JIMMA UNIVERSITYCOLLEGE OF NATURAL SCIENCES DEPARTMENT OF BIOLOGY.

STUDY OF MEDICINAL PLANTS USED BY INDIGENOUS PEOPLE OF MENCHODISTRICT, JIMMA ZONE, SOUTH WEST ETHIOPIA.

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ATHESISSUBMITTED TO DEPARTMENT OF BIOLOGY,COLLEGE OF NATURALSCIENCES, JIMMAUNIVERSITY FOR THE PARTIAL FULFILLMENT OF MSC DEGREE IN BOTANICAL SCIENCE.

APRIL, 2024

JIMMA, ETHIOPIA

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ABSTRACT

Study of medicinal plants used by local people and associated indigenous knowledge was conducted in Mencho District, Jimma Zone, South West Ethiopia. The purpose of this study was to investigate and document medicinal plants used by local people and their indigenous knowledge. A total of 377 general and key informants, all of whom were over the age of 25, were used including 347 men and 30 women, which were selected to got information on medicinal plantsuse from seven sampled kebeles.Datawere collected using semi-structured interviews,field observations and group discussions. Descriptive statistics, informant consensus factor, fidelity level, preference ranking,direct matrix ranking and paired comparision were also calculated. A total of 72 medicinal plant species distributed across 41families were collected from the study area and identified. From the total collected plant species56(77.8%) were used for the treatment of 28 human ailments, while 11(15.3%) plant species were used for treating sevenlivestock ailments. The remaining 5(6.9%) plantspecies were used for treating threeboth human and livestock ailments. Herbs represented by 28(39%) species followed by shrubs with 24 (33%) species and tree 20 (28%) species. The most frequently used plant parts were leaves 33 (46%), followed by roots 13 (18%), seeds 12 (17%), barks 8 (11%), fruit 3 (4%) and flower 3(4%).The most widely used method of preparation was crushing 26 (36%), powdering 16 (22.2%), pounding 12 (16.7%),chewing and roasteting5(6.9%) each and squeezing 3(4.2%)and rubbing 2(3%), pulverizing and powdering 1(1.4%)and crushing and pounding 1(1.4%) and exudating 1 (1.4%).The common route of administration recorded was oral 51(71%) followed by dermal 10 (14%), nasal 4(6%), both oral and dermal6(8%)and oral andnasal 1(1%). The most preferred plant species remedy for curing ailmentsof the evil eyes is*Echinopskebericho*, followed by *Ricinuscommunis*and*Vacheliaabyssinica* was the most preferred species by healers for the treatment of teeth infection.*Cordia africana* was shown to be the top multipurpose species. This study revealed that the study area was rich in medicinal plants. Agricultural expansion, construction,overgrazing, firewood collection, timber and charcoal production were considered major threats to medicinal plants. Therefore, awareness creation for local people of the study area to conserve medicinal plants in their homegarden is recommended.

Key words: Ethnobotanical,indigenous knowledge, medicinal plants,MenchoDistrict,traditional healers

LIST OF ABBREVIATIONS

EARO	Ethiopian Agricultural Research Organization
EVM	Ethno-veterinary Medicine
FAO	Food and Agriculture Organization
IK	Indigenous Knowledge
KTH	Key Traditional Healers
IUCN	International Union for Conservation of Nature and Natural Resource
ITM	Improved Traditional Medicines
NMSA	National Meteorology Service Agency
SNNP	South Nation, Nationalities people
TM	Traditional Medicine
UNEP	United Nations Environmental Programmed
WHO	World Health Organization
ICF	Consensus Factor
WWFN	World Wide Fund for nature

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1. INTRODUCTION

1.1 Background of the Study

John Harsh Berger first used the term "ethnobotany" in 1896 to describe a subfield of botany that dealt with the usage of plants by early or primitive peoples.Many botanists were already including human use of plants in their studies before the word ethnobotany was coined. Harsh Berger, however, was the one who suggested that the field of ethnobotany might be given its own definition, boundaries, goals and methods (Cotton, 1996).Ethnobotany is the study of relationships and interactions between peoples and plants with respect to their cultural values. Interactions and relationships between peoples and plants is different from place to place because of their relative importance use and different social ethnic and cultural factors.Again, ethnobotany is a broad term referring to the study of direct interrelationships between humans and plants (Martin,1995).This includes the use of plants as food, medicines,building materials,and for any other economic application (Farnsworth,1994).The different botanists, anthropologists, explorers, missionaries and other people who traveled around the globe would see a plant, identify, classifyand name the plant for the purposes of science, ask a person the name of the plant in the local languageand list the local uses of the plant.

Medicinal plants are a major source of medicine in the healthcare system, particularly for the rural populace.Plants have not only nutritional value but also, in the eyes of the local people, they have medicinal and ritual or magical values(Abbink, J.1995).Men were well aware of the medicinal properties of some plants growing around them since 3000 B.C. In Ethiopia, evidence of using plants for medicinal purpose was found in medicinal text books that have been written in Geez or even Arabic between the mid of 17^{th} century and the beginning of the 18^{th} century (Gebre Egziabher *et al.*,2013).Pankhurst (1995) explained that, during and after Italian occupation the general population, with the exception of the privileged groups, depended almost entirely on traditional medicine.Of the 250,000 higher plant species on earth, more than 80,000 have medicinal property. Ethiopia is one of the world's 12 evolved biodiversity centers with the presence of over 45,000 different plant species (WHO, 2002).There are some attempts in investigating medicinal plant uses and there is yet no in depth study on the relation between medicinal plants and indigenous knowledge on sustainable management of such plant resources(Edwards, 2001).

Different countries have vernacular name to describe cultural medicinal practitioners emphasizing their close association with their community in which they live and practice. Example, in India they are called indigenous healer. In China they are called Bare foot doctors, in Cuba they are called Corianders, In Mencho (study area) “Ogeessa Qoricha aadaa’’in Afaan Oromo.Ethiopia is well known for its geographical diversity which has favored the formation of different habitats and vegetation zone, as well as it is the home of many languages, cultures and beliefs of local knowledge and practice of the people which among others includes the use of medicinal plants (Mirutse Giday, 2001).

Some studies have shown that most of the medicinal plants utilized by the Ethiopian people are harvested from the wild (Mirutse Giday, 1999). As time goes on however, these wildly occurring medicinal plant species, and the associated local knowledge is being eroded. There are two sources of threats to medicinal plants: natural and man-made. The study was conducted in Mencho District on traditionally used medicinal plants, to document their uses and to indicate their status based on information collected from dwellers.Again, the study also documenting mode of preparation, mode of application, dosage and amount used with the medicine.

1.2 Statement of the Problem

In developing countries like Ethiopia, the indigenous knowledge about medicinal plants was transferred secretly from generation to generation orally. In addition, the indigenous knowledge of people of a given community have their own local specific knowledge on plant use, management, conservation and as remedies were getting lost owing to migration from rural to urban areas, industrialization expansion of modern educationconsequently specialized healers do not convey their knowledge to next generation. In most parts of the country, the wild plants and forests were almost totally lost by human impact like deforestation, agricultural expansion, over exploitation and population growthand hence there was evident loss of biodiversity. One part of Ethiopia to see such problems was in Oromia Regional State particularly in Mencho District.The region is suffering habitat and species loss due to continued deforestation, and over usage of medicinal plants as well as loss of associated knowledge and little has been done to document ethnobotanical knowledge which was basic for conservation and community development activity.Until this moment, no research on ethnobotanical study of medicinal plants was conducted in Mencho District. Because of the District is newly organized separated from Dedo

District in 2008 E C.Therefore, the study wasaimed to help people of the study area to be aware of problems associated with medicinal plants and give attention for the threatened medicinal plants.In addition, the documentation of the indigenous knowledge of medicinal plants can be part of the information source for those who want to conduct research further on ethnobotanical study and development of modern drug; hence this study wasinitiated to fill gaps in the documentation of ethnobotanical knowledge in the study area.

1.3 Research Questions

The main focus of the study was to investigate the traditional use and management of medicinal plants of Mencho District community.The findings of the study would try to answer the following main research questions.

- What types of human and livestock ailments are treated by medicinal plants species in Mencho District.
- What types of knowledge are used remedy preparation, doseand application of medicinal plants?
- What is the current conservation status of traditional medicinal plants?

1.4 Objective of the Study

1.4.1 General Objective

To assess medicinal plants and associated indigenous knowledge used to treat human and livestock ailments in the study area.

1.4. 2 Specific Objectives

- To collect, identifyand document medicinal plant species used to treat human and livestock ailments.
- To indicate parts of plants used, mode of remedy preparation and administration in the study area.
- To assess the current conservation status of medicinal plants in the study area.

1.5 Significance of the Study

Until now there is notany research on ethnobotany done in the area. Because of the District recently formed. Therefore, the finding of this study was to help people of the study area to be aware of problems associated with medicinal plantsand give attention for the threatened medicinal plants. The findings are also used as input by other researcher who wants to carry out

the study on medicinal plantsand can be part of the information source for those who want to conduct further research in the same issue and the development of modern drugs.

1.6The scope of the study

Overall, this study was conducted in Oromia Regional State, South West of Jimma Zone, in Mencho District. The study was conducted to collect, identify, document and to know the current status of ethnobotanical study on medicinal plants and related indigenous knowledge in the local people of Mencho District. Andit was restricted to the area because of fund, time, accessand budget problems.

