of the Africa country settlers for the last four centuries. In this region, especially in the semi-arid region, through the centuries, the local descendants of the country, learned to use the native natural resources, but also imported resources from the Old World to use in treating illnesses or infirmities in themselves and their livestock. Zoo therapies form an integral part of the local culture, and information about animals and their uses are passed from generation to generation through oral folk lore (Alves and Alves 2011, Alves *et al.,* 2009). Therefore the adaptation of the various human groups to the rich biological resources generated invaluable local knowledge systems that include extensive information on animal uses in general and medicinally useful species in particular (Alves and Rosa, 2007).The use of animals for medicinal purposes is part of a body of traditional knowledge that is increasingly becoming more relevant to discussions on conservation biology, public health policies, sustainable management of natural resources, biological prospect and patents (Alves and Rosa, 2005, Alves *et al*., 2010a, b, c, Souto *et al.,* 2009 *).*

2.3 The importance of plant species in ethno-veterinary medicine

Around the world in all countries there exists traditional knowledge related to the health of humans and animals. Accordingly in Africa, traditional healers and remedies made from plants play an important role in the health of a lot of people Rukangira, (2001) and animals, which is studied by ethno-veterinary medicine. Ethno-veterinary medicine studies traditional knowledge folk beliefs, skills, methods and practices used for the treatment of livestock ailments (Tabuti *et al*., 2003). It provides a lot of medicines which are cheap and locally available than pharmacotherapy. Farmers can prepare and use homemade remedies without an expenditure of energy and time (Yirga *et al*., 2012a).

Ethiopia is the country known with many nationalities and remarkably diverse flora, including numerous endemic species that are utilized in different traditional medical practices. As some study like Ngeh *et al*., (2007) indicated that, in Ethiopia, people have been using both plant and animal species for medication of different animal and human diseases over centuries when there was no modern health service delivery (Medicinal plants are the base for the development of new drug and the survival of human kind as well as other livestock).

On other hand different authors like, Miller, (1998) stated that medicines are extensively and safely used to alleviate various symptoms of diseases. As a result of this, in recent times the study focus on plant research has increased all over the world and there is widespread of belief that natural plant remedies are healthier and harmless than the synthetic ones (Murthy *et al.*, 2005). Plants are good sources for new, safe, biodegradable and renewable drugs however the use of plants as therapeutic agents in addition to being used as food is age long (Joy *et al*., 2012).

For centuries to treat a variety of people and animal diseases the medicinal plants that are recognized for their ability to produce a wealth of secondary metabolites and mankind has used many species (Kaur *et al*., 2013). These herbal medicines are prepared from a variety of plant materials such as leaves, stems, roots, barks, fruits, seeds, flowers and so on. Because they usually contain most of the biologically active ingredients and are used primarily for treating mild to chronic ailments (Guluma *et al*., 2017). Generally, plant remedies are still the most important and sometimes the only sources of therapeutics for nearly 80% of human and more than 90% in livestock population in Ethiopia. Estimated floras of 6500 to 7000 species of higher plants are medically important and out of these medically important 12% are endemic to Ethiopia.

2.4 Method of preparations and route of administration

The medicinal plants have several methods of traditional preparation for different types of ailments and they have various preparation forms like pounding, powdering, concoction, decoction, powder, crushed and homogenized in water, squeezed, smoked, extracted by boiling stem and enclosed in a piece of close. Concoction constituted the highest type of preparation form, followed by crushed and homogenized in water and powder form (Lulekal *et al*., 2008; Hailemariam *et al.*, 2009).

The majority of medicinal plant preparations are made from mixtures of different plant species with different additive substances like honey, sugar, teff powder, butter, soda ash, salt, ground honey, soil and charcoal ash for the treatment of single ailment. These additive substances have double function i.e to improve flavor and reduce adverse effects such as vomiting and diarrhea and enhance the efficacy and healing conditions. There are various routes of administration for the products of traditional medicinal plants prepared. The major routes of administration are oral,

dermal, nasal, anal, auricular and optical. Both oral and dermal routes permit rapid physiological reaction of the prepared medicines with the pathogens and increase its curative power (Endalew 2007).

2.4.1 Application

The prepared traditional medicines to treat the livestock disease in Ethiopia are applied in a number of methods. It includes drinking, put on, eating, painting, tied, washing, sniffing, smoking, swallowing and brushing. Internal ailments commonly treated by making the infected animal to drink herbal preparations and external parasite treated by painting herbal preparations on an infected area(Behailu, 2010).

2.5 The common disease of live stocks

Throughout the world there was different disease that attacks the health of livestock. However, the disease commonly known has been the same almost in all of the countries of the world. But, their prevalence is different based on the countries climatic conditions. Therefore, the rural people are forced to use traditional medicines for the treatment of their livestock.

The major livestock diseases reported include anthrax, black leg, lump skin disease, coccidiosis, eye diseases and ectodermicones, dermatophytosis, dermatophilosis, trypanosmosis, bovine pasterolosus, fasciolosis, actinobasilosis, mastitis, african horse sickness, strangles, glanders, fowl pox disease, babesiosis, botulisim, coli basilosis, ketosis, tetanus, foot and mouth diseases, contageus ectyoma, mite, tick infestation (personal communication with Metu district Veterinary Clinic experts).

3 METHODS

3.1 Description of the Study Area

The study was conducted in Metu rural district which is situated in the Ilu Aba Bor Zone Oromia Regional State, South west of Ethiopia. It occupies an area of approximately 736.4km^{2}and also the study district consists of 29 “Ganda”.The geographical location of the study area is approximately 8˚12'00"-8˚30'00"N latitude and 35°10'00" -35°40'00"E longitude in Metu District which begins around Metu town and far away until 22km from Metu town and 600 km away from the state capital city of the country, Addis Ababa in south west wards.

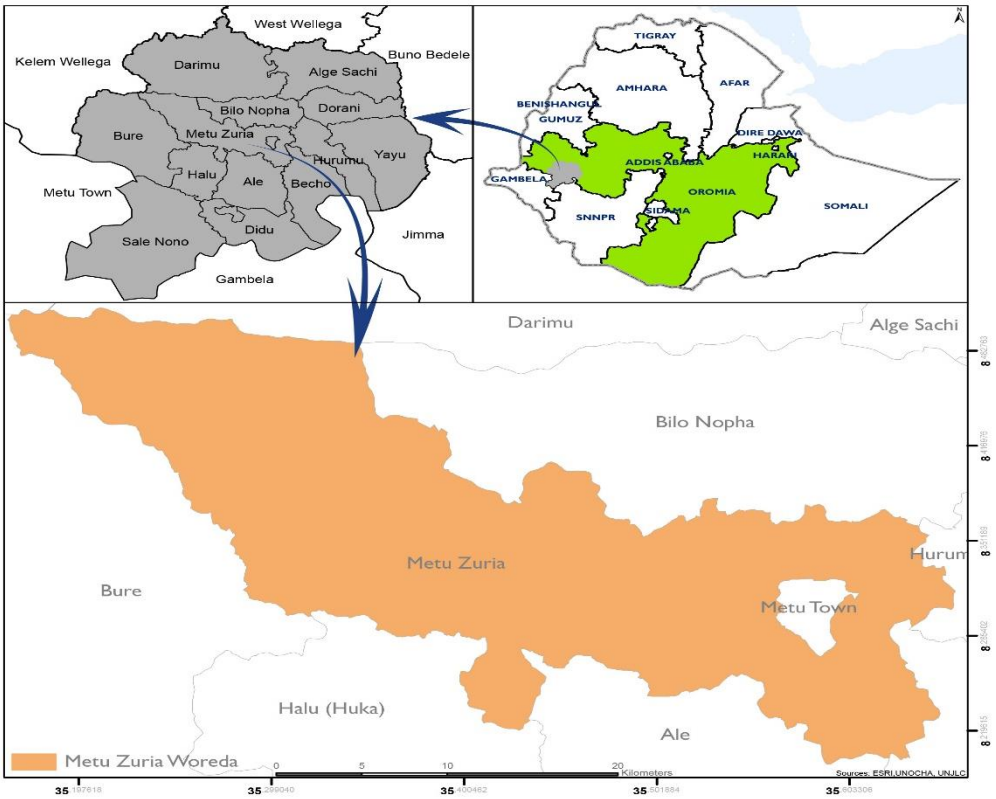

Figure 1: Map of study area of Mettu District (Source-CSA 2007)

Metu District is bordered in the north by Nopa District, south by Alle District, east by Hurumu District and west by Bure District of Oromia Region.

The temperature and rainfall data for this study obtained from Gore Meteorological Station (EMSA, 2018). This shows that the annual average temperature ranges from 17.6^{o}c-20.2^{o}c, while the annual mean rainfall ranges from 1427.5-1997.2 mm. and the altitude of the study area

ranges from 1500-2500 m.a.s.l. based on altitudinal variations, Metu District has two agro-climatic zones namely midland, and low land (MWCPANRO, 2019).

3.2 The study Population

The total population of Metu District was 60,646 of which 30,309 were males and 30,337 were females, based on information of past National census Agency (NCA) of Ethiopia reports (CSA, 2007). But the recent data shows that the total populations of the district are 91,045 of these, 50,849 are male and 40,119 are females (MWCPANRO, 2019). The target populations used in this study were selected from ten (10) "Ganda" residents of livestock owners and traditional healers. A total of ten(10) "Ganda" were selected from 29 "Ganda" in Metu district based mainly on gifted with diverse natural forest, grazing land, production of large number of livestock and the availability of traditional healers identified with the local elders and "Ganda" authorities (Appendix 5).

3.3 Methods

3.3.1 Reconnaissance survey and sampling site selection

A reconnaissance survey of the study area was conducted starting from September 2019 (one week before the actual data collection) in order to obtain an impression of the site conditions, to collect information on accessibility and to identify sampling design and to determine the number of study sites included.

3.3.2 Sampling design

3.3.3 Selection of informants

To investigate and document the indigenous knowledge of plants used in veterinary practices ten (10) "Ganda" were purposively selected from the total of twenty nine (29) "Ganda" based on the availability of traditional healers, presence of livestock owners, distant from livestock clinic station, availability of grazing land and information obtained from a reconnaissance survey was conducted by the investigator in Metu District, Ilu Aba Bor Zone. From the study population representative informants and knowledgeable traditional medicine practitioners were selected using purposive sampling approaches in the manner described by Martin, (1995) who stated that when recording indigenous knowledge controlled by ethno botanical healers or by certain social

groups, the choice of key informant is vital. For ethnobotanical data collection and the associated indigenous knowledge, ten (10) “Gandas” namely: Alga gosu, Agelo workayi, Agelo dheko, Alga guracha, Beroy gabisa, Beroy shonkora, Homadidu, Alebuya, Medalu and Tulube were purposively selected from 29 “Ganda”. Accordingly twelve (12) informants were selected from each “Ganda” including key informants so that, the total number of informants involved in the ethno medicinal survey were 120 informants (20 key informants and 100 general informants (75 men and 25 women). This is due to shortage of time; harvesting season of the farmers, unfavorable situation to contact all the people, financial shortage to distribute the questionnaires for more than informants, shortage of transportation to visit all the selected “Gandas” site so, that the researcher was used convenience sampling method. However the twenty (20) traditional key informants (healers) (15 males and 5 females) were selected purposively based on the recommendation from local elders, peer-recommendations from community members, knowledgeable inhabitants, veterinarians or governmental bodies of Mettu district. Whereas general informants were selected by convenience sampling from 4,882 households of total population of ten selected “Ganda” by choosing any confortable sample from each “Ganda” to see the general knowledge of medicinal plants in the people during visits to houses in the study “Ganda”. This is due to by tossing a coin and using him or her as informant whenever head of the coin is up.