2. REVIEW OF RELATED LITERATURE

2.1 Indigenous Knowledge

Indigenous knowledge can be defined as a body of knowledge built up by a group of people through generations of living in close contact with nature (Fikret, 1993). In fact, a variety ofterms are used as:“local knowledge, traditional knowledge, indigenous traditional knowledge, indigenous technical knowledge, traditional environmental knowledge, rural knowledge, traditional ecological knowledge” and so forth with similar meanings. Local knowledge can be summed up as the wisdom of a people for survival in their own environment. It is a broad concept that covers all forms of knowledge of a particular community living in a particular area and also it is specific to communities and local environments (UNEP, 1995). Indigenous knowledge again refers to the accumulation of knowledge, rule, standards, skills and mental set, which are possessed by local people in a particular area (Quanash, 1998). It is the result of many generations’ long years’ experiences, careful observations and trial and error experiments.

Indigenous knowledge is specific knowledge of specific community (people and or ethnic group) and developed through trial and error of long period of time to solve their health or other problemson the ecosystem and the household level health practices. The health practices that start from home remedies for primary health care to specialized healing traditions like bone setting, poison healers, delivery and veterinary healers are found among various communities (R. Hiranmai Yadav,2013).It is widely believed in Ethiopia that the skill of traditional health practitioners is 'given by God',and knowledge on medicines is passed orally from father to a favorite child, usually a son or is acquired by some spiritual procedures. Traditional healing knowledge is guarded by certain families or social groups (WHO, 1990).

The knowledge of medicine is passed secretively to household (beloved) son or to the most closely relative kind and is acquired by some spiritual procedures. This can be the basic factor that can be resulted in extinction of the knowledge of medicine. The wide spread use of medicine among both urban and rural population in Ethiopia could be attributed to cultural acceptability, efficiency against certain type of ailments, physical accessibilityand economic affordability as compared to modern medicine.

The knowledge of medicinal plant in Ethiopia is specific to ethnic group, community culture, religion and the knowledge is passed from generation to generation orally and secretive.

Traditional medicinal knowledge is dynamic and practitioners make every effort to widen their scope by reciprocal exchange of limited information with each other or through reading either one of the traditional pharmacope as written in Arabic or Geez that are produced as far back as one hundred or more years (Dawit Abebe, 1986). According to WHO due to poverty and lack of access to modern medicine about 80% of the total populations of Ethiopia are depending on traditional medicine for their primary healthcare to treat different types of human ailments eventhough the knowledge of medicinal plant is the oldest medicinal knowledge peoples are backing to the use of it because of its cheapness, easy availability and rare side effect as well as the high cost andsevere side effect of western drugs (Awoyemi *et al.,* 2012).

2.2 Medicinal plants and Ethno-medicine in Ethiopia.

Ethiopia has a significant portion of two of the world's 25 biodiversity rich areas hot spot i.e. the eastern Arc Mountain Biodiversity Hotspot, and the Ethiopian highland Hot Spot (Conservation International at www. Biodiversity hot spots.org)due to the geographical diversity of Ethiopia has favored different habitats and vegetation types, that medicinal plants are also a component of these. This geographical diversity couples with multiplicity of ethnic groups with complex cultural diversity make the country the home for high diversity of traditional knowledge, practice and uses of medicine (Dawit Abebe and Ahada Ayehu, 1993; Zemeda Asfaw, 2001; Mirutse Giday, 2001).Ethiopia is believed to be home for about 6,027 species of higher plants with approximately 12% endemism, and hence one of the six plant biodiversity rich countries of Africa (UNEP, 1995).Of these about 800 species of plants are used in the traditional health care system to treat nearly 300 mental and physical disorders (Pankhurst, 1990 and Vecchiato, 1993).

The diversity is also considerable in the lower plants but exact estimate of these have to be made. The genetic diversity contained in the various biotic make up is also high thus making the country a critical diversity hot spot for plants. As one of the 12^{th} Vavilovian centers of origin/ diversity for domesticated crops and their wild relatives, it is home of many endemic crops and genetic stocks (Endashaw Bekele, 1978).Different vegetation types that are found in the various agro-ecological zones of Ethiopia accommodate with various types of medicinal plants (Endashaw Bekele, 2007). Edwards (2001) reported that the woodlands, montane vegetation including grasslands, forests and the evergreen scrubs and rocky areas contain more medicinal plants with higher concentrations in the woodlands. The observed that the microphylous

vegetation of the woodlands listed more medicinal plants species followed by the Montane-grassland and riverine vegetation while the afro-alpine vegetation ranked last. Thousand of identified medicinal plant species are reported in the Ethiopian Flora; however, many others are not yet identified. About 300 of these species are frequently mentioned in many sources (Jansen, 1981). Globally, the estimate of medicinal plant species range from 35, 000 - 50, 000 species and out of this about 4000 - 6000 species have entered the world market of medicinal plantsdrugs (Farnsworth*et al.*,1991).The greater concentration of medicinal plants are found in the Ethiopian parts such as Bale Mountain National Park,in Minjar Shenkora District in North Shewa Zone, Amhara region,Cheffa District of the country following the concentration of biological and cultural diversity (Edwards, 2001).

2.3 The role of medicinal plants

Traditional medicine remains the main resource for a large majority (80%) of the people in Ethiopia to treat their illnesses and maintain their healthand medical consultancy including the consumption of medicinal plants has a much lower cost than modern medical attention (Asfaw Debela *et al*., 1999). So, medicinal plants are the main source of traditional medicine for the rural population and are of high demand in the health care systems of this population when compared to modern medicine, ethno-medicine activities need special consideration and backup (Abbiw, 1996).This was linked to the establishment to record medicinal plants to improve accessibilityand dissemination of information on medicinal plants (Tsige Gebre Mariam, and Kaleab Asres, 2001).

2.4 Sources of supply of medicinal plants to treat human ailments

According to Zemed Asfaw (1999; 2001), most medicinal plants used by the herbalists are collected from the natural vegetation. Home based medicinal plants use relies on plants of the homegarden crops, weeds and that grow wild around human habitation. The cultivated medicinal plants are mostly produced in homegardens either for medicinal or other purposes.Medicinal plants of homegarden are known to the public as the knowledge on them is open or public. According to Endashaw Bekele, (2007) Medicinal plants obtained from wild habitats are found in different natural ecosystems of the forests, grasslands, woodlands, wetlands, in field margins, and garden fences, as weeds and in many other microhabitats from where they are harvested when the need arises. These are free access resources to all with appropriate knowledge and who want to use them for the family for practicing medicine or for sales. Most traders purchase

medicinal plants from collectors. Consumers get their supply from different sources including from own garden, purchasing from traders and healers. Medicinal plants are also imported informally. In Ethiopia, except in a few cases where a few food crops with medicinal value are cultivated, there is no organized cultivation of plants species for medicinal purposes. The reason for this is that the quantities of medicinal plants traded are very small and there is no organized large scale value addition and processing. However, there is a potential in the future for increased demand for some of the species and therefore, it is important to identify them and start the necessary research on the propagation as well as cultivation techniques. Such program was also provided basis for small enterprises to improve the income generating capacity of the local people.

2.5 Plants in Ethno-veterinary Medicine

In all countries of the world, there exists traditional knowledge related to the health of animals. In Africa, traditional healers and remedies made from plants play an important in the health of millions of animals (Rukangria, 2001), which is studied by ethnoveterinary medicine. Ethiopia is leading in livestock population in Africa, with an estimated population of 43 million cattle, 2.3 million sheep, 18.6 goats, 17 million horse, 0.6 camels, and 34.2 million poultry,4.5 million donkeys and 0.36 million mules (2006/7 CSA). However, livestock productivity is relatively poor owing to inadequate availability of feed, widespread ailments, poor health services and insufficient knowledge on the dynamics of the different farming systems in the country (Yirga and Hassen, 2000). Ethno veterinary medicine is frequently used for treatment of livestock ailments by many different ethnic groups in Ethiopia. Nearly 90% of livestock production in the countryuse plant based traditional medicine as their major health care system (Endashaw Bekele, 2007).

Ethno veterinary medicine studies local knowledge, folk beliefs, skills, methods, and practices used for treatment of livestock ailments (Tabuti *et al.,* 2003). It offers medicines which are cheap and locally available than pharmacotherapy.Because of the higher price of modern medicinesand lack of accessibility to a modern veterinarian in the rural areas; farmers rely on traditional veterinary healers for treatment of livestock ailment (Harun-or- Rashid *et al.,* 2010). EVM refers to centuries' old inter-and multidisciplinary components of health that are holistic in application and comprises local ethno knowledge and associated skills, techniques, practices, beliefs, taboos, cultures, practitioners and socio-economic structures pertaining to the healthcare and healthful

husbandry of food, work and other income-producing animals (McCorkle, 1992). Similarly (Etana Tolosa, 2010) explain that in Ethiopia people have used traditional veterinary methods to treat livestock ailments for generations. Plants comprise the largest component of the diverse therapeutic elements of traditional livestock healthcare practices. Herbal medicine is the branch of traditional medical practices that is most amenable to scientific investigation. Plants are also invaluable subjects of international development. Knowledge of medicinal plants can empower livestock owners to solve animal health problems cost-effectively.

Ethiopia covers several ecological zones and therefore, has a wide variety of natural resources, many of which are favorable to various species of plants and animals. Unfortunately, a large number of animal diseases also exist in the country, limiting livestock production. In this country, as in other countries, veterinary medicine involves the work of bone-setters, midwives, religious healers and people who claim the moment 95% of these alternative medicines are of plant origin (Dawit Abebe, 1986; Mirutse Giday and Amenu, 2003). The majority of the population (90%) that lives in Ethiopia depends mainly on traditional medicines to meet their healthcare needs (WHO, 2002).

In Ethiopia as well as in most developing countries, animal ailment remains one of the principal causes of poor livestock performance, leading to an ever increasing gap between the supply of and the demand for, livestock products (Agrawal, 1995). Cattle owners in Ethiopia have long been aware of serious ailments such as desta (rinderpest), aftegir (foot and mouth ailment), abasenga (anthrax), abagorba (blackleg), gendi (trypanosomiasis) and ailments caused by internal and external parasites, and of the zoonotic nature of ailments: anthrax and rabies. Before the introduction of modern veterinary practice, traditional healers were usually the only people approached to attend to these livestock ailments.The various traditional practices included prevention of ailments, recognition of toxic plants, surgical intervention and crude vaccination methods (Mesfin Tadesse and Obsa, 1994).Cost of treatment is therefore,an important determinant of the usefulness of veterinary drugs. In Ethiopia, conventional veterinary services have been playing a paramount role in the control and prophylaxis of livestock ailments in the last three decades. How veterinary stations and those who have access to veterinary services may not be able to afford to pay for them. Additionally, reduced funding for animal disease control is an issue in Ethiopia and is likely to influence the incidence of some serious livestock ailments (Sori, *et al.*, 2004). In Ethiopia, livestock production directly constitutes important sources of

livelihood, in addition to its contribution to crop production (Tafesse and Mekonen, 2001). Beside this, most developing countries including Ethiopia, animal ailment remains one of the principal causes of poor livestock performance, leading to an ever increasing gap between the supply of, and the demand for, livestock products (Teshale *et al*., 2004). To overcome this problem, many people mainly use traditional medicines to treat their livestock ailments.

2.6 Plant parts used for traditional medicine purposes

Medicinal plant parts used for remedy preparation such as leaves, stems, roots, bulbs, seed, fruits and flowers. Consumption of leaves for remedies preparation is more advantageous than using roots, stem, flowers or the whole plant, since harvesting leaves does not pose a great danger to the survival of an individual plant as compared to the roots, stem and whole plant. Leaves, flowers and roots may contain more active principles in comparison to fruits, seeds, bark, and latex. The local communities in many parts of the country also use leaves in their remedy preparations than other plant parts (Bayafers Tamene, 2000; Mirutse Giday *et al*., 2003).

2.7 Methods of traditional medicines preparation

A number of techniques are used to prepare medicinal plant remedies. These include: pounding powdering, chewing, chopping, decoction, crushing, boiling, burning, chewing, concoction, cooking, homogenizing, infusion, powdering, rubbing and squeezing. According to Haile Yineger *et al*. (2008), substances like cold water, honey, coffee, butter, olive oil, salt, sugar, kerosene, ash and milk are used as additives or solvents with the plant materials during the preparation of remedies.The superiority of single species utilization over poly herbal remedies preparation is reported by Endalew Amenu,(2007)and Muthuswamy, R.(2009). The preparations vary based on the type of ailment treated and the actual site of the ailment.

2.8 Route of administration of the traditional medicines

The prepared drugs are administered through different routes of administration. The major routes of administration include: oral, dermal, nasal, and external on skin, anal and vaginal routes (Kebu Balemie*et al.*,2004).Medicinal plants are applied through different routes of administration internally or externally. Internal applications include through mouth, eyesand nasal or through the ear canal and external applications involve dermal treatments (Ermias Lulekal, 2005).

2.9 Dosage of medicinal plants used to treat human ailments.

The amounts of remedy, and prescription rates are generally dependent on the degree and duration of the ailment (Haile Yineger *et al.,* 2008).The units used to determine the dosage of the plant medicines are varied depending on the experience of individual healer, on diagnosis and the duration of the illness as well as age, physical and health condition of the patient. According to Mirutse Giday *et al*. (2009), liquid remedies administered to humans are usually measured by tea or coffee glasses or plastic cups, or number of drops. Recovery from the disease, disappearance of the symptoms of the diseases, fading out of the ailment sign and judgment of the healer to stop the treatment are some of the criteria used in determining duration in the administration of the dosage. According to Dawit Abebe and Ahadu Ayehu (1993), the real drawback in traditional medicine mostly arises from lack of precision in dosage.

2.10 Threats to medicinal plants in Ethiopia.

The health care practice is mainly dependent on medicinal plants collected from the wild. In spite of this, the medicinal plant biodiversity is being depleted due to manmade and natural calamities. Moreover, the indigenous knowledge associated with the conservation and use of medicinal plants is also disappearing at an alarming rate. The wide spread use of medicine among both urban and rural population in Ethiopia could be attributed to cultural acceptability, its attributed efficiency against certain types of ailments, physical accessibilityand economic affordability as compared to modern medicine. In view of this, development and its ultimate integration of medicine with the modern system is believed to have significant impact in the expansion of the health care coverage. There is a traditional distinction between attitudes to knowledge, on the parts of academia and industry (Reta, 2013).Environmental degradation, deforestation, agricultural expansion, over grazing and high population growth is potential treats to the survival of many potential valuable medicinal plants (Feoli *et al.,* 2002).As Endashaw Bekele, (2007)andMuthuswamy, R. (2009) explained many medicinal platform producing medicinal plants for the market and healers may not participate and fully collaboratesome plants used in medicines. Such taenicides are widely known to be toxic.

2.11 Conservation status of medicinal plants in Ethiopia

Some studies have shown that most of the medicinal plants utilized by the Ethiopian people are harvested from the wild (Mirutse Giday, 1999; Tesfaye Awas and Zemed Asfaw, 1999).As time

goes by however, these wild occurring medicinal plant species and the associated traditional knowledge is getting eroded. There are basically the same source further elaborates that even though indigenous knowledge systems are rapidly disappearing under the influence of Western culture, 80% of the world's population exclusively rely on traditional medicine; especially in developing countries, where they have the resources to sustain primary healthcare systems. The plant-based traditional medicine has been repeatedly verified by photochemical, pharmacological and clinical tests motivating further studies on medicinal plants in different parts of the world (Damtew.*et al.,* 2002).According to (WHO, IUCN and WWF, 1993) the population of medicinal plants, which in many parts of the world are being seriously depleted due to over-exploitation and loss of habitats; resulting in a lack of essential medicines and so reducing options for the future. For this reason the best way for conservation of medicinal plant was to start and orchestrate such a process for each country to prepare a national strategy for the conservation and sustainable use of its medicinal plants.

The process of preparing a strategy was help in: developing a consensus on what needs to be done, assigning tasks to different institutions, motivating participants to undertake the tasks and monitoring progress. Then preparing the guide lines that assign each task to a target group.Finally, the experts most needed for a Programmed of conservation and sustainable utilization of medicinal plants are: Conservationist, Campaigners, Ecologists, Ethnobotanists, Health Policy-makers, Horticulturists, Legal Experts, Park Managers, Park Planners, Pharmacognosists, Plant Breeders, Plant Genetic Resource, Specialists, Plant Pathologists, Religious Leaders, Resource Economists, Seed Biologists, Taxonomists, Health Practitionersand Agronomists. There is some conservation actions that have been undertaken around the world designed to protect threatened medicinal plants from further damage (Cunninghum, 1996).

3. MATERIALS AND METHODS

3.1 The Study Area

The study was conducted in Mencho District, Jimma Zone, and South-West of Ethiopia. Mencho District is one of the 22 Districts of the Jimma Zone. Located at a distance of 385 km from AddisAbaba, it is bordered by Kersa District in the North, Omo Nada District in the East, SNNP (South Nation, Nationalities people) regional state in the South and Dedo District in the West. It is located at 7°18′0″ to 7°28′30″°N and 37°0′0″ to 37°20′0″°E (Figure 1). The total population is estimated to be 191,368 with male, 96,188 and female 95,180(Mencho District Agricultural Office plan, 2015 E.C).The annual rainfall of the District ranges from 400-1500mm depending on variation in elevation of the District.

There are 20 rural and 3 urban kebeles in the District. From these kebelesthe study was conducted in seven kebeles namely: Mole Ogado, Mole Magala, Busase Elen, Garitu Magala, Garitu Kedida, Darar Korma and Yaya Lake are purposiely selected based on the availability of many medicinal plants, presence of healers and accessibility of the area(Mencho District Agriculture Office Plan, 2015). The weather condition falls in high land, low land and “wonea Dega”.Meteorology Service Agency (NMSA) indicates Mencho District obtains high rainfall between May to October and low rainfall from November to February.The study area was topographically characterized 92.35% covered by farm land, 3.5% valley and 4.15 % mountains (Mencho District Agricultural Office plan, 2015 E.C).

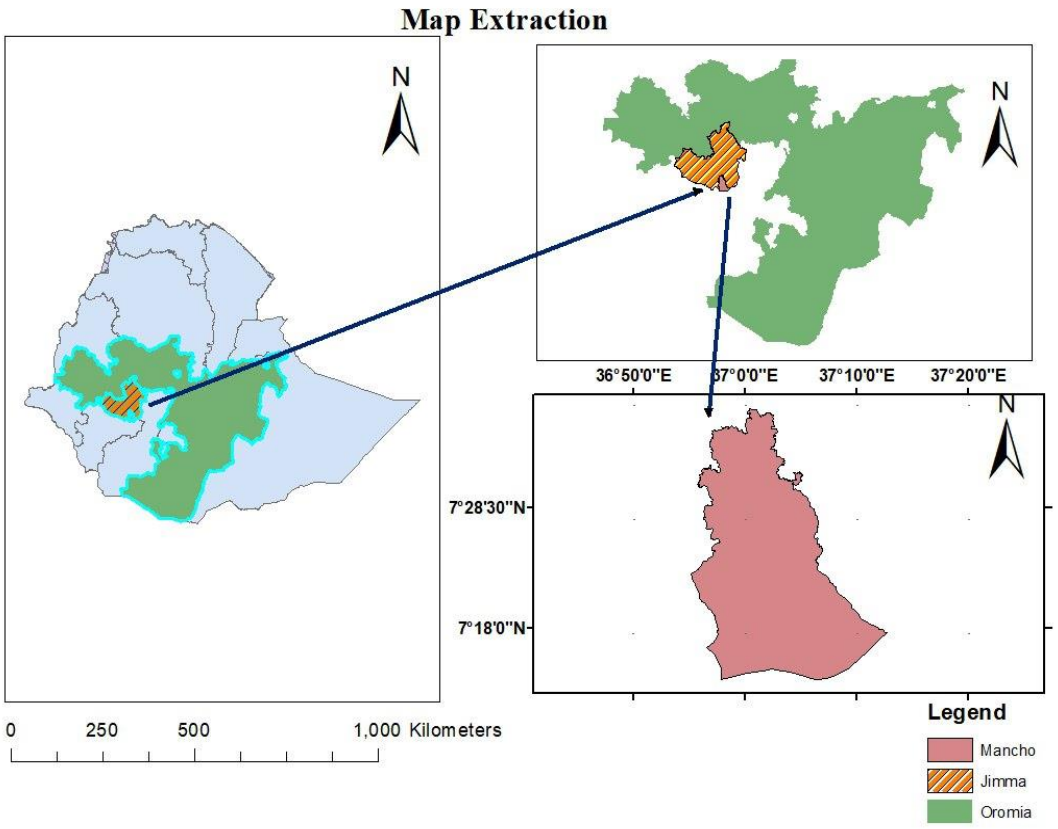

Figure 1:Map of Study Area (Mencho District)