3.3.4 Data collection

The data were collected from September 2019 to October 2019 through a combination of semi-structured and as open-ended interviews, to obtain indigenous knowledge of the local community. The collection of data is based on the information supplied by the healers during the interview. Specimens of plants that are used by the traditional healers for treatment of livestock ailments were collected. The specimens of plants were collected in the field using standard botanic methods together with the traditional healers, that including the vegetative parts and reproductive parts, such as leaves, and flower, fruiting and/or seed parts as it is appropriate for taxonomic identification. The medicinal plants were collected from the wild and home gardens based on the informant’s responses. For the collected plant specimens the necessary information was recorded. Preliminary identification is done at the site (field) and finally the collected voucher specimens coded, pressed, dried, and then were taken the

Herbarium of Jima university and identified using experts, flora of Eretria and Ethiopia volume 1-8 and taxonomic keys (Edwards *et al*., 2000; Hedberg *et al.*, 2006) and by making comparison with the already identified specimens that are deposited at the herbarium.

During collection of data information regarding traditional medicinal plant type from wild or home garden, diseases treated, habitat, parts used, condition of the plant used, method of preparation, dosage of the remedies, route of administration (application), ingredients added, their local names were recorded. Multipurpose role of some medicinal plants were also recorded.

Interviews and discussions were based on a checklist of questions prepared beforehand in English, and translated to "Afan Oromo". Preservation and threat status were recorded. Other additional relevant information was recorded by repeated inquiries at different times with the same informants to check the accuracy of information already collected.

3.4 Data analysis

To analyze the collected data MS Excel spread sheet were used to make simple calculations and to determine proportions and draw bar graphs, figures, tables and organized for statistical analysis. Data analysis were done using descriptive statistics to compute administration, dosage and plant habit with the number, percentage, and frequency of species, genera and families of ethno-veterinary medicinal plants, their growth forms, proportions of plant parts used, modes of remedy preparation and routes of administration to be used to determine correlation of medicinal plant knowledge with age range or education level of informants. The most useful information gathered on medicinal plants and associated knowledge reported by local people was statistically analyzed using the following methods:

3.4.1 Preference ranking and direct matrix ranking

Preferences of ethno-veterinary plant species used to treat the commonly reported livestock ailments in the study area were ranked by adding the values/scores of preferences given by respective informants so as to identify the most-preferred ethno-veterinary medicinal plant species to treat the most frequently reported disease type in the area. Direct matrix ranking exercises, were employed, following Martin (1995) and Alexiades (1996).

3.4.2 Pair -wise ranking

To understand the local people perception on activities threatening ethno-veterinary plants, pair wise ranking will be conducted and the number of possible pairs was calculated using the relation:

$$Y = N(N-1)/2$$ (Ertug, 2004)

Where 'Y', is the sum of all factors rated by respondents in each sites, 'N' is the number of factors (activities).

Accordingly, many threatening factors were identified by the community. The total number of factors was determined using the above formula and then the ten pairs were arranged and presented to the key informants to choose one from the two threats at a time. Then the score from each respondent summed up, the ranks determined and the factors that received the highest total score was ranked first (Kebu and Fassil, 2006).

3.4.3 Direct Matrix ranking

Direct matrix ranking will be done following Martin (1995) in order to compare multipurpose use of a given species and to relate this to the extent of its utilization versus its dominance. The use categories included were edibility, medicinal value, construction value, household use, agricultural tool, fuel wood, forage and fencing. Each key informant was asked to assign and give value about the importance and usefulness of each wild and home garden plant species on the basis of the following rating as 4= Excellent, 3= very good, 2= good, 1= least used, 0= not used

Accordingly, each key informant used such ratings to assign the multipurpose wild and home garden plant species in each category. The values given by the informants were averaged and the use and value of each plant species was ranked.

3.4.4 Informant Consensus factor (ICF)

Informant consensus factor (ICF) was computed to determine the most important livestock ailment categories in the District, and identify potentially effective ethno-veterinary medicinal plant species in the respective disease categories. Accordingly, reported traditional

remedies and corresponding diseases of livestock were grouped in categories. ICF was then obtained by computing number of use citations in each disease category (nur) minus the number of times a species used (nt), divided by the number of use citations in each category minus one ICF= nur- nt/ nur-1(Heinrich, 1998).

3.4.5 Index of fidelity level (FL)

The relative healing potential of each reported medicinal plant used against livestock ailments were evaluated using an index of fidelity level (FL) (Alexiades, 1996), given by FL=Ip/Iu X 100, where “Ip” is the number of informants who independently cited the importance of a species for treating a particular disease and “Iu” the total number of informants who reported the plant for any given disease.

3.5 Ethical consideration

Permission were first obtained from the district and Ganda administrative offices to conduct the study by showing the letter is written from the academic department of biology of Jima University and explaining the purpose of the study. In addition, Informed consent were obtained from each informant who participated in this study after explaining the purpose of the study and assuring them of the most responsible judicial use in the resulting information before the start of interviews.

4 RESULTS

4.1 Demographic Characteristic of the informants

A total of 120 informants (90 males and 30 females) were involved in the study. The age of the respondents was ranged in between 18 to 87 years and also their ages were grouped into young (18-35), adult (36-45) and elderly (above46). Most of the informants were elderly grouped which constitute 37 (37.83%) (Table1).

Even if, the general informants sampling techniques was random sampling techniques as a chance when the respondents grouped in their ethnic group all the informants belonged to the Oromo ethnic group (Table1). They spoke Afan Oromo language, the official working language of the Oromia Regional State. On the other hands, the experience of the participants concerning to this traditional ethno-veterinary medicine were varied from 5 to 65 years. Educational statuses of the respondents were included; illiterates, grade 1-4, grade 1-8 grade level 9-12, Diploma and Degree holders. Majority of the respondents were illiterates. (Table 1)

From the group interviewed the majority of informants were Protestant, proceed by Orthodox follower. The income of the respondents in the study area was mainly based on the cultivation of crops and livestock husbandry.

Table 1: Demographic Characteristics of participants

Variable	Categories	Count(number)	Percentage
Sex	Male	90	75
	Female	30	30
Age	18-35	27	22.50
	36-45	27	22.50
	46-55	29	34.16
	Above 56	37	30.83
Educational Status	Illiterate	32	26.66
	1-4	27	22.50
	5-8	28	23.33
	9-12	25	20.83
	Diploma and Degree	8	6.66

4.2 Medicinal plant species and Families frequently used in the study area

In this study, a total of 55 ethno-veterinary medicinal plant species were identified and recorded for treating 22 livestock ailments. These were distributed into 52 genera and 39 families (Appendix 1).

From the total recorded plants species, Family Fabaceae constitute 5 (five) species and *Solanaceae and Asteraceae* constitute 4 (four) species each followed by *Cucurbitaceae*, 3 species and four of the reported plant families that are *Ranunculaceae, Lamiaceae, Moraceae and Brassicaceae* were constitute 2 (two) species each have been frequently used and reported plant families and species for ethno-veterinary practices (Table 2) and the remaining 31 families represented by one species each. Many plants were mentioned against particular diseases, one plant species to one disease, and mixing of two or more different medicinal plants against a single disease was also commonly observed (Appendix 1).

Table 2: Medicinal plants family with two or more plant species in the study area.

Family name	No of plant species	% of plant species	No of plant genera	% of plant genera
Fabaceae	5	9.09	5	9.61
Solanaceae	4	7.27	4	7.69
Asteraceae	4	7.27	2	3.84
Cucurbitaceae	3	5.45	3	5.77
Ranunculaceae	2	3.63	2	3.84
Lamiaceae	2	3.63	2	3.84
Moraceae	2	3.63	1	1.92
Brassicaceae	2	3.63	2	3.84

4.2.1 Sources and habitat of ethno-veterinary medicinal plants

The sources and habitat of ethno-veterinary medicinal plants are wild, home garden and both wild and home garden. In the present study most of the ethno-veterinary medicinal plants data were collected from the wild (75%) followed by home garden as indicated below (Figure 2)

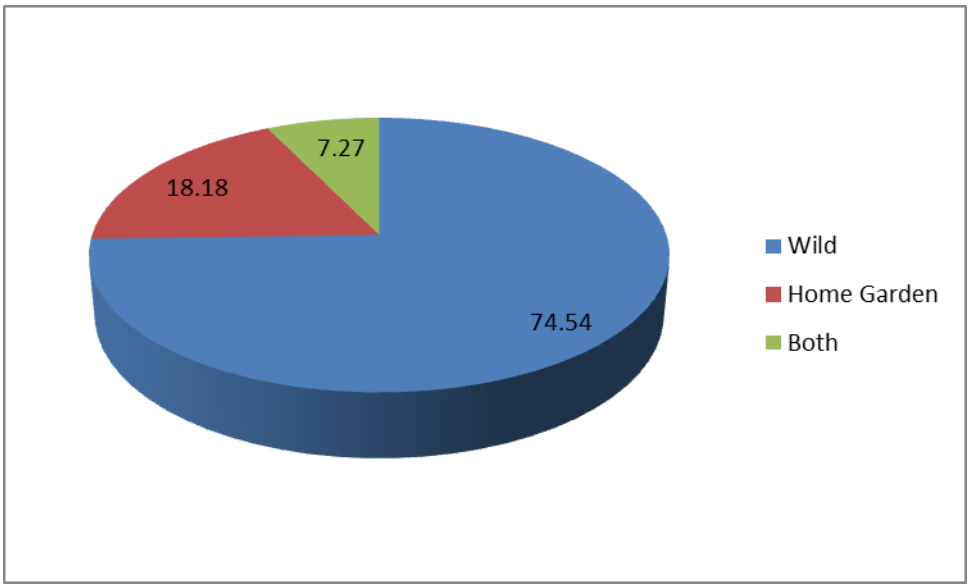

Figure 2: Sources of ethno-veterinary medicinal plants in Metu District.

4.2.2 Habit of the medicinal plants

The different habits of medicinal plants that are used for ethno-veterinary health problem are involved. In the current study the growth form of the medicinal plant species were represented by herbs, trees, shrubs and climbers. Among these the most widely used in the study area were herbs followed by trees as showed below (Figure 3).