3.2 Population of the study

The total population of the study is 6682 household heads of the Kebeles. Therefore, Mole Ogado (990), Mole Magala(1200), Busase Elen(865), Garitu Magala(901), Garitu Kedida(410), Darar Korma(1001)and Yaya Lake(1115) Kebeles are respectively. Hence, sample size was determined from these populations (Mencho District Agricultural Office plan, 2015 E.C.).

3.3 Sources of data

The study was made use of data from primary sources. While the primary sources of data was the information collected fromsample population of the study.

3.4 Sample size and sampling technique

In order to collect ethnobotanical data, menand women household informants with different age were selected from seven kebeles and the sample size was determined by Bartlett *et al*. (2001) as follows:

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

where n is the sample size of the research, N is the total number of households in the population , in this case total number of households in the particular selected Kebeles (6682), *e* is the maximum variability of making error 5% (0.05), and 1 is the probability of event occurring.

$$n = 6682/1 + 6682(0.05)2$$

$$=6682/17.705$$

$$=377$$

n= 377 which is based on the total number of households of the selected Kebeles. (From the particular selected 7 kebeles of the District).Therefore, the sample size for each of these seven kebele was calculated using the proportion of the number of households in each kebeles to the total number of the household of the selected Kebeles in the District. The sample size of each kebeles were calculated using proportionality ni= $\frac{nxNi}{N}$, where ni is sample size of each kebele, Ni is household population size of each kebele i the, i=1 2 3 4 n is sample size, N is total households in sample kebeles. Key informants were purposively selected based on recommendation of local authorities, elders and religious leaders. The choice of key informants was followed the suggestion made by Martin (1995).

Table1:Sample size for general informants for the ethnobotanical data collection in the study area

District	Kebeles	Number of total households	General informats			Key informats		
			M	F	T	M	F	T
Mencho	Mole Ogado	990	54	-	54	2	-	2
	Mole Megala	1200	66	-	66	2	-	2
	Busase Elen	865	47	-	47	2	-	2
	Garitu Megala	901	46	1	47	3	1	4
	Garitu Kedida	410	32	-	32	2	-	2
	Darar Korma	1001	51	1	52	3	1	4
	Yaya Lake	1115	60	-	60	3	-	3
Total	7	6682	356	2	358	17	2	19

3.5. Data collection methods and procedures

The necessary data for this study was collected during March to June 2015 E.C. using semi-structured interview,field observationsand group discussion.The semi-structured interviews were based on the questions prepared beforehand in English language that was translated into 'Afan Oromo' that is the mother language of the informants.Beforeadministering the interview questions, conversation with the informants were held by the help of kebele officials to clarify the objective of the study, and to build trust on the common goal of the study. The data collection on plants of local names, site of collection (wild, homegarden and cultivated), conservation practicesand ailment treated, parts of plants used for treatments, methods of preparation, dosage, effects of treatment, and duration of treatment was recorded from informants.

3.5. 1 Specimen identification

Based on ethnobotanical information provided by informants specimens were collected following the published volumes of Flora of Ethiopia and Eritrea (Hedberg and Edwards's, 1989; Demissew *et al.*, 2021).Voucher specimens were stored at the herbarium of Jimma University.

3.6. Data analysis

Descriptive statistics like percentage and frequency were used to analyze and summarize the data on medicinal plants, and associated knowledge.The most useful information was gathered on medicinal plants reported by local people: medicinal value, methods of preparation, route of application, types of ailment and ailment treated and parts used and habit were documented and analyzedthrough descriptive statistics. Facilities in Microsoft Excel spread sheet were utilized to make simple calculations to determine proportions and draw bar graphs, pie chart and tables.In addition, for data analysis the following methods are used.

3.6.1 Informant consensus factor (ICF)

In order to evaluate the reliability of information during the interview, informants were contacted at least two times for the same ideas to check the validity of the information recorded. If the ideas of the informants contradict with the original information, it will be rejected since it is considered as unreliable. It was calculated for categories of ailments to identify the agreements of the informants on the reported cures using the formula used by(Rodrigo,2005), and Tilahun, (2007). ICF was calculated using the following formula.

ICF = nur- nt/nur- 1 Where

ICF = informants consensus factor

nur = number of use citation in each category

nt = number of species used

3.6.2Fidelity level

The fidelity level (FL), the percentage of informants claiming the use of a certain plant for the same major purpose, was also calculated for the most frequently reported ailments using the following equation (Tilahun, 2007).

$FL\% = NP/N* 100$ Where;

FL=fidelity level,

Np= the number of informants that claim the use of a plant species to treat a particular ailment.

N =is the number of informants that use the plants as a medicine to treat any given ailment.

3.6.3 Preference ranking

The preference ranking was employed following Martin (1995)and Cotton (1996), for eight most important medicinal plants used in treating the evil eyes. Eight key informants were selected to assess the degree of effectiveness of these eight medicinal plants against the ailment. The medicinal plant believed to be most effective to treat the illness has got the highest value 8 and the least effective got the lowest value 1. The value of each species was summed up, and the rank was determined based on the total score. This helps to indicate the most effective medicinal plants used by the local people to treat the ailment.

3.6.4 Direct matrix ranking

Direct matrix ranking exercise was 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.Based on information gathered from informant's multipurpose tree species was selected out of the total medicinal plantsand use diversities of these plants were listed to select key informants to assign use values to each species.The use-values include construction, charcoal production, firewood collection, furniture manufacture and medicine. Key informants were

chosen to conduct this activity and each key informants were asked to assign use values (5 = best, 4 = very good, 3= good, 2 = less used, 1= least used). Accordingly, each key informants use values for the multipurpose medicinal plant species, average value of each use-diversity for a species were takenand the values of each species was sum up and ranked.

3.6.5Paired comparison

Paired comparison was methods that used for evaluating the degree ofimportance of plant species, which are used in the treatment of teeth infections in the study area. In paired comparison, items are presented in pairs and decisions are made by individual infornants on the relative importance of one of the items from a pair (Martin 1995). In this case, five medicinal plants were paired with each other to be select by ten of the key informants. The total number of possible pairs (10) was obtained by applying the formulan(n-1)/2, where n is the number of medicinal plants being compared.

3.7 Ethical consideration

Majority of the population in the study area were religiously Muslim in my data collection no problems facing me due to the population in the study area intellectual property. The procedural approaches for data collection were taken permission from the government office. Following this, contact was made with the offices of the District after which the purpose of the study, the possible result and benefits from the results were presented to the District's agriculture and rural development and to offices of the kebeles administrations of each sample kebeles by having the recommendation letter from JimmaUniversity.

Then questionnaires were prepared in English and translated into Afan Oromo, the language informants in the study speak. The design of the household questionnaire did not harm to the quality of the data as it did not include any identifying information like name, or address of a person on questionnaire. The informants were also well informed as the study is only for the purpose of academic research rather than for any other business or illegal activities. Hence, they were not forced to answer any question they were not comfortable with and there was a room for them to ask for a clarification of any question they want to be clarified.

4. RESULTS

4.1 A Socio demographic characteristics of the informants.

Age, gender, marital status andeducationlevel of informants were present in the study region. The age category includes young (25–40), the middle age (41–65), and the elders (above 65) are among them.The age range between 41and 65includesthe greatest number of informants.Education wise majority (83.6%) are uneducated whereas afew (16.4%) are educated.Additionally, almost all of the informants who were interviewed were married (Table 2)

Table 2:Demographic characteristic of informants.

Variables	Category	Number	Percentage
Gender	Male	347	92%
	Female	30	8%
	Total	377	100%
Age	20-40	170	45%
	41-65	187	50%
	Above 65	20	5%
	Total	377	100%
Occupation	Farmer	354	94%
	Merchant	9	2%
	Government employee	14	4%
	Total	377	100%
Educational status	Educational status		
	Uneducated	315	83.6%
	Educated	62	16.4%
	Total	377	100%
Marital status	Married	359	95%
	Single	18	5%
	Divorced	-	-
	Total	377	100%
Religion	Muslim	353	94%

	Orthodox	24	6%
	Protestant	-	-
	Others	-	-
	Total	377	100%
Ethnicity	Oromo	377	100%
	Ahmara	-	-
	Others	-	
	Total	377	100%

A total of 377 general informants and key informants, all of whom were over the age of 25, were used including 347 men, and 30 women. Men informants made up the majority (92%) of the sample. Five percent of theinformants were typically older than 65.