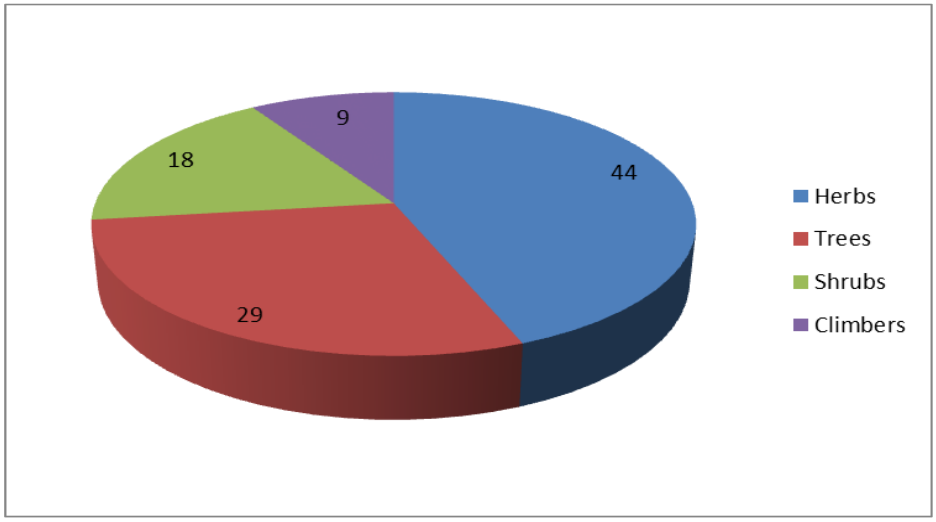

Figure 3: Proportions of Growth forms of medicinal plants identified for treatment of different livestock ailments in the study area.

4.2.3 Availability of Medicinal plants based on the season

As described in the study area availability of ethno-veterinary medicinal plants were determined by season; so many of the herbaceous plants were available seasonally which accounts 69.09% some of the plants were available all the time (21.81%), and the rest were difficult to get which constitute 7.27%.

4.2.4 Plant parts Used for medicine

According to the information obtained from the informants, people of the study area used different plant parts as a sole or in mixture for the preparation of traditional medicine. Different plant parts such as leaves, seeds, roots, bark and whole plant were used for treatment. Accordingly, the most plant parts used for medicine were Leaves alone 15 (27.27 %) followed by Root alone 10 (18.18%), bark alone 8 (14.54%), Seed alone 3 (5.43%), Fruit alone 3 (5.43%), Bulb alone 1(1.81%), Rhizome alone 1(1.81%), Whole parts used 2 (3.63%), Above ground used 1(1.81%) and Root-leaves mixed 7 (12.72%), Leaf-stem mixed 2 (3.63%), Leaf-bark mixed 1(1.81%) and Leaf-Fruit mixed 1(1.81%) (Figure4). During the utilization of these plant parts, a wide harvesting of leaves and seeds compared to roots, barks and whole plants which are important for survival of plants has a less negative impact on the survival and continuity of useful medicinal plants and hence does not affect sustainable utilization of the plants, but in this study area the roots, barks and whole plants were used for other purpose in addition to ethno-veterinary practice by the traditional healers and the residents. They also depend on medicinal plants for various purposes such as forage, firewood, spice, construction, agricultural tools and food which have the negative pressure on sustainability of the medicinal plants and climate change too.

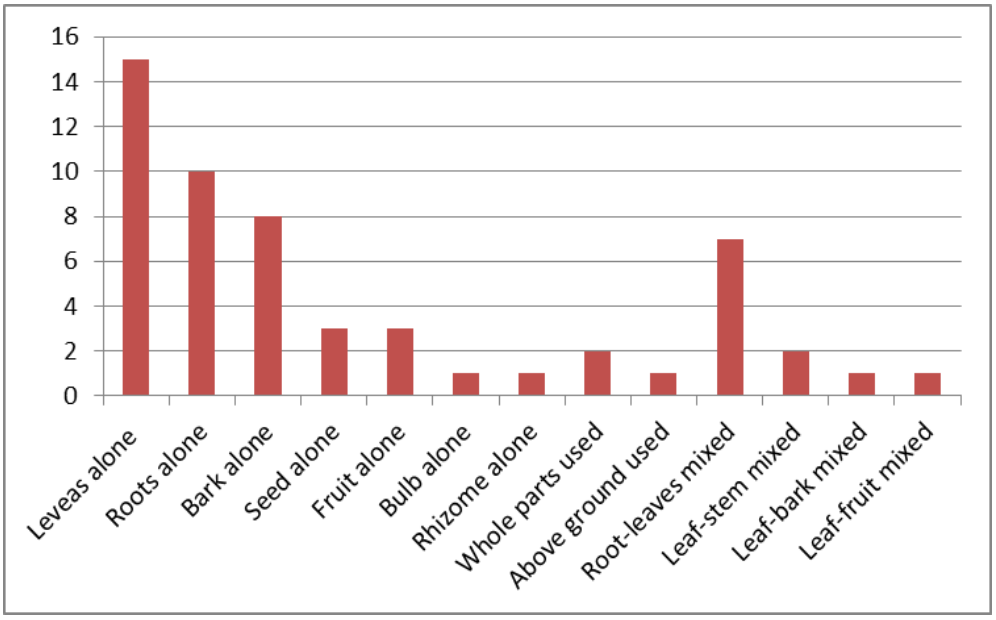

Figure 4 Proportions of parts of medicinal plants used to treat Livestock ailments

4.2.5 Modes of preparation of medicinal plants

The local people of the study area employed several methods of preparation of traditional medicines from plants such as pounding, crushing, squeezing, powdering, rubbing, burning, smoking and chewing. Pounding was the most frequently reported method of traditional medicine preparation and followed by crushing and powdering (Table 3). Based on the type and degree of complexity of livestock ailment there were various modes of remedy preparation reported to be used in the District. This may be believed that, its curative potential would increase due to the possibility of effective extraction of plant ingredients when crushed/powdered which increases the healing power of the remedy through faster physiological reaction.

Therefore, the way of preparations were either used fresh or can be stored in different clean and dry containers (e.g., old clothes, used up plastic bags or sealed bottles and different traditional containers such as: broken clay made containers,) to keep them for a long period of time to be used later when necessary. Accordingly, the way of preparations may involve using a single plant part or mixtures of different organs of the same plant or mixture of organs from different plants collected by different materials such as knife, axes, sickles, back-hoe, etc. Therefore, some of the mixtures they used were, salt, coffee residue, whey, maize flour,

wood ash, and some spicy plants such as ginger and garlic are some of the additives that the local people reported to use as additives.

Table 3: Methods of traditional medicinal plant preparation in the study area

Forms of preparation	Frequency of use	Percent
Pounding	42	76.36
Crushing	3	5.45
Powdering	3	5.45
Squeezing	2	3.63
Rubbing	2	3.63
Burning	1	1.81
Chewing	1	1.81
Smoking	1	1.81

4.2.6 Route of Administration and dosage determination in treatment of livestock

According to the current study traditional plant remedies were reported to be administered through oral, dermal, nasal or optical routes of the diseased animal. In the area the most route of administration was oral application which accounted 40 (72.72%) followed by dermal 7 (12.72%), oral and dermal 4 (7.27), optical 2 (3.63), nasal and oral or nasal 1(1.81%).

As the informants said both pounding and powdering are used as strategy to preserve the plant materials that are not available all seasons. Though, traditional practitioners often use any dry clean containers to preserve traditional medicines in herbal remedy preparation. According to the responses of the informants in the study District, the dose of remedies as well as frequency of administration varies depending on the age and size of animal treated. Relatively some amounts of plant remedies measured using cup, jug, bottle, plastic container, “qabe”, etc. and their own hands to squeeze the crushed medicinal plants and were given for different animals. In addition, some remedies were administered once, while others were given for three or five days.

4.3 Types of livestock diseases and traditionally used medicinal plant species

In this study, the informants reported that there are 22 livestock health defects. Each health problem could be treated using only one or more types of medicinal plant species (Table 3). Among the recorded health defects, 21(95.45%) were treated using two or more types of medicinal plant species in mixed form or separately while 1 (4.55%) were treated using only one species (Table 4). For instance, to treat '*lulluka*' or Black Leg the local people used 25 types of medicinal plant species. In the same way Trypanomoisis was treated by 24 types of plant species, Emaciation was treated by 17 types of plant species. External parasite, Fasciolosis, Brucellosis, Brucellosis, Keratoconjunctivities, Rabies viruses, FMD (foot mouth disease) were treated by 2 types of plant species each. To treat Coughing and Babesiosis the local people use nine and ten plant species respectively (Table4).This indicated that the accessibility of alternative sources of medicinal plant species to treat the same type of disease.

Table 2: The number of medicinal plants used to treat livestock diseases in the study area.

No	Livestock disease treated	Local Name	Number of plants used or frequency	Percent
1	Emaciation	Huqqina	17	30.90
2	Wound	Madaa dhaqnaa	6	10.90
3	Black Leg disease	Lullukaa	25	45.45
4	Trypanomoisis disease	Gandii	24	43.63
5	Mastitis	Harma jabaatu	3	5.45
6	Babesiosis	Dhukkuba dhiigafincofsisu	10	18.18
7	Mineral deficiency	Horii biyyoo nyaattu	8	14.54
8	Diarrhea	Albaatii	6	10.27
9	Internal parasite	Dhukkuba garaa keessaa ykn	15	27.27

		Raammoo garaa keessaa		
10	Coughing	Qufaa	9	16.36
11	Snake biting	Ciniinnaa bofaa	2	3.63
12	External parasite	Cinii	2	3.63
13	Fasciolosis	Baallee/qorqqaa	2	3.63
14	Brucellosis	Asaabala	2	3.63
15	Keratoconjunctivities	Dhukkuba Ijaa	2	3.63
16	Pasterilosis disease	Roqomsiisaa	7	12.72
17	Bloating	Garaa bokoksaa	8	14.54
18	Colic	Garaa ciniinnaa	5	9.09
19	Tick	Silmii	1	1.81
20	Rabies viruses	Dhukkuba saree maraattee	2	3.63
21	FMD(foot mouth disease)	Dhukkuba Qeensa horii gidduu madeesu	2	3.63
22	Coccidiosis	Dhukkuba dhiiga albaasu	3	5.45

4.4 Ranking of most important medicinal plants

4.4.1 Preference ranking of ethno-veterinary plants

When there are different species given for the same health problem, people show preference of one over the other. In this study preference ranking exercise with 10 of the key informants for medicinal plants that were reported to be used against Black Leg disease, the most commonly reported livestock disease under the gastro-intestinal disease category, showed that *Cyphostemma cyphopetalum(frese)* and *Echinops kebericho* were most-preferred plant species for the management of the reported disease, Black Leg disease (Table 5).

Table 3: Results of preference ranking of medicinal plants reported for treating livestock Black Leg disease

Medicinal plants	Informants Labeled A to J											
	A	B	C	D	E	F	G	H	I	J	Total Score	Rank
Thalictrumrhynchocarpum	7	8	9	9	10	8	7	8	8	9	83	3rd
Plectranthus longipes	6	7	7	6	5	7	8	7	7	6	66	8th
Clerodenderum myricoides	7	6	5	4	6	5	6	7	6	7	59	9th
Echinops kebericho	8	9	10	9	10	8	8	9	9	10	90	2nd
Echinops longifolius	7	7	6	7	7	8	10	9	6	5	72	7th
Ipatiens tinctoria	7	8	9	9	7	9	10	6	7	8	80	4th
Trichilia dregeana	4	5	6	5	4	5	3	5	6	7	50	10th
Asparagus africanus	6	7	8	9	8	10	9	7	7	8	79	5th
Croton macrostachys	7	6	7	8	8	9	10	6	7	7	75	6th
Cyphostemma cyphopetalum	10	10	10	9	10	9	8	10	9	10	95	1st

N:B-Scores in the table indicate ranks given to medicinal plants based on their efficacy. Highest number 10 for the medicinal plant which informants thought was most effective in treating Black Leg disease and the lowest number (1) for the least-effective plant.

4.4.2 Pair wise ranking or Factors threatening to Medicinal plants

In Metu district, comparison of six threatening factors of medicinal plants was conducted using 10 key informants. The results in this study indicated that charcoal making stood first, followed by Agricultural expansion, construction and tools, firewood collection, grazing and deforestation. These are a few management problems of plant resources in the area.

Table 6: Paired comparison for factors affecting medicinal plants in the study area

Preferred Item/Factors	Deforestation	Agricultural expansion	Over grazing	Construction and tools making	Charcoal making	Fire wood collection
Deforestation	-------	Aex	Def	Ctm	Chm	Fwc
Agricultural expansion	Aex	-------	Aex	Aex	Chm	Aex
Over grazing	Ovg	Aex	------	Ctm	Chm	Fwc
Construction and tools making	Ctm	Aex	Ctm	-------	Chm	Ctm
Charcoal making	Chm	Chm	Ovg	Chm	----	Chm
Fire wood collection	Fwm	Fwm	Fwm	Ctm	Chm	------
Frequency	1	7	2	6	9	5
Rank	6	2	5	3	1	4

KEY: Chm=Charcoal making , Axe= Agricultural expansion, Ctm= Construction tools making

Fwc= Fire wood collection, Ovg= Overgrazing and Def=Deforestation.

4.4.3 Direct matrix ranking

In the study area, many of the ethno-veterinary medicinal plants were utilized for multiple purposes in addition to their medicinal values. The major uses include medicine, fencing, fire wood, charcoal and construction. Five commonly used or reported multipurpose species and five use categories were involved in direct matrix ranking exercises in order to evaluate their relative importance to the local people (Table 7).

As shown in Table 7, *Pittosporum viridiflorum* and *Albizia gummifera* were ranked 1st and 2nd and hence are the most preferred medicinal plants by local people for various uses.

Table 7: Direct matrix analysis of selected medicinal plants based on five use categories.

Use value (key: 5= best, 4= very good, 3= good, 2= less used Use category (FWD = firewood, CHAR = charcoal, CONS = construction, FEN = fence, MED = medicine.

Use categories	Medicinal Plant Species																			
	Albizia gummifera				*Ehretia cymosa*				*Pittosporum viridiflorum*				*Bersema abysinica*				*Croton macrostachyus*			
	Informants (A-D)				Informants				Informants				Informants				Informants			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
MED	3	2	4	4	3	5	3	2	4	4	5	3	3	2	2	2	3	4	2	3
FEN	3	4	5	3	4	4	3	4	5	3	4	3	4	2	2	2	4	3	2	4
FWD	4	5	3	3	4	3	5	3	5	5	4	4	4	4	3	3	3	4	4	4
CHAR	4	3	5	3	4	4	4	4	4	5	4	5	5	3	4	4	4	2	3	4
CONS	5	4	4	3	3	2	4	3	5	5	5	4	2	3	2	2	2	2	3	2
Individual total	19	18	21	16	18	18	19	16	23	22	22	19	18	14	13	13	16	15	14	17
Total	74				71				86				60				62			
Rank	2				3				1				5				4			

4.4.4 Informant consensus factor or Test of efficacy of ethno-veterinary Medicinal plants

From the Livestock diseases which are thought to be cured by the ethno-veterinary practitioners eleven major livestock diseases were identified and grouped into 22 veterinary diseases in Mettu District.. The Highest Informants' Consensus Factor (ICF) values were obtained for Kerato-conjunctivities (0.93), External parasite (0.92), Rabies viruses (0.83), Diarrhea (0.81), Wound (0.77), Colic (0.63), Trypanomoisis (0.60) and Black Leg disease (0.55) categories (Table 8). In addition, highest plant use citation 62 (51.66) was recorded for Black Leg disease (Table 8).

Table 8: ICF values of traditional medicinal plants for treating livestock ailments in Metu District

No	Disease category	Number of plant species/nt	% of all species	Number of informant cited/nur	% of all use citations	ICF
1	Keratoconjunctivities	3	5.45	30	25	0.93
2	External parasite	2	3.63	14	11.66	0.92
3	Rabies viruses	2	3.63	7	5.83	0.83
4	Diarrhea	3	5.45	12	10	0.81
5	Wound	6	10.90	23	19.16	0.77
6	Colic	5	9.09	12	10	0.63
7	Blackleg disease	25	45.45	62	51.66	0.60
8	Trypanomoisis Disease	24	43.63	53	44.16	o.55
9	Mineral deficiency	8	14.54	12	10	0.36
10	Babesiosis	10	18.18	12	10	0.18
11	Bloating	8	14.54	9	7.5	0.12

Note: ICF = nUr – nt/nUr-1 where nUr is number of use reports from the informants while nt is the total number of medicinal plants used.

ICF=Informant consensus factor

4.4.5 Fidelity level of medicinal plants or Relative healing potential of medicinal plants

FL is an important means to see for which ailment particular plant species is more effective; accordingly *Calpurnia aurea* (Aiton) Benth. Showed highest fidelity level value (100%) for External parasite disease category followed by *Phytolacea dodecandra* (37.5%). Under the internal parasite therapeutic category, highest fidelity level value was recorded for *Justicia schimperiana* (100%) *Brucea antidysenterica* (100%) has also showed relatively high healing potential record under Brucellosis disease category. Accordingly for the other some disease category collected in the study area, the highest and lowest fidelity level value were recorded as shown in the table (Table 9).

Table 9: Fidelity level values of medicinal plants commonly reported against a given veterinary Ailment category.

No	Medicinal plant	Therapeutic category	IP*	IU*	FL* Value%
1	*Calpurnia aurea*	External parasite	13	13	100
2	*Phytolacea dodecandra*	External parasite	3	8	37.5
3	*Brucea antidysenterica*	Brucellosis	3	3	100
4	*Justicia schimperiana*	Bloating	3	3	100
5	*Croton macrostachyus*	Bloating	3	10	30
6	*Solanum dasyphyllum*	Internal parasite	3	5	60
7	*Ipatiens tinctoria*	Internal parasite	5	10	50
8	*Plectranthus longipes*	Black Leg disease	3	3	100
9	*Lepidium stivum*	Black Leg disease	13	26	50
10	*Phytolacea dodecandra*	Couphing	5	5	100
11	*Thalictrum rhynchocarpum*	Couphing	16	42	38.09
12	*Vernonia auriculifera*	Wound	3	5	60
13	*Achyranthes aspera*	Babesiosis	3	3	100
14	*Trichilia dregeana*	Babesiosis	3	5	60
15	*Brassica carinata*	Colic	3	5	60
16	*Zinjiber officinale*	Colic	3	10	30
17	*Bersema abysinica*	Emaciation	5	5	100
18	*Asparagus africanus*	Emaciation	13	18	72.2
19	*Albizia gummifera*	Trypanomoisis disease	15	15	100
20	*Cyphostemma cyphopetalum*	Trypanomoisis disease	10	15	66.67

FL= Fidelity Level, Ip = number of informants who independently cited the importance of a species for treating a particular disease, Iu* = total number of informants who reported the plant for any given disease.

4.5 Indigenous knowledge transfer

In the study area the major ways in which the people of the district transfer their indigenous knowledge from generation to generation on types of medicinal plants, traditional concepts of illnesses, methods of diagnosis and treatment among traditional healers of Metu District was by word of mouth to a family member, especially to an elder son. Such knowledge is kept secretly as it is passed only within the same family circle follows vertical manner. However, none of the participants had any written documents on traditional medicine, whereas all healers reported that they had received the knowledge from their parents, grandparents or someone in the family circle orally and through observation based practice, in turn sharing it to their children in a similar manner. But few individuals can show and tell others outside their family members if they have close relationship. As most of the informants said that the age at which this knowledge transferred to the others was usually at old age. On the other hands according to some traditional healers believe the medicine does not work if it is being told to everyone and sold to others.

4.6 Threats to Medicinal Plants

People use various wild species of plants for food, medicine, clothing, shelter, fuel, fiber, income generation and the fulfilling of cultural and spiritual needs throughout the world (Zemede, 2001). In Mettu district as the information collected from the informants, various causes were recorded as the main threats for medicinal plants in the area. The study indicated that there were loss of plants as a result of agricultural expansion (coffee planting), firewood, charcoal, timber, construction material, reduction of plants which are not suitable for coffee shade and urbanization were the main contributing factors for the loss of plant species in general and medicinal plants in particular in the study area. In addition, improper use of resources such as harvesting the whole part even for the need of a single part of a medicinal plant could be a considerable threat to medicinal plants.

4.7 Medicinal Plant Conservation Efforts of the Local People

People of the study area conserve the local vegetation not only to meet their fodder, fruits, construction, fuel wood, commercial values, cultural and spiritual needs but also for their medicinal contribution, as the knowledge is with them. As some of the informants in the study area reported that most of them had awareness of the importance of conserving medicinal

plant species and some of them were practicing some conservation activities like cultivation in home gardens, jump over rarely obtained medicinal plants while they were plough their lands and while they were cutting down some plants. The majority of the informants were not practicing any conservation effort. They simply went to the wild to collect medicinal plants as they need and did not mind about the long term survival of these plants

5 DISCUSSIONS

Traditional healers involved in the current study were well known in treating many illnesses with homemade remedies from local medicinal plant species which agrees with the finding of Yineger *et al*., 2008. Majority of the respondents were older than 45 years indicating they have better traditional knowledge in treating livestock illnesses in terms of number of medicinal plants cited, number of use citations, method of collection, method of preparation and remedy administration. In the other hands less medicinal knowledge exists in relation to young age which probably indicates the fact that traditional knowledge was developed through years of experience. In addition, the efficacy of the remedies prepared by these experienced ethno-veterinary practitioners was by far better than the younger ones. This report is in line with different findings documented in different parts of Ethiopia (Araya *et al*., 2015; Gidey *et al*., 2003; Balemie *et al*., 2003; Gidey *et al*., 2009).