4.2 Medicinal plant species used by indigenous people of Mencho District.

The number of medicinal plants collected, identified and documented from the study area was 72 species distributed in 41 families.From a total of medicinal plants species 56 (77.8%) were used to treat human ailments 11 (15.3%) were used to treat livestock and 5(6.9%) were used to treat both human and livestock ailments, respectively.The most diverse families were *Asteraceae*and *Fabaceae*consist of 7species each followed by *Solanaceae, Rosaceae,Lamiaceae* with each 4specie,*Rutaceae*and*Euphorbiaceae*eachwith3species*Verbenaceae,Rubiaceae,Acanthaceae, Myrtaceae,Moraceae, Appiaceae* each with 2speciesand the rest families were represented by one species each (Table 3).

Table 3: List of the most commonfamilies of medicinal plants in study area.

No	Name of Families	No of species	Percentage (%
1	*Asteraceae*	7	9.7%
2	*Fabaceae*	7	9.7%
3	*Solanaceae*	4	5.6%
4	*Rosaceae*	4	5.6%
5	*Lamiaceae*	4	5.6%
6	*Euphorbiaceae*	3	4.2%
7	*Rutaceae*	3	4.2%
8	*Verbenaceae*	2	2.8%
9	*Myrtaceae*	2	2.8%
10	*Moraceae*	2	2.8%
11	*Appiaceae*	2	2.8%
12	*Rubiaceae*	2	2.8%
13	*Acanthaceae*	2	2.8%
14	Other 28 families	28	38.8%

4.3 Sources of medicinal plants in the study area.

From collected plant species that are used to treat humanand livestockailments were collectedfrom the wild vegetation 43(59.7%), homegardens15(20.8%)and cultivatedland 14(19.4%) respectively.According to the findings,43 (59.7%),15 (20.8%) and 14 (19.4%) of the medicinally significant plant species used to treat human and livestock ailments that were identified in seven kebeles in Mencho District were harvested fromthe wild, homegardensand cultivated landrespectively (Figure 2).

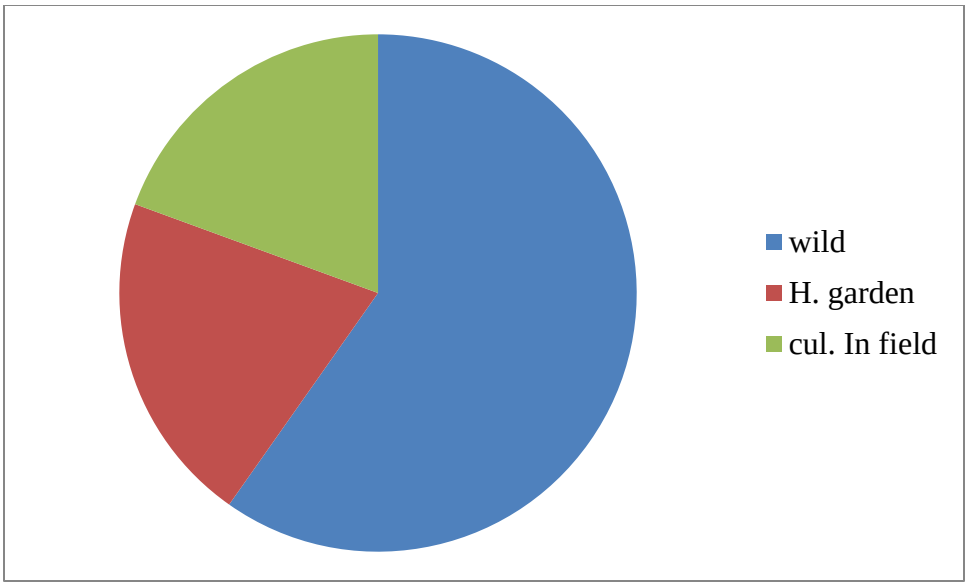

Figure 2:Source of medicinal plants used to treat human and livestock ailments in the study area

4.4 Dosage

The study revealed that indeginous people believe the effectiveness of medicine but there is great fear about the amount taken particularly for human medicines which are taken internally. In Mencho District the unit for measuring dosage to treat various ailments was poor. The traditional healers use different measurements for dosage, mostly they use their finger lines and finger nails for the measurement of the amount to be taken and different measuring tools like spoon, coffee cup, tea cup and glass cups are common for those remedies which are taken orally. But, these measurements are not accurate enough to determine the precise amount. For medicinal plants that are taken topically there is no clear cut dosage. The measurements used to determine the dosages are not standardized and doses given depend on the age, physical appearancesand health conditions; that is, children are given fewer doses than Adults, physically strong individual takes more dose than weak individual depending on the type of ailment.Though such prescription difference was practiced, still the amount prescribed by healers for both children and adults might not conform to the standard prescriptions as in modern medical literature.According to the discussion made the healers of Mencho District never administer treatments that are taken internally to pregnant women, for children below six months of age and people under unconsciousness.

4.5 Medicinal plant species used to treat human ailments.

From 72 medicinal plants collected, identified and documented in the study are56 species distributed in 26 families are used to treat human ailments.These plants are used to treat 28 different types of humanailments.A ailment canbe treated with combination ofplant species or single plant. For example, Evil eye can be treated with 7 species, Tonsillitis, Wound and Cough with 6 species, Teeth infection and Eye infection with 5 species each(Table 4).The fact that the above mentioned ailments being treated by a number of species is due to diverse knowledge of the people on plant useand ease of accessibility of plant species for treatment.

Table 4*:* Human ailments and number of plant species used

No	Ailment treated	Total plant Species	Percent (%)
1	Evil eye	7	9.72%
2	Tonsillitis	6	8.33%
3	Cough	6	8.33%
4	Teeth infection	5	6.94%
5	Eye infection	4	6.94%
6	Wound	5	8.33%
7	Blood pressure	3	4.2%
8	Tape worm	3	4.2%
9	Diarrhea	3	4.2%
10	Swelling	2	2.8%
11	Ring worm	2	2.8%
12	Bone break	2	2.8%
13	Blood clothing	2	2.8%
14	Skin rush	2	2.8%
15	Hemorrhoid	1	1.4%
16	Febrile illness	2	2.8%
17	Bleeding	1	1.4%
18	Kidney infection	1	1.4%

19	Streptothricosis	1	1.4%
20	Homebodies	1	1.4%
21	Spider	1	1.4%
22	Tetanus	1	1.4%
23	Anemia	1	1.4%
24	Typhoid	1	1.4%
25	Goiter	1	1.4%
26	Gonorrhea	1	1.4%
27	Ascariasis	1	1.4%
28	Digestive problem	1	1.4%

4.5.1 The growth form of medicinal plants used to treat human ailments.

The following figure illustrates the growth form of medicinal plant species used to cure human illness in the study areas: herbs 24(33.3%), shrubs 18 (25%), trees 14(19.4% respectively (Figure.3).

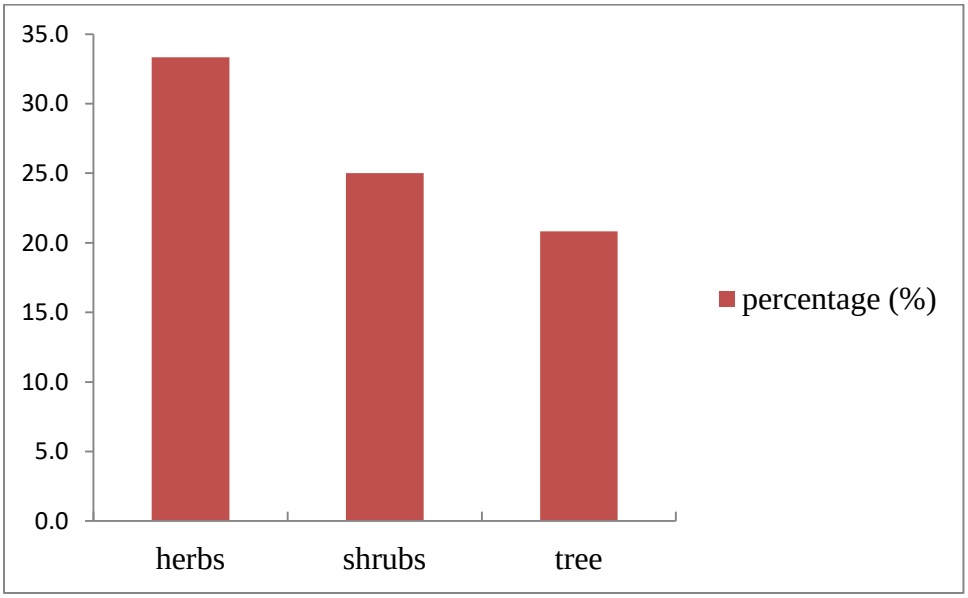

Figure 3: Growth form of plants used for medicinal purposes for human ailments

4.5.2 Medicinal plant parts used to treat human ailments.

From collected medicinal plant species used by local people of the study area leaves(35%) are reported the most plant part for remedy preparation, followed by roots 11 (15%), seeds and barks 7 (9.7%) each, fruits and flowers 3 (4%) each (Table 5).

Table 5 :Parts of medicinal plants used for human ailment treatments

No	Species	No of plant species	Percent
1	Leaves	25	35%
2	Roots	11	15 %
3	Seeds	7	9.7%
4	Bark	7	9.7%
5	Fruit	3	4%
6	Flower	3	4%
Total		56	77.8%

4.5.3 Medicinal plant preparations for human ailments

The people in the study area use a variety of techniques to prepare traditional remedies for various conditions when it comes to the remedy for humans. Depending on the ailment being treated andwhere it is actually located, different preparations are used. The main technique for preparing plant parts as remedies wascrushing, which accounts for22 (30.6%) followed by powdering 13(18%), pounding7 (9.7%), chewing 5 (6.9%), roasting 4 (5.6%), squeezing3(4.2%)and rubbing 2(2.8%)(Figure 4).