In this study the majority of males (75%) and some females (25%) of medicinal plant practitioners were selected. The reason why greater numbers of traditional practitioner were male are the local tradition of restricting such practices mostly to males whereas females were not allowed much to be involved in outdoor activities and but remain home as they look after babies and carry out home activities like cooking food , etc. Other ethno-veterinary studies conducted in other parts of Ethiopia for example in Medebay-Zana District, Northern Ethiopia by Yirga *et al., (*2012) and in four districts of Jimma zone by Yigezu *et al*., (2014) come up with similar conclusion. It was also observed that females' knowledge in medicinal plants is by far limited to plants, which are found in domestic environments like *Allium sativum, Zinjiber officinale, Brassica carinata, Lepidium stivum, Carica papaya, Echinops kebericho and Pisum stivum*.

In comparison of educational status, non-educated and low grade level informants have much knowledge of traditional medicine whereas educated or higher grade level informants had low knowledge of traditional medicine, which is an indicative of impact of modern education regarding to the indigenous knowledge of medicinal plants (Yigezu *et al*., 2014).

Plants have played a great role in fighting many ailments in human and livestock in many indigenous communities of Ethiopia. Even though the fact that ethno-veterinary medicine has been very important for the animal health care of most developing countries it has not yet

been well documented and much effort is needed in research and integration activities in these countries. Therefore, traditional medicine is the primary health care system of resource poor communities (WHO, 2001). People prefer traditional medicine to modern medication because of economic reason, and inaccessibility to modern medication (WHO, 2002).

However, Plants consists the largest component of the different therapeutic elements for traditional livestock healthcare practices.

In general, the present study documented 55 ethno-veterinary medicinal plant species belonging to 39 families which were identified and documented with details of their local name, family name, scientific name, habit, plant part used, their traditional preparation, route of administration and mode of application and habitat were they collected and documented (Table 3).

According to this study, Fabaceae 5 (9.09%), Solanaceae and Asteraceae 4 (7.27%) each and *Cucurbitaceae* 3 (5.45%) were the most dominant families of herbal remedies identified in the study area. This also indicates that the area consisted of considerable diversity of plant species. This finding is consistent with Yibrah, (2014*)* who conducted and reported Solanaceae (11.76%), Fabaceae (9.80%), Asteraceae (9.80%), Lobeliaceae (7.84%), Lamiaceae (7.84%) and Euphorbiaceae (7.84%) on ethno-veterinary botanical survey of medicinal plants in Kochore district of Gedeo Zone, Southern Nations Nationalities and Peoples Regional State (SNNPRs).

The majority of the reported medicinal plant species were collected from wild. This is because there was no strong tradition or observed practice by the local people to cultivate medicinal plants in their home garden. The ethno-veterinary medicinal plants were harvested and processed only when the need arose. Therefore such dependence on the wild habitats has a long-term negative effect on the conservation statuses of medicinal plants. Traditional medicinal plants are harvested mostly from wild stands which are in line with study of (Giday *et al.*, 2009) in the Meinit ethnic group of Ethiopia. Encouraging people to grow medicinal plants in the home gardens, mixing with crops in farmlands and live fences is important.

All plant growth forms were not equally used as remedies, because of the difference in distribution among the growth forms. This leads to the wide use of herbs and shrubs for their

medicine. In this study the habit of the medicinal plants recorded indicated that most of them were herbs (43.63%) followed by trees (29.09%), shrubs (18.18%) and climbers (9.09%).

The dominance of herbs is due to easy availability to local people and their abundance in the area. This finding is in line with most medicinal plant inventories done by Debela,(2001) on Indigenous People of Boosat Woreda, Wolenchiti Area; by Lulekal,(2005) in the Manna Angatu Moist Montane Forest, Bale and by Endalew, (2007) in Indigenous people of Ejaji area (Chalya Wereda) West Show, in which herbs are the dominant growth forms of medicinal plants.

In contrast, other studies documented shrubs and trees as the most frequently used life forms in ethno-veterinary practices conducted by Giday (2013) in Afar people of Ada'ar District, Afar Regional State, by Lulekal *et al*.,(2014) in Ankober District, North Shewa Zone, Amhara Region; by Albie and Mehamed (2016) in Jigjiga town, and by Yigezu *et al*.,(2014) in four districts of Jimma zone.

The existence of some plants particularly the medicinal plants were affected by season. Accordingly, in this study many of the plants were available seasonaly (69.09%), some are available all the time (21.81%), and the rest, difficulty to get (7.27%) as described in the study area. This seasonal availability of medicinal plants may have potential factors contributed for declining utilization of homemade remedies of the study areas. This finding was consistent with the finding of Taddesse and Dereje (2015) which reported many of the plants were available all the time (78.4%), some are available seasonally (15.7%), and the rest difficulty to get (5.9%) as described at selected Horro Guduru District, Western Ethiopia. Similarly, modernization of the young generation, availability of modern drugs, and expansion of lands for farming was potential factors contributed for declining utilization of homemade remedies in the study area.

Regarding to the plant parts used for ethno-veterinary medicinal purposes, different plant parts like leaves, seeds, roots, bark and whole plant were used for treatment. However, people of the study area were used plant parts as a single or in mixture for the preparation of traditional medicine. In this current study, the part of the medicinal plant which was highly used for the preparation of the remedies were leaves (23.63%) followed by roots (18.18%), this might be

associated with traditional beliefs, about a powerful therapeutics effect or anti illness effects of leafs and root parts for treating various ailments.

This study was agreed with the studies conducted in other parts of Ethiopia conducted by Giday and Ameni (2003) in two Districts of southern Tigray, by Mesfin, (2007) in Ada'ar District, Afar Regional state and by Giday and Teklehaymanot (2013) and Yirga *et al*. (2012) in Medebay-Zana District, Northern Ethiopia which indicated that leaves were the most frequently used plant part to treat livestock ailments.

In this study the majority of plant parts used as remedies to treat livestock ailments were leaves. This is in line with the studies conducted by (Poffenberger *et al*., 1992). This indicated that collection of leaves for traditional remedies poses no major threat to the survival of plants in comparison with other parts; such as roots, stem, bark and whole plant. In contrast other studies conducted in different parts of the country, roots were as the most frequently used parts in ethno-veterinary practices (Birhan *et al*., 2018).

Most of the ethno-veterinary practitioners in the study District prefer fresh plant (73.68%) materials to prepare effective and efficient remedies. This was agreed with other findings that were documented in different parts of Ethiopia (Chekole *et al*., 2015; Mekuanent *et al*., 2015). According to these study the use of fresh plant materials for remedy preparations is considered as most of the bioactive chemicals are retained in fresh plant materials as compared to dry ones. In preparation of medicine for livestock, the healers have been using various methods of preparation of traditional medicines for different types of ailments. The preparations differ based on the type of disease treated and the actual site of the ailment. Grinding or crushing and soaking or boiling different parts of plants are common methods for drug extraction (Deeba, 2009).

The principal methods of remedy preparation from the plant parts were reported to be through pounding which accounted for 76.36% followed by Crushing, powdering (5.45% each) and Squeezing (3.63%). In this study, majority (98.18%) of traditional remedies were prepared using the mixture of the medicinal plants. In most cases, traditional plant remedies were prepared by pounding the remedial plant part and mixing it with water at room temperature. This is in line

with the report of other studies conducted by (Tamiru *et al*., (2013) in Dabo Hana District, West Ethiopia and Lulekal *et al*., (2008) at Mana Angetu District, southwestern Ethiopia.

Based on the information gathered from the respondents especially from those who are highly accepted by the society for their ability in healing different health problems (key informants), most of the remedies preparation condition was fresh followed by fresh or dry.

Majority (98%) of these preparations are done from mixtures of different plant species with different additive substances like salt, coffee residue, whey, maize flour, wood ash, and some spicy plants such as ginger and garlic. Similar result was also reported by Gidey (1999; Tamene, (2000) at Semi-wet land of Cheffa Area, South Wello, Ethiopia and by Mesfin,(2007) in Wonago Woreda, SNNPR, Ethiopia. They identified the additive substances in herbal remedy preparations with their possible benefits.

The medicinal plants were applied through different routes of administration like oral, dermal, oral and dermal, optical, nasal and oral or nasal routes (figure 6). Oral application was the highest and most commonly used route of application followed by dermal which were also reported by Dawit and Ayehu (1993) to indicate oral as the main route of application used. This is probably due to oral routes allowed rapid physiological reaction of the prepared medicines with the pathogens and increases its curative power (Mesfin, 2007). But the dosage determination was the big problem in the study area because there is no standardized known unit of measurements of the plant remedies. Inconsistencies of doses have also been reported in similar studies conducted elsewhere in the country (Giday and Teklehaymanot, 2013).

However, the dosage was determined by using different container which is made from different materials and their own hands. The dosage management is generally dependent on the severity and duration of the diseases, age and body size conditions of the animal. This agrees with report of ethno medicinal plant knowledge and practice by Abera (2014) from Gimbi district, southwestern Ethiopia.

A total of 22 livestock ailments were identified that are treated by traditional medicinal plants in the area. In this study Combination of different medicinal plants was used to heal various

diseases. Common diseases affecting livestock health's in the study area were Black leg which were treated by 25 species, Trypanomoisis by 24 species, Emaciation by17, internal parasite by 15, Babesiosis by10, Coughing by 9, both Mineral deficiency and Bloating by 8, Pasterilosis by 7, again both Mastitis and Coccidiosis by 3, Snake biting, External parasite, Fasciolosis, Brucellosis, Keratoconjunctivities and FMD (foot mouth disease) were treated by 2 species each (Table 5). This showed that some livestock ailments have opportunities to be treated by more plant species in the study districts. This finding was agreed with the work of Endalew Amenu (2007) worked in Ejaji Area West Shewa, Ethiopia, that reported 27 livestock problems).

The type and number of medicinal plant species used to treat each livestock ailments also varied from ailments to ailments for example as wound, cough, diarrhea and rabies were treated by the various plant species in Metu Districts respectively.

In Mettu District 22 different livestock diseases were reported. Similar results were reported in Ethiopia from selected four Districts of Jimma Zone, by Yigezu *et al*., (2014) and in Ankober District North Shewa Zone by Lulekal *et al*.,(2014) which were documented 74 and 51 medicinal plant species for treating 22 and 33 livestock ailments respectively. These findings clearly indicate the importance of plant based ethno-veterinary remedies in the management of livestock disease in different regions of Ethiopia. One or more of the plant species identified in this study were also reported from other parts of Ethiopia (Sori *et al*., 2004; Lulekal *et al*., 2008; Yirga *et al*., 2012a).