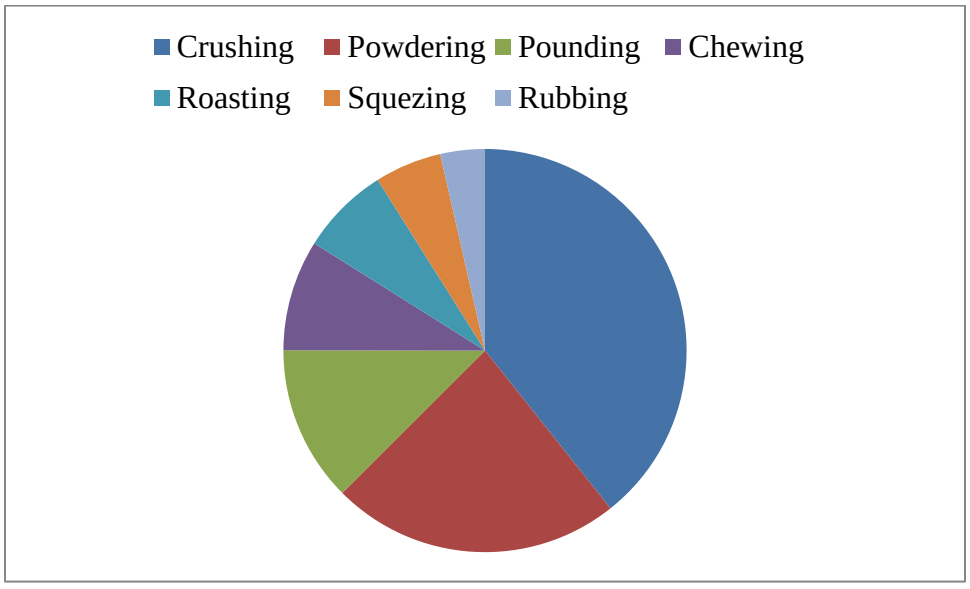

Figure 4: Method of medicinal plant preparations for human ailment

4.5.4 Method of application of medicinal plants used to treat human ailments

The current study indicated that the oral administration accounted for 38 (53%),dermal applicationfor 9 (12.5%), nasal administration for 3 (4.2%), both oraland dermal application for 6 (8.33%) and oraland nasal combined for 1 (1.4%) each (Table 6).

Table 6: Methodsof application of medicinal plants used to treat human ailments.

Number	Methods of application	Number of informants	Percentage (%)
1	Oral	204	53%
2	Dermal	48	12.5%
3	Nasal	16	4.2%
4	Oralanddermal	32	8.33%
5	Oral and nasal	6	1.4%

4.6 Medicinal plants used to treat livestock ailments.

From the collected medicinal plants, 11 species belonging to 10 families were used for treatment of livestock ailments.These are *Ricinus communis, Euphorbia amplyphla,Vernonia amygdalina, Ficus sur, Clausena anisata, Cupresus lusitanica, Senna didymobotrya, Nicotiana tabacum, Lepidium sativum,Allium sativum*and *Nigella sativa*.As most informants agree, even though the area has high number of livestock population, the local people do not have enough knowledge about ethnoveterinary medicinal plants compared to those used for treatment of human ailments.

Regarding their habitats,73% species were collected from the wild and27%plant speciesfrom cultivated land. More species for livestock treatment were collected from the wild. And also in the study areaherbs like; *Nicotiana tabacum, Lepidium sativum,Allium sativum*and *Nigella sativa*and shrubs like; *Clausena anisata, Sennadidymobotrya*andtrees like; *Ricinus communis, Euphorbia amplyphla, Ficussur, Vernonia amygdalina*and *Cupresus lusitanica*wereused only for the treatment of livestock ailments.

4.6.1Major livestock ailments in the study area.

There are seven cattle ailments in total that have been recognized as being treated by localpeople of medicines.Blacklegwho is treated by three species, followed by abdominal pain and skin

infectionseach treated bytwo species.Mule malaria, Leeches, Anthrax andBloating areeach treated by one species in the research area (Table 7).

Table 7: Livestock ailments and number of plant species used

No	Ailment treated	Total plant Species	Percentage (%)
1	Anthrax	1	1.4%
2	Blackleg	3	4.2%%
3	Mule malaria	1	1.4%
4	Bloating	1	1.4%
5	Leeches	1	1.4%
6	Abdominal pain	2	2.8%
7	Skin infections	2	2.8%

4.6.2 Medicinal plant parts used to treat livestock ailments.

Incomparison to other plant parts, leaves were more frequently utilized for preparations when treating livestock ailments. From plant parts documented to prepare medicines to livestock ailments, leaves accounted the highest part by 7 species (9.7%) followed by seeds, 3 species (4.2%)and bark 1 species (1.4%)(Figure 4).

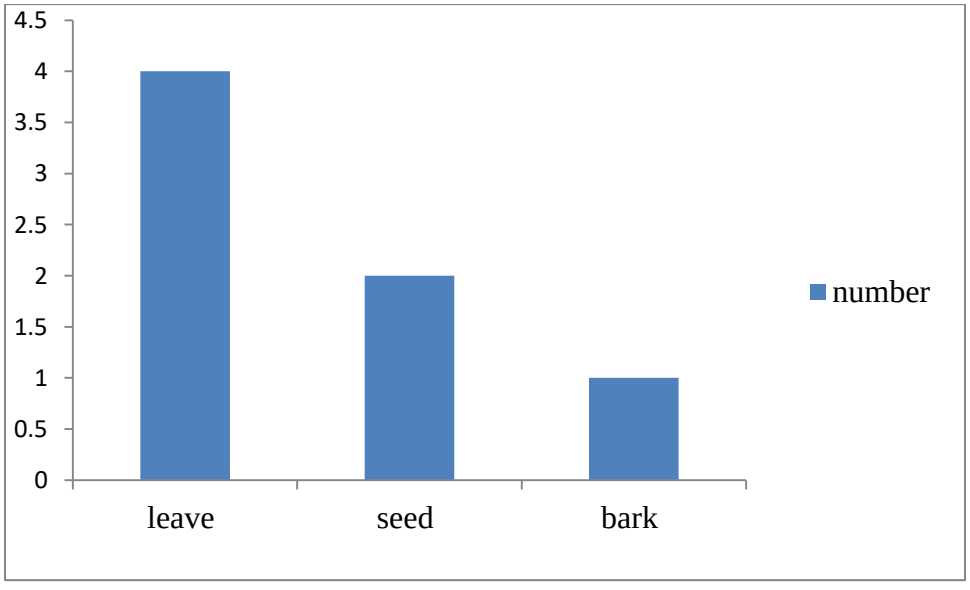

Figure5:Plant parts used to treat livestock's ailments in the study area

4.6.3 Preparation of medicinal plant used to treat livestock ailments.

The preparation method of livestock medicinal plants includes various techniques.Such as, crushing, pounding, powdering, roasteting and exudating.Remedy preparations vary based on the type of ailments treated and the actual site of the ailment. Crushing, which accounts for 4(5.6%), followed by pounding 3 (4.2%), powdering 2(2.8%) roasteting 1(1.4%)and exudating 1(1.4%) were methods of remedy preparations used bypeople in Mencho District.Crushing was the most frequently reported method of preparation of traditional medicine in the study area.

4.6.4 Application of medicinal plant used to treat livestock ailments

The method of applications like oral, dermal and nasal have been documented in associated with various ailments. Oral application of remedies was found to be the highest which accounted for 8(11%) followed by dermal 2 (3%) and nasal 1(1.4%) each (Figure 6).

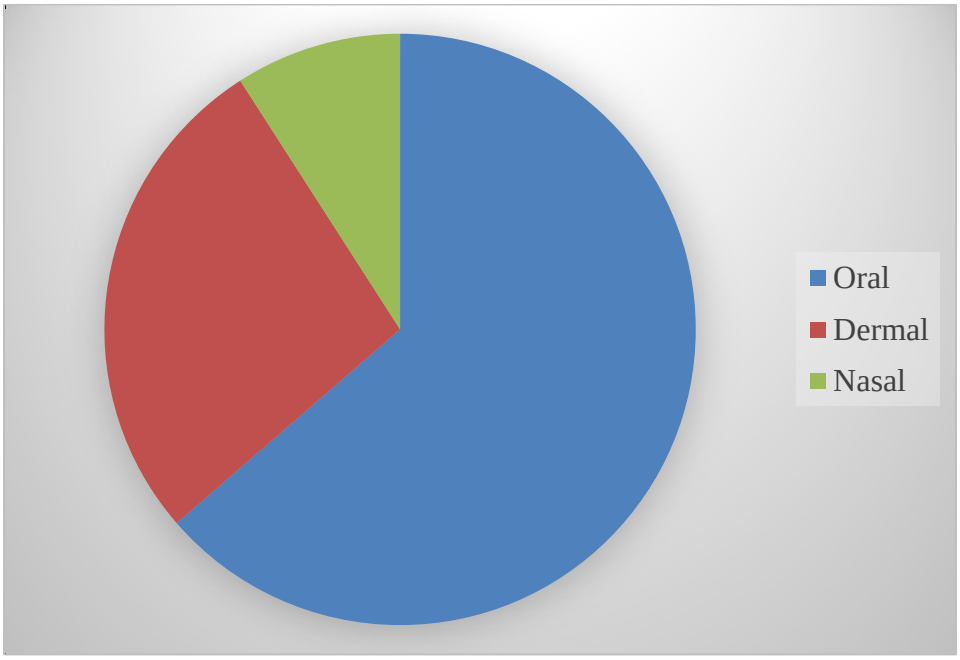

Figure 6 : Methods of application of medicinal plants used to treat livestock's ailments in the study area.