In the study area the medicinal plants that are preferred more by the local people were showed by ranking of medicinal plants. This indicated that local people obtain the knowledge through experience and could identify medicinal plants that are effective for treatment of their livestock ailments. Medicinal plants used to treat Black Leg disease; *Cyphostemma cyphopetalum (frese)* stood first and hence is the most effective medicinal plant to cure Black Leg disease followed by *Echinops kebericho*. In the study area, a number of medicinal plants were found to be multipurpose species being utilized for a variety of uses. Direct matrix ranking showed that, of the total medicinal plants *Pittosporum viridiflorum Sims* is the most multipurpose medicinal plant followed by *Albizia gummifera*. This disagrees with the finding of Amsalu (2007) which reported *Croton macrostachyus* as highest and *Eucalyptus globulus* the second

multipurpose in Farta District South Gonder Zone of Amhara Regional State. However, the study by Megersa (2010) reported that *Croton macrostachyus* as third multipurpose medicinal plant in Wayu Tuka District, East Wollaga Zone of Oromia Regional State (Netsanet, 2017).

Traditional practitioners, particularly medicinal plant herbalists have a detailed knowledge-base of traditional medicine in our country. But the knowledge is passed orally from one generation to the next through professional healers, knowledgeable elders and/or ordinary people (Jansen, 1981). The present study indicated that vertical transfer of ethno-veterinary knowledge to the most selected family member and few individuals outside the family members orally with great secrecy. Even though the informants participated in this study had acquired knowledge and practice with great secret, most of them have willingness to transfer the knowledge to others, which indicated the knowledge of traditional medicine as professional secret which also agree with the finding of Yirga *et al*., 2012a. According to Khan *et al*., (2012) traditional veterinary knowledge like all other traditional knowledge systems was transferred orally from generation to generation and it may disappear, because of rapid human population, environmental and technological changes which was also the case in Metu district. A rich wealth of indigenous medicinal plants use and knowledge was also recognized. However, the knowledge and use of these plants were not documented; they are only transmitted from generation to generation orally. According to Alcorn (1984), indigenous knowledge develops and changes with time and place. The knowledge on the type, part used, dosage, administration of the medicinal plants is circulating only among traditional practitioners of traditional medicine based on the severity of diseases (Tadese *et al*., 2014).

In this study as the information gathered from the informants indicated that the threats of medicinal plants increased from time to time. The charcoal production was the major medicinal plant threats followed by agricultural expansion. This might be due to continuous agricultural expansions, charcoal production for different purposes in addition to lack of attention towards the medicinal plants. Additionally environmental degradation, cultivation of marginal lands and urbanization were also reported from different areas as the factors causing a great threat, for immediate disappearance of the knowledge which agrees with the findings of (Gradé *et al*., 2009) .

Additionally the harvest involving roots, rhizomes, bulb, bark and stem have a serious threat on the survival of the mother plant in its habitat. Thus the frequent collection of fresh plant materials in dry season has a strong influence on the conservation statuses of medicinal plants.

However, according to the study of Dawit and Ahadu, (1993) herbal preparation that involves roots, rhizomes, bulbs, barks, stems or whole parts have negative effects on the survival of the mother plants. In this regard, the present study indicated that root was the second commonly utilized part of the medicinal plant, which shows the presence of high risk on the survival of those reported plants in the study area.

Even though various threats have a very deep effect on medicinal plants, the effort of local people to grow medicinal plants actually in home garden is very less. So that some people and the District Agricultural Office have started conserving the plants by in-situ method (in their natural habitat), live fences, road sides, different places of worship (churches and mosques), in their farm fields or farm margins. Some local people are also conserving medicinal plants by ex-situ method by planting them in their home gardens. As reported by Moa Megersa (2010), home gardens are central target for in-situ and ex-situ conservation of traditional medicinal plants.

6 CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

In this study area 55 plant species which are grouped into 39 families of ethno-veterinary medicinal plants were identified and recorded that have been used to treat 22 types of livestock diseases in the study District.

The present study was conducted to document veterinary traditional medicinal plants as well as indigenous ethno-veterinary knowledge and practices of communities in Metu District. The study area was still rich in ethno-veterinary medicinal plants and indigenous knowledge associated with each traditionally used plant species. The plants were mainly collected from the wild by the help of traditional health practitioners. The knowledge is passed from generation to generation in an oral manner. Therefore without being properly documented this information could easily be lost or distorted. According to this study the majorities of medicinal plant remedies were prepared from fresh plant materials and some from fresh or dried plant materials. Additionally from the different growth forms of the plant, herbs are highly utilized than shrubs, trees and climbers. However, different parts of the plant were involved for preparation of ethno-veterinary remedies from these leaves are used more than other plant parts followed by roots and various method of remedy preparation mainly through pounding followed by crushing and powdering.

Most of the medicinal plants are administered orally. This finding shows that there is lack of standardized measurements in the determination of doses in the study area since there were variations in the units of measurement and the quantity of plant parts used. Hence, the precision and standardization of dosage could be one of the problems for the recognition of the traditional health care system.

The major threats to medicinal plants and the associated knowledge in the study area are agricultural expansion, firewood collection, charcoal production; uses of plants for construction, for furniture making and also unwillingness of young generation to gain the ethno-veterinary knowledge that are underestimated due to modern education and oral acquisition and transfer of the knowledge were reported as the threat by the local people.

Therefore, awareness creation efforts are needed to increase the local community's knowledge on the importance and conservation of medicinal plants and also awareness rising should be made among the healers (practitioners) to ensure the sustainable use of the indigenous knowledge.

6.2 RECOMMENDATION

Based on the above conclusions the following Recommendations are forwarded:

- Still the area is wealthy in natural forest so that; further ethno-botanical studies should also be conducted on the reported medicinal plant and the other plant species of the study area so as to utilize them in drug development.
- Thus attention should be given to the medicinal plants and seasonally available medicinal plants those having importance to societal need.
- Further investigation is needed to determine safety, toxicity and dosage of that used for ethno-veterinary medicinal plants.
- Planting of multipurpose and rarely available plants is beneficial.
- Government and local community should give more attention to conserve medicinally important plants.
- Agricultural expansion, firewood collection, illegal charcoal production and timber production should be minimized by searching the other option for the local community.
- Wild Medicinal plants should be domesticated around home garden and in live fence.
- Ethno-veterinary knowledge should be documented on regular basis rather than being transmitting through oral tradition
- Awareness raising should be made among the healers to ensure the sustainable use of traditional medicinal plants and the associated indigenous knowledge.
- The government should identify and organize those individuals with indigenous knowledge and their knowledge should be used for the country's development.
- Encourage the local medicinal practitioners to promote the use of traditional medicinal plants by giving recognition.

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APPENDICES

Appendix 1: List of ethno-veterinary medicinal plants used for treating livestock diseases.

Code	Plants Local name	Scientific name	Family name	Habita T	Habit	Parts used	Livestock disease	Mode of preparation	Route of Administration
BM31	Maxxannee	*Achyranthes aspera*	*Amaranthaceae*	W	H	WPs	6,22	Pounding dissolved in water then drenching	Oral
BM24	Ambabbeessa	*Albizia gummifera* (J.F. Gmel). C.A. Sm.	*Fabaceae*	W	T	B	1,3,4,6,7	Pounding dissolved in water and then drink	Oral
BM32	Qullubbiiadii	*Allium sativum L.*	*Alliaceae*	HG	H	Bul	9,10,18	pounding mix with water then drenching	Oral
BM14	Gur-sadee	*Allophylus macrobotrys* Gilg	*Sapindaceae*	W	Sh	L&St	1,4,9	Squeeze with residue and then gave it	Oral
BM38	Reetii	*Aloe barbadensis* Miller	*Aloaceae*	W	H	L	4, 11, 18	Pounding and drink the juice	Oral
BM52	Qicuu	*Amorphophallus abyssinicus* (A. Rich.) N.E. Br	*Araceae*	W	H	R	3,6	Pounding and Drink	Oral

Code	Plants Local name	Scientific name	Family name	Habita T	Habit	Parts used	Livestock disease	Mode of preparation	Route of Administration
BM 19	Sariitii	*Asparagus africanus* Lam.	*Asparagaceae*	W	H	R	1,9	Pounding and dissolved in water then drenching	Oral
BM 20	Lolchiisaa	*Bersama abyssinica* Fresen.	*Meliantha ceae*	W	T	B	1	Burning and gave the ash with the food	Oral
BM 34	Ijaraafuu	*Brassica carinata* A.Br.	*Brassicaceae*	HG	H	Se	3, 18	powdering dissolve in water then drenching	Oral
BM 08	Qomonyoo	*Brucea antidysenterica* J.F.Mill	*Simaroubaceae*	W	Sh	L& R	9,13	Pounding dissolve in water then Drenching	Oral
BM 15	Anfaarree	*Buddleja polystachya* Fresen.	*Budlejaceae*	W	T	L	15	Chewed and drop the juice in the eye	Optical
BM 10	Ceekaa	*Calpurnia aurea* (Aiton) Benth.	*Fabaceae*	W	Sh	L	6,12, 14	rubbed and wash the body with it	Dermal
BM 18	Harangamaa gurraacha	*Capparis tomentosa* Lam.	*Capparidaceae*	W	Sh	R	3,10, 13	Pounding and gave the juice	Oral& Nasal

Code	Plants Local name	Scientific name	Family name	Habita T	Habit	Parts used	Livestock disease	Mode of preparation	Route of Administration
BM 36	Mimmixa	*Capsicum annum* L.	*Solanaceceae*	HG	H	Fr	19	Pounding mix the flour with water then apply on the body	Dermal
BM 40	Pappaayyaa	*Carica papaya* L.	*Caricaceae*	HG	T	L	2,3	Crushed and tied on the body	Dermal
BM 07	Hidda feetii	*Clematis longicauda* steud.ex A.Rich	*Ranunculaceae*	W	CL	L	4	Pounding and give it	Oral
BM 09	Maraasisaa	*Clerodendrum Myricoides* (Hochst.) Vatke	*Lamiaceae*	W	Sh	R	1,3,4	Pounding dissolved in water then gave it	Oral
BM 22	Qullubbii waraabessaa	*Crinum abyssinicum* Hochst. Ex A. Rich.	*Amaryllidaceae*	W	H	R	1,4,6,7	Pounding and mix the juice with water then gave it	Oral
BM 28	Bakkanniisa	*Croton macrostachyS* Del.	*Euphorbieae*	W	T	L&St	3,4,16	Burn and then Smoking	Nasal

Code	Plants Local name	Scientific name	Family name	Habita T	Habit	Parts used	Livestock disease	Mode of preparation	Route of Administration
BM 43	Coqorsa	*Cynodon dactylon* (L.) Prers	*Poaceae*	W	H	WPs	17	Pounding and Drink	Oral
BM 30	Hidda reeffa	*Cyphostemma cyphopetalum (*fresen)	*Vitaceae*	W	Cl	R	1,3,4,6,7	Pounding dissolved in water then drink	Oral
BM 02	Asaangira	*Datura stramonium* L.	*Solanaceae*	W	H	L	2	Crushed and Applied to the body	Dermal
BM 47	Sarxee	*Dracaena fragrans* (L.) Ker Gawl.	*Dracaenaceae*	BO	Sh	L& Fl	1,3,4	Pounding dissolve in water then drink	Oral
BM 37	Qarabichoo	*Echinops kerebicho* Mesfin	*Asteraceae*	Bo	H	R	3	Pounding dissolve in water then drink And squeezed then take it	Oral
BM 21	Kosonbee	*Echinops longifolius* C.B.Clarke	*Asteraceae*	W	H	R	1	Pounding and dissolved in water then drink	Oral
BM 26	Ulaagaa	*Ehretia cymosa* Thonn.	*Boraginaceae*	W	T	L& R	1,4	Pounding dissolved in water then drink	Oral

Code	Plants Local name	Scientific name	Family name	Habita T	Habit	Parts used	Livestock disease	Mode of preparation	Route of Administration
BM 39	Korchii	*Erythrinabrucei* Schwinef	*Fabaceae*	Bo	T	B	2	pounding and wash the body	Dermal
BM 54	Harbuu	*Ficus sur* Forssk.	*Moraceae*	W	T	Fr	3	Pounding then drink the juice	Oral
BM 25	Dambii	*Ficus thonnigii* Blum.	*Moraceae*	W	T	L	3	Pounding dissolved in water then drink	Oral
BM 48	Heennaa	*Indigoferaarrecta* Hochst. ex A. Rich	*Fabaceae*	W	Sh	L	1,4	Pounding and Squeezed and then give it	Oral
BM 49	Hansoosillaa	*Ipatiens tinctoria* A.Rich. .	*Balsaminaceae*	W	H	R	9, 10	Pounding dissolve in water then Drenching	Oral
BM 05	Dhumugaa	*Justica schimperiana* (Hochst.ex.Nees)	*Acanthaceae*	BO	Sh	L	4,11	pounding dissolved in water then applied	Oral and Dermal
BM 42	Buqqee hadhooftuu	*Lagenaria siceraria* (Molina) Standl.	*Cucurbitaceae*	HG	Cl	Fr	7	Pounding and Drink	Oral

Code	Plants Local name	Scientific name	Family name	Habita T	Habit	Parts used	Livestock disease	Mode of preparation	Route of Administration
35	Shiinfaa	*Lepidium Sativum* L.	*Brassicaceae*	HG	H	Se	9,10, 17, 18	Powdering and dissolved in water then drenching	Oral
BM 46	Homachoo	*Helinus mystacinus* (At)E.Mey ex Steud	*Rhamnaceae*	W	Cl	AB g	5	Pounding and then rubbed on the breast	Dermal
BM 53	Saranbaawoo	*Cucumis ficifolius* A.Rich	*Cucurbitaceae*	W	CL	R& L	3,5 20, 21	Rubbedthe breast with it	Dermal
BM 29	Goofichoo	*Nicotiana tabacum* L.	*Solanaceae*	HG	H	L	3,9	Pounding and then drenching	Oral
BM 44	Meexxii	*Phoenix reclinata* Jacq.	*Arecaceae*	W	T	L	15	Pounding and applied the juice	Optical
BM 06	Handoode	*Phytolaca dodecandra* L'Her.	*Phytolaceae*	W	Sh	L& R	10,12,13	Pounding and then applied	Oral& Dermal
BM 45	Atara/Aatoo	*Pisum sativum* L.	*Fabaceae*	HG	H	Se	3,4	Powdering and dissolve the flour in water then drink	Oral

Code	Plants Local name	Scientific name	Family name	Habita T	Habit	Parts used	Livestock disease	Mode of preparation	Route of Administration
BM 16	Soolee	*Pittosporum viridiflorum* Sims	*Pittosporacea*	W	T	L& B	16	Pounding dissolved in water and drenching	Oral
BM 04	Yeeroo	*Plectranthus longipes* Bake	*Lamiaceae*	W	H	L	3,4	Pounding dissolved with water then drenching	Oral
BM 12	Hoomii	*Prunus africana* (Hook.f.) Kalkman:	*Rosaceae*	W	T	B	9	Pounding dissolved in cold water thengive it	Oral
BM 27	Deqqoo	*Ritchiea albersii* Gilg	Capparidaceae	W	Sh	B	3,4,17	Pounding dissolved in water then drenching	Oral
BM 50	Abbaa seekkoo/ Dhangaggoo	*Rumex nervosus* Vahl.	*Polygonaceae*	W	H	R& L	1,3,4,7	Pounding and drink or squeeze and take it	Oral
BM 55	Xeenaadam	*Ruta chalepensis* L.	*Rutaceae*	HG	H	L	13	Pounding then drink the juice	Oral
BM 13	Gatamaa	*Schefflera abyssinica* (Hochst. ex A.Rich.) Harms	*Araliaceae*	W	T	B	2	crushed and pour the juice	Dermal

Code	Plants Local name	Scientific name	Family name	Habita T	Habit	Parts used	Livestock disease	Mode of preparation	Route of Administration
BM 51	Hiddii waraabessaa	*Solanumdasyphyllum* Schumach. & Thonn	*Solanaceae*	W	H	R	9	Pounding dissolve in water then drink	Oral
BM 41	Botoroo	*Stereospermumkunthianum* Cham.	*Bignoniaceae*	W	T	B	1,3	Pounding dissolve in water then drink	Oral
BM 03	Siraabuzuu	*Thalictrum rhynchocarpum* Dill. & A. Rich.	*Ranunculaceae*	W	H	L&R	1,3,4,5,6,7,8,9,10	Poundingmix Withwater And salt then drenching	Oral
BM 11	Luuyyaa	*Trichilia dregeana* Sond.	*Meliaceae*	W	T	B	3,6,9	Pounding dissolved in water then drenching	Oral
BM 01	Doobbii/Gurgubbee	*Urtica simensis Steudel* (Hochst. ex. A. Rich.)	Urticaceae	W	H	L&R	1	Pounding mixed with water and then applied	Oral
BM 17	Ebicha	*Vernonia amygdalina* Del.	*Asteraceae*	W	T	L	17	Pounding dissolved in water then drenching	Oral
BM 23	Reejjii gurraacha	*Vernonia auriculifera* Hiern	*Asteraceae*	W	Sh	L	2,4,6,8,9	Pounding and drenching or pour the juice	Oral& Dermal

Code	Plants Local name	Scientific name	Family name	Habita T	Habit	Parts used	Livestock disease	Mode of preparation	Route of Administration
BM 33	Gijinbila	*Zingiber officinnale* Roscoe	*Zingebiraceae*	HG	H	Rh	3,9,10,17, 18	Pounding mix with water then drink	Oral

Key: Habitat(W= Wild, HG=Home garden), Habit(T=Tree,Sh=Shrub,H=Herb,Cl=climber)

Parts Used (L=Leaf, R=Root, B=Bark, St=Stem, Se=Seed, Fr=Fruit, Rh=Rhizome, Bu=Bulb, ABG=Above ground, WP=Whole Parts, L&B=Leaf and Bark,

L&R=Leaf and Root, L & St=Leaf and Stem, L & Fl=Leaf and Flesh)

Key: (Disease Treated): 1 (Emaciation), 2 (wound), 3 (black leg), 4 (Trypanomoisis), 5 (mastitis) 6 (Babesiosis), 7 (mineral defficency), 8 (Diarrhea), 9 (internal parasite), 10 (coughing), 11 (snake poisone), 12 (externalparasite), 13 (Fasciolosis), 14 (brucellosis), 15 (kerratoconjunctivities), 16 (pasterilosis disease), 17 (bloating), 18 (colic), 19 (tick), 20 (Rabies viruses), 21 (FMD) foot mouth disease, 22 (Coccidiosis)

Appendix 2: Checklist of semi structured questions used for interview for collection of data of different medicinal plants and the associated knowledge

PART_ONE

Direction: please indicate your choice by encircling one of the letters from the given alternatives.

I. Questionnaires Filled by Practitioners.

1. Name of key Respondents _____
2. In which kebele do you live?_____

3. Residence. A, Rural B, Town

4. Age. A. 23-35 B. 36-45 C. 46-55 D. Above 56

5 Sex A.Male ☐ B. Female ☐

6. Religion A. Protestant B. Orthodox C. Muslim D. Wakefata

7. Ethnic group A. Oromo B. Amhara C. Guragie D. others

8. Educational status

A.1-4 B.5-8 C. 9-12. D. diploma E.degree F. uneducated

PART _TWO

Direction: please answer the following questionnaire based on direction of each questions.

1. Do you know any traditional medicinal plants used to treat the livestock ailments in your area?

A. Yes B. No

2. If the answer for question number 1 is yes, how many Ethno-veterinary medicinal plant species do you know? _____

3. What is/are the local name of these ethno-veterinary medicinal plants that you know?

_____

4. Where do you obtain these ethno-veterinary medicinal plants?

A. wild B. home garden C. both

5. In what forms these medicinal plant species exists?

A. herbs B. shrubs C. tree D. climbers E. Epiphytes

F. liana

6. What is/are the local names of the livestock diseases treated with each of these medicinal plants?

7. Do you think that the availability of these ethno-veterinary medicinal plants affected by season?

A. Yes B. No

8. When these ethno-veterinary medicinal plants available?

A. all the time B. available seasonally C. difficult to get

9. Which parts of this ethno-veterinary medicinal plant used as remedies?

A. leaf B. root C. bark D. flower E. leaf and bark

F. bark and root G. others

10. In what methods do you prepare these medicinal plants?

A. powdering B. chewed C. Squeezing D. burning E. others

11. Is there any other ingredients added while you are preparing these ethno-veterinary medicinal plants?

A. Yes B. No

12. If there is any, what things to be added to prepare the required ethno-veterinary medicinal plants?_____

13. Through which routes these ethno-veterinary medicinal plants to be given for the infected domestic animals?

A. oral B. anal C. on dermal D. through eyes E. through nose

F. through ear

14. At what growth stages of the plants do you harvest (collect) these medicinal plants for use?

A. at younger (seedlings) stage B. at matured stage

15. How do you collect these medicinal plants used to treat livestock diseases?

A. by cutting stems B. by cutting branches C. get off with the root

16. What is/are the most common treated livestock diseases in your area? And which medicinal plant species most commonly used to treat this/these disease/s?