4.7 Medicinal plant species used to treat both human andlivestock ailments.

The plant species used to treat bothhumanandlivestock ailments are *Justicia schimperiana, Phytolaccadodecandra, Vernonia amygdalina, Trigonella foenumgraecum*and*Hagenia abyssinica*species. From these five different species, four species collected from wild vegetation, while one species gathered from cultivated field. Regarding growth form two are trees,2 are shrubsand one is herb.The parts of a plant used for remedy preparation of human and livestock ailments are seed and root stood first each with 2 species(2.7%) and leaves account 1(1.4%).The common forms of preparationsare pounding2(2.8%) followed by powdering 1(1.4%), pulverizing and powdering each 1(1.4%) and crushing and pounding each 1(1.4%).The methods of application oral and dermal have been documented in associated with various ailments. Oral application of remedies was found to be the highest which accounted for 6 (8.3%) followed by dermal 2 (2.8%) as described.

4. 8 Informant consensus factor (ICF)

According to the incidence of the ailment in the study area, the ailments were grouped into different categories. Then, ICF was calculated for each category of ailment. The value of the factor ranges from 0 to 1;the value of 1 indicates there is a high rate of agreement between informants. Therefore,results showed thatthe highest ICF values were recorded for Abdominal dryness,Ascariasis, Spider andGoiter (100% each), scored the highest informant consensus factorfollowed byTape worm,Eye infection,Blood pressure,Snake bite,Ring worm,Teeth infection,Evil eye,Febril illnessand wound(Table 8).

A high value of ICF indicates there is a consistency between key informants to treat this ailment, while a low value indicates there is a variation between key informants' agreement on plant species usage in treating a given ailment category.For example,in the study area the lower informant consensus factor 0.83 to 0.85 scored for the category of ailments Wound andFebril illness respectively.This category may be indicative for lack of consistency in the use of plant species for these ailment.

Table 8: Informant consensus factor by categories of ailments in the study area.

Disease category	Number of species (nt)	Numberof use citation (nur)	ICF
Evil eye	7	66	0.90
Teeth infection	5	51	0.92
Wound	4	19	0.83
Eye infection	3	21	0.96
Ring worm	3	40	0.94
Blood pressure	2	33	0.96
Tape worm	2	39	0.97
Febril illness	2	8	0.85
Snake bite	2	31	0.96
Abdominal dryness	1	11	1
Ascariasis	1	21	1
Spider	1	9	1
Goiter	1	15	1

4.9 Fidelity level

Fidelity level values of selected medicinal plants were calculated against frequently reported human ailments.The fidelity values of medicinal plants range from 0.45%-100% in the study area.Therefore, medicinal plants such as*Acmella caulirhize, Echinops kebericho*and*Allium sativum* were the highest fidelity level (100%, 99% and 98%) respectively.The highest FL value of medicinal plants indicates that they have high healing potential in the study area (Table 9).

Table 9: Fidelity value of traditional medicinal plants for the most frequently reported ailments

No	Medicinal plants	Disease treated	Ni	N	FL=Ni/NX100
1	Vacheli*aabyssinica*	Goiter	32	38	0.84
2	*Echinops kebericho*	Evil eye	150	151	0.99
3	*Eucalyptusglobulus*	Cough	39	45	0.86
4	*Acmella caulirhize*	Tonsillitis	97	97	1.00
5	*Phytolacca dodecandra*	Rabies	83	105	0.79
6	*Allium sativum*	Teeth infection	105	107	0.98
7	*Coffea arabica*	Wound	26	36	0.72
8	*Ocimum lamiifolium*	Febrile illness	15	33	0.45

4.10 Preference ranking

People favor one species over another when different species are recommended for the same health issue. The most perefered remedy for curing ailments of the evil eyewas *Echinopskebericho,* followed by *Ricinuscommunis*and*Carissa spinarum*was the least effective(Table 10).

Table 10: Preference ranking of medicinal plants used for treating evil eye.

Plant species	Informants(I_1- I_8)								Total	Rank
	I_1	I_2	I_3	I_4	I_5	I_6	I_7	I_8		
Echinopskebericho	7	8	8	7	7	6	8	7	58	1st
Ricinus communis	8	6	5	5	8	5	7	6	51	2nd
Withania somnifera	6	7	6	4	6	4	4	8	45	3rd
Afrocarpus falcatus	5	2	7	8	3	8	6	4	43	4th
Brucea antidysenterica	2	3	3	3	5	7	2	5	30	5th
Hypericumquartinianum	4	1	2	6	4	1	5	3	26	6th
Olea europaea	3	5	1	1	2	3	3	1	19	7th
Carissa spinarum	1	4	4	2	1	2	1	2	17	8th

4. 11Direct matrix ranking

In the study area, the majority of the population used wild plants for a variety of uses, including construction, charcoalproduction, firewood collection, furniture manufacture and medicine. Direct matrix ranking was carried out to evaluate the relative importance and their multi-purpose uses. Of these, six commonly reported multipurpose species and five use-categories were used to calculate direct matrix ranking with the help of five informants.Result showed that *Cordia Africana* ranked first and hence it is the plant most exploited for various purposesfollowed by *Juniperus procera, Eucalyptus globulus, Vachelia abyssinica, Crotonmacrostachyus*and*Afrocarpus falcatus* (Table 11). So, the top ranked species are most likely to be highly threatened as they are used for many purposesand deserve attention for conservation.

Table 11 : Direct matrix ranking for multipurpose species

Use categories	*Cordia africana*	*Juniperus procera*	*Eucalyptus globulus*	*Vachelia abyssinica*	*Croton macrostachyus*	*Afrocarpus falcatus*
Construction	4	3	5	1	1	1
Charcoal production	4	2	1	4	3	3
Fire wood collection	5	5	3	5	4	3
Furniture	5	5	4	1	1	2
Medicine	2	2	3	3	3	1
Total	20	17	16	14	12	10
Rank	1st	2nd	3rd	4th	5th	6th

Keys: (5 = best, 4 = very good, 3= good, 2 = less used, 1= least used).

4.12 Paired comparison

Paired comparison was one method that to determine the most preferred medicinal plants among the five species that were used to treat teeth infections in the study area. The responses of ten informants showed that *Vachelia abyssinica* ranked first followed by *Erythrina brucei* (Table

12). The result indicated that *Vachelia abyssinica* was the most preferred while *Prunus africana* was the least favored over the other plant species cited in treating the teeth infection.

Table 12: Paired comparisons of five medicinal plant species used to treat teeth infection.

Medicinal plants	Informants (I_1 to I_{10})											
	I_1	I_2	I_3	I_4	I_5	I_6	I_7	I_8	I_9	I_{10}	Total	Rank
Vachelia abyssinica	4	3	4	4	4	3	3	4	3	4	36	1st
Erythrina brucei	2	4	2	3	2	3	3	2	2	3	26	2nd
Allium sativum	2	1	2	1	2	1	2	2	1	1	15	3rd
Lepidium sativum	1	1	1	1	1	2	1	1	2	1	12	4th
Prunus africana	1	1	1	1	1	1	1	1	2	1	11	5th

4.13 Threat and conservation practices of medicinal plants

4.13 .1 Threats of medicinal plants.

In Mencho District from the interview of informants, various factors were recorded as the main threats for medicinal plants in the area. According to informants response the most mentioned threats to medicinal plants of the study area are agricultural expansion 227 (60%), construction 76 (20%), grazing land 37 (10%), fire wood collection 19 (5%), timber production 11 (3%) and charcoal production 7 (2%) in the studay area.

4.13.2 Conservation practices of medicinal plants.

When we see conservation practices of medicinal plantsin the study area, plants are essential to human survival and daily activity. In the district from the interview of informants, various factors were recorded as the main threats for medicinal plants in the area.Regarding conservation of medicinal plants in the District very poor observation was recorded. Some practitioners have started to conserve medicinal plants by cultivating at homegardens, though the effort was very small.According to the healers, nowadays searching of medicinal plants require long time and moving long distance even going to neighboring District to collect the plants. Even some healers have started to grow some medicinal plants in the coffee plant as a fence and in their home garden as a result of scarcity of plants in the wild. For example, about (20.8%) plant species were collected from homegardens and (19.4%) plant species were collected fromcultivated land.These plants include;*Echinops kebericho, Zingiber officinale, Ocimum lamiifolium, Withania*

somnifera, *Ruta chalepensis*, *Dicliptera laxata*, *Rosa rubiginosa*and *Pentas lanceolata*.This indicates there is an effort to start conserving afew medicinal plants.

5. DISCUSSION

The present study revealed that the number of medicinal plants collected, identified and documented from the study area was 72 species distributed in 41 families.From a total ofmedicinalplants species 56 (77.8%) were used to treat human ailments,11 (15.3%) were used to treat livestock and5(6.9%) were used to treat both human and livestock ailments respectively.This finding is inline with the finding of Haile *et al.,* 2008 which says from collected medicinal plants large numberand percentage are used to treat human ailments than livestock ailments. The study was carried inBale Mountain National Park, Ethiopia.

The most diverse families were *Asteraceae* and*Fabaceae*which were 7species each; followed by *Solanaceae,Rosaceae*and*Lamiaceae*with4specieseach.*Rutaceae*and*Euphorbiaceae*with3speciese ach,*Verbenaceae,Rubiaceae,Acanthaceae,Myrtaceae,Moraceae, Appiaceae* with 2species each and the rest families were represented by one species each.This finding shows that family *Asteraceae* and *Fabaceae* contributed the highest number of medicinal plant species when compared to other families.Similar to this result another study in Ethiopia also noted that *Asteraceae* was the dominant family with 5–15 medicinal plant species among others (Getaneh and Girma, 2014; Chekole *et al.,* 2015).The dominancy of the *Asteraceae* family may be due to it contains a wide range of biologically active compounds and the largest families in the plant kingdom (Gazzaneo *et al.,* 2005; Simbo, 2010; Chijindu *et al*., 2020). Similar to this finding several studies in Ethiopia (Lulekal *et al.,* 2008; Mesfin *et al.,* 2009; Abera, 2014; Amsalu *et al.,* 2018;Kidane *et al*., 2018; Tefera, 2019) have reported *Fabaceae* as a dominant family containing 5–26 medicinal plant species. The fact that similar plant species have been reported from various regions of the nation for their medicinal properties may indicate that these plants actually have some remedial potential and that there is information flow between various localities of the Mencho District.