_____

17. How do you transfer ethno knowledge of medicinal plants?

A. orally B. in written C. others

18. To whom do you transfer the ethno knowledge of medicinal plants?

A. to selected family members

B. outside family members

C. to learners

19. From whom do you acquire the knowledge of ethno-veterinary medicinal plants?

A. from older family members

B. from other elders

C. others

20. Do you have willingness to transfer these ethno-veterinary medicinal plants?

A. Yes B. No

21. What do you think about the utilization of the ethno-veterinary medicinal plants in the time?

A. declining B. not reduced

22. What are the factors responsible for the utilization of ethno-veterinary medicinal plants?

A. difficulty of preparation

B. seasonal unavailability of plants

C. side effect of the remedies

D. lower effectiveness of the remedies

E. climate change

F. deforestation

G. Lack of willingness of practitioners to transfer the knowledge.

II. Questionnaires Filled by users of traditional medicinal plants

PART_ONE

Direction _please indicate your choice by encircling one of the letters from the given alternatives

1. Name of users of medicinal plants_____

2. In which kebele do you live _____

3. Residence. A, Rural B, Town

4. Age. A. 23-35 B. 36-45 C. 46-55 D. Above 56

5 Sex A. Male ☐ B. Female ☐

6. Religion A. Protestant B. Orthodox C. Muslim D. Wakefata

7. Ethnic group A. Oromo B. Amhara C. Guragie D. others

8. Educational status

A.1-4 B.5-8 C. 9-12. D. diploma E. degree F. uneducated

9. What is your main source of income? _____

10. Are you governmental employer?

A. Yes B. No

PART _TWO

Direction: please answer the following questionnaire based on direction of each questions

1. Did you use traditional medicinal plants for your livestock's?

A. Yes B. No

2. If you say yes for question number one from whom did you obtain?

A. elders B. younger

3. What types of disease did you treat with it?_____

4. Did you prepare for yourself?

A. Yes B. No

5. How did you get its effectiveness?_____

6. Have you tried to get the knowledge from the practitioners?

A. Yes B. No

7. If you can say yes for question number 6 whom did you ask?

A. family members B. Other relatives

8. What problems do you think faced in using traditional medicinal plants in local communities? _____

9. What did the local communities in conservation of the medicinal plants?

_____

10. How do the youngest generations think about the local knowledge of plants used for treating livestock ailments?

11. If you have any other idea /character to explain (express)?

_____

_____

Appendix: 3 Table of List of informants participated in ethno-veterinary study.

No	Name	Sex	Age	Kebele	Educational Status
1	Legese Adeba	M	45	Alga Gosu	11
2	Suleman Keno	M	27	Alga Gosu	4
3	Diribu Aga	M	36	Alga Gosu	4
4	Takele geremu*	M	81	Alga Gosu	9
5	Chanalo Keno	M	24	Alga Gosu	9
6	Manaye Tekalign	M	47	Alga Gosu	8
7	Jaleta Dhaba	M	60	Alga Gosu	-------
8	Garame Feyisa	F	56	Alga Gosu	-------
9	Gezahegn Biru	M	55	Alga Gosu	--------
10	Age Birdo	F	70	Alga Gosu	--------
11	Aster Amare	F	32	Alga Gosu	4
12	Taka Disasa*	M	75	Alga Gosu	----------
13	Adanech Asefa*	F	45	Agalo Workayi	12
14	Shewaye Nigatu	F	42	Agalo Workayi	8
15	Tamiru Ayele	M	35	Agelo Workayi	10
16	Belachew Assefa	M	60	Agelo Workayi	----------
17	Tamiru Mamo*	M	80	Agelo Workayi	8
18	Fekede Kebede	M	36	Agelo Workayi	6
19	Yadeta Abdisa	M	75	Agelo Workayi	----------
20	Kebede Mecha	M	73	Agelo Workayi	4
21	Nuguse Dhaba	M	60	Agelo Workayi	2
22	Indale Arfasa	M	30	Agelo workayi	8
23	Bikiltu Dhaba	F	22	Agelo Workayi	10
24	Gudeta Regasa	M	55	Agelo Workayi	10
25	Dabala Disasa	M	60	Agelo Dheko	10
26	Tafari Haile	M	55	Agelo Dheko	5
27	Silesh Mamo	M	50	Agelo Dheko	8

28	Tamiru Gamtesa	M	48	Agelo Dheko	7
29	Gudane Regasa*	F	55	Agelo Dheko	10
30	Mule Wage	F	45	Agelo Dheko	7
31	Gazahagn Dhaba*	M	65	Agelo Dheko	3
32	Tadele Wondimu	M	53	Agelo Dheko	10
33	Getacho Dinka	M	42	Agelo Dheko	7
34	Taku Tariku	M	35	Agelo Dheko	6
35	Habtamu Abdisa	M	28	Agelo Dheko	--------
36	Tamiru Mekonnin	M	45	Agelo Dheko	6
37	Terefe Amente	M	75	Alga Guracha	9
38	Mebrate Debela	M	45	Alga Guracha	4
39	Tilahun Beyan	M	51	Alga Guracha	4
40	Bula Jima*	M	87	Alga Guracha	-------
41	Tibebu Jima	M	33	Alga Guracha	9
42	Obsa Jote	M	55	Alga guracha	4
43	Tamiru Desalegn	M	40	Alga guracha	4
44	Taye Abera	M	37	Alga Guracha	---------
45	Alemayehu Terefe	M	24	Alga Guracha	9
46	Alemnesh Wandimu	F	26	Alga Guracha	10
47	Fikade Gizaw	F	55	Alga Guracha	------
48	Gemechu Tefera	M	45	Alga Guracha	------
49	Habtamu kusa*	M	56*	Beroyi Gabisa	6
50	Abate Tadese	M	65	Beroyi Gabisa	-------
51	Girma Gada	M	35	Beroyi Gabisa	4
52	Dhuguma Kano	M	62	Beroyi Gabisa	--------
53	Gume Sirna	F	40	Beroyi Gabisa	6
54	Takele Kebede	M	58	Beroyi Gabisa	Digree
55	Gosa Bure	M	70	Beroyi Gabisa	----------
56	Alamayo Gosa	M	34	Beroyi Gabisa	9
57	Adise Amado	F	53	Beroyi Gabisa	-------

58	Nuguse Taka	M	28	Beroyi Gabisa	4
59	Alamitu Tujuba*	F	56*	Beroyi Gabisa	3
60	Bultu Abera	F	35	Beroyi Gabisa	6
61	Lama Biru*	M	77*	Beroyi Shonkora	------
62	Kebede wadajo	M	58	Beroyi Shonkora	------
63	Mohamed Husen*	M	60*	Beroyi Shonkora	-------
64	Getacho Bula	M	40	Beroyi Shonkora	6
65	Alamitu Dibaba	F	35	Beroyi Shonkora	10
66	Xibabu Tadese	M	28	Beroyi Shonkora	10
67	Sixota Tadese	M	30	Beroyi Shonkora	10
68	Fikade Gedamu	F	36	Beroyi Shonkora	8
69	Indale Teferi	M	35	Beroyi Shonkora	10
70	Teferi Senbeto	M	62	Beroyi Shonkora	4
71	Workinehe Merdasa	M	55	Beroyi Shonkora	8
72	Birhanu Tefera	M	65	Beroyi Shonkora	8
73	Gabre Mirkana*	M	70	Homadidu	-----
74	Ramate Tamiru	F	55	Homadidu	------
75	Chala Ebisa	M	41	Homadidu	3
76	Tamiru Muluneh	M	65	Homadidu	3
77	Abdisa Fogi*	M	60	Homadidu	-----
78	Jorbase Kumsa	F	42	Homadidu	2
79	Mulugeta Workineh	M	40	Homadidu	7
80	Sutuma Dibaba	M	48	Homadidu	-------
81	Deneke Tadese	M	50	Homadidu	Diploma
82	Yenenesh Gezhagn	F	47	Homadidu	4
83	Tadese Areru	M	50	Homadidu	8
84	Shono Namara	M	34	Homadidu	8
85	Shibeshi Fanta*	M	55	Alebuya	9
86	Ayane Gudeta*	F	45	Alebuya	8
87	Abiyu Zengaw	M	72	Alebuya	-----

88	Geremew Cherinet	M	65	Alebuya	------
89	Degineh Gizaw	M	38	Alebuya	10
90	Defaru Fayisa	M	43	Alebuya	4
91	Birhane Kenea	F	50	Alebuya	10
92	Getachew Zewde	M	42	Alebuya	2
93	Mulunesh Lema	F	45	Alebuya	7
94	Mitiku Worku	M	40	Alebuya	-----
95	Wondimu Assefa	M	36	Alebuya	8
96	Taye Shiferaw	M	37	Alebuya	8
97	Kasahun Tefera	M	30	Madalu	10
98	Abebe Muluneh*	M	46	Madalu	9
99	Konjit Birhanu	F	28	Madalu	2
100	Girma Kebede	M	37	Madalu	Diploma
101	Misgana Dibaba	M	38	Madalu	Diploma
102	Mitike Arega	F	25	Madalu	10
103	Wosenelesh Samuel	F	28	Madalu	10
104	Birhanu Biru*	M	55*	Madalu	3
105	Manale Sisayi	F	62	Madalu	----
106	Genet Wadajo	M	48	Madalu	8
107	Daginesh Alemayehu	F	42	Madalu	Diploma
108	Tesfaye Ewnetu	M	54	Madalu	3
109	Olana Defar	M	55	Tulube	Digree
110	Mese Agafari*	F	60	Tulube	-----
111	Alamu Dibesa	M	35	Tulube	Diploma
112	Ole Agafari	F	35	Tulube	8
113	Dubale Bungul	M	58	Tulube	Diploma
114	Tahir Musa	M	47	Tulube	-------
115	Malaku Abdu	M	56	Tulube	11
116	Abadir Denu	M	55	Tulube	4
117	Adamu Alemayehu	M	25	Tulube	--------

118	Adanech Tadese	F	57	Tulube	4
119	Defar Dinka*	M	84	Tulube	--------
120	Ebisa Negeri	M	75	Tulube	------

* represent key informants.

Appendix: 4. The total house hold population of the study area.

No.	Name of the kebles	Total house hold population		
		Male	Female	Total
1	Alga gosu	219	23	242
2	Alga guracha	322	36	358
3	Agalo warqayi	217	130	347
4	Agalo dheko	234	222	456
5	Baroyi shonkora	306	53	359
6	Baroyi gabisa	387	42	429
7	Halle buya	711	45	756
8	Homadidu	662	51	713
9	Madalu	182	58	240
10	Tulube	882	100	982
	Total			4,882

Declaration

I declare that this thesis is my original work. It is entitled as ‘‘Indigenous knowledge of Plants used in veterinary practices in Metu District, Ilu Aba Bor Zone, Oromia Regional State, South west Ethiopia”.

Therefore, it has not been presented for a degree in any university. All sources of materials used in the thesis have been correctly acknowledged.

Name: Bahiru Mulu Signature ---------- Date ----------

Advisors	**Signature**	**Date**
Mr. Tamene Belude	----------	----------
Mr. Belachew Beyene	----------	----------