The sources of medicinal plants are wild vegetation 43 (59.7%), homegardens 15 (20.8%) and cultivated land 14 (19.4%). Some investigations in Ethiopia found that more people picked

therapeutic herbs from the wild than from homegardens and cultivated field.The resultis similar to many Ethiopian researchers (Gidey*et.al.,* 2010) indicated that the majority of medicinal plants were obtained from wild vegetation source.Again,this result agrees with a various reports from Ethiopia(Abera, 2014;Chekole *et al*., 2015; Amsalu *et al.,*2018),which reported 42.6%–81.6% of medicinal plant species were collected from natural vegetation.

The current findings showed that the local people in the study area believe the effectiveness of medicine but there is great fear about the amount taken particularly for human medicines which are taken internally. In Mencho District the unit for measuring dosage to treat various ailments was poor. The healers use different measurements for dosage, mostly they use their finger lines and finger nails for the measurement of the amount to be taken and different measuring tools like spoon, coffee cup, tea cup and glass cups are common for those remedies which are taken orally. But, these measurements are not accurate enough to determine the precise amount. For medicinal plants that are taken topically there is no clear cut dosage.The measurements used to determine the dosages are not standardized, and doses given depend on the age, physical appearances and health conditions; that is, children are given fewer doses than Adults, physically strong individual takes more dose than weak individual depending on the type of ailment.Though such prescription difference was practiced, still the amount prescribed by healers for both children, and adults might not conform to the standard prescriptions as in modern medical literature. According to the discussion made the healers of Mencho District never administer treatments that are taken internally to pregnant women, for children below six months of age and people under unconsciousness.Dawit Abebe (1986) has also discussed lack of precisionand standardization as one drawback for the recognition of the healthcare system.

In the area 28 human ailments are identified which are treated by 56 plant species where single species can treat one ailment or a number of ailments. Similarly, one ailment canbe treated with combination of plant species or single plant.For example, evil eye can be treated with 7 species, tonsillitis,wound and cough with 6 species each,teeth infection and eye infection with 5 species each.The fact that the above mentioned ailments being treated by a number of species is, coupled with the frequent occurrence of the ailments and ease of accessibility of plant species for treatment. Most of the plant reported as medicinal plants in the study area was also reported as

having medicinal properties by different people from different parts of Ethiopia. For instance, Ermias Lulekal *et al* (2013) reported 37 species of medicinal plants from North Shewa Zone.

The growth form of medicinal plant species used to cure human illness in the study areas are herbs 24(33.3%),shrubs 18 (25%) trees 14 (19.4%) respectively. In which herbs were the dominantgrowth forms.This inline with the work of Gidey, (2001), Endalew Amenu (2007),Tesfaye *et al*.,(2009) in which herbs take the first lead.

The current study revealed that leaves 26 (36%) were the dominant plant part for remedy preparation, followed by roots 11 (15%), seeds and barks 7 (9.7%) each, fruits and flowerswith 3 (4%) each (Table 6). This finding inline with various studies conducted in Ethiopia (Zerabruka 2012; Meragiaw *et al.,* 2016; Amsalu *et al.,* 2018; Kidane *et al.,* 2018; Tefera 2019; Kassa *et al.,* 2020) reported leaves (32.6%-56% medicinal plants) as the most widely used plant parts.And also other finding is inline with the results of Tamene *et al.* (2000) study conducted in Cheffa showed that the highest plant parts used for preparation of remedies is leaf (56.89%).

Various methods of remedy preparations from medicinal plants were used in the study area.The main technique for preparing plant parts as remedies was reported to be crushing, which accounts for 22 (30.6%) followed by powdering 13 (18%), pounding 7(9.7%), chewing 5(6.9%), roasting 4 (5.6%),squeezing, 3(4.2%), rubbing 2(2.8%). The findings indicated that the majority of remedies made from a single plant species, whereas only a small number of remedies were made from several plant species. This study is inline with Kassa *et al.* (2020) in Minjar-Shenkora District, North Shewa Zone and Amsalu *et al*. (2018) in Gozamin District, East Gojjam Zone.

The present study showed that oral application for human accounted for 38 (53%) follwed by dermal application for 9(12.5%), nasal application for 3 (4.2%), both oral and dermal application for 6 (8.33%) and oral and nasal combined for 1(1.4%) (Table 6). This result is inline with various studies in Ethiopia and other countries (Zerabruka & Yirga, 2012; Chekole *et al*., 2015; Meragiaw *et al*., 2016; Mersha *et al.,* 2016; Amsalu *et al.,* 2018;Kidane *et al.,* 2018;Tefera, 2019) they reported that the major way of medicinal plants administration was through oral route with 42.5–74 percentage.

From the collected medicinal plants, 11 species belonging to 10 families were used for treatment of livestock ailments.These are*Ricinus communis,Euphorbia amplyphla,Vernonia amygdalina,*

Ficus sur, Clausena anisata, Cupresus lusitanica, Sennadidymobotrya, Nicotiana tabacum, Lepidium sativum,Allium sativum and *Nigella sativa.*Regarding their habitats,8(73%) species were collected from the wild and 3 (27.3%) from cultivated land. More species for livestock treatment were collected from the wild. Similar study conducted by Giday *et al.* (2003) from Zay people in Ethiopia indicates harvesting of 82%medicinal plants from the wild and also otherstudies in Ethiopia is inline with medicinal plant species are harvested from wild habitats (Lulekal *et al.* 2008; Giday *et al.* 2009, and Yirga *et al.* 2010).

The current study indicated that, leaves were more frequently utilized for preparations while treating livestock ailments as compared to other plant parts.From plant parts used to prepare remedy for livestock leaves are the highest followed by seeds and bark (Fig.4).The finding of Hailemariam *et al.* (2009), Yigezu *et al*. (2014), Usmane *et al.* (2016), Mohammed *et al.* (2016) and Feyera *et al.* (2017) in Ethiopia indicates similar findings.

The present study showed that the preparation method of livestock medicinal plants includes various techniques.Such as, crushing, pounding, powdering, roastetingand exudating are carried out. From this crushing, which accounts for 4 (5.6%), followed by pounding 3 (4.2%), Powdering 2(2.8%), roasteting 1(1.4%)and exudating 1(1.4%) were methods of remedy preparations used by the local people in Mencho District.Crushing was the most frequently reported method of preparation of medicine in the study area. This may be due to the possibility of effective extraction of plant ingredients when crushed that its curative potential would increase.

The preparations are either used fresh or can be stored in different cleanand dry containers for later use. Preparations may involve using a single plant part or mixtures of different organs of the same plant or mixture of organs from different plants.This finding is also inline with the results of Tamene *et al.* (2000), in Cheffa who revealed that pounding, crushing, and squeezing (88.88%) are the most commonly used mode of preparation. Also this agrees with the work of Kuma (2014).The methods of application were oral, dermal and nasal have been documented in associated with various ailments in the study area. Oral application of remedies was found to be the highest which accounted for 28(39%) followed by dermal 12 (17%) and nasal 6(8.3%) (Figure6).This finding is inline with research findings in other parts of Ethiopia (Tolossa *et al.,* 2013).

The current study revealed that plant species used to treat both livestock and human ailments are *Justiciaschimperiana,Phytolacca dodecandra,Vernonia amygdalina,Trigonellfoenumgraecum*and*Hagenia abyssinica species*. From these five different species, four species collected from wild vegetation, while one species gathered from cultivated field. This result inline with the work of Endalew Amenu (2007), in which the wild sources of plants for the treatment of livestock and human ailments are, took the lead.The common forms of preparations are pounding followed by powdering, pulverizing and crushing and pounding. The routes of application are oral and dermal have been documented associated with various ailments.Oral application of remedies was found to be the highest followed by dermal.

The ICF determined the informant agreement for a plant species in treating a specific ailment. ICF values range from 0 to 1, with values close to one indicating a high rate of informant agreement on plant species used against ailment categories. ICF values close to zero indicate a low level of agreement among informants regarding the use of a specific plant species for the treatment of a specific ailment. Abdominal dryness, Ascariasis, Spiderand Goiter are the highest informant consensus values (1) with each. When only one or a few plant species are indicated to be used by a large number of informants to treat a specific ailment, high informant consensus factors are obtained, whereas low ICF values indicate that informants disagree about which plant to use. This finding is inline with Heinrich *et al.* 1998.

In the present study, the fidelity values of medicinal plants range from 0.45% to 100% in the study area *Acmella caulirhize,Echinops kebericho* and *Allium sativum* species have the highest FL (100%, 99% and 98%) respectively. The highest FL value of medicinal plants indicates that they have high healing potential in the study area (Table 12). Those species that scored lower FL value such as *Ocimum lamiifolium(*45%*)* and *Coffea arabica (*72%*)* might explain that the species are little information about the use of this medicinal plant among the people of Mencho District.

The preference ranking of eight medicinal plant species used for treating evil eye was assessed. *Echinops kebericho* ranked first indicating that it is the most effective in treating evil eye followed by *Ricinus communis* and the least preferred specie was *Carissa spinarum*(Table 9). The direct matrix revealed that the most multipurpose medicinal plant was *Cordia africana,* which was followed by *Juniperus procera, Eucalyptus globulus, Vachelia abyssinica, Croton*

macrostachyus and *Afrocarpus falcatus* (Table 10).The paired comparison showed that *Vacheliaabyssinica* ranked first indicating that it is the most effective remedy for treating teeth infections followed by *Erythrina brucei*, whereas *Prunus africana* was the least preferred for teeth infectionscompared to the others provided for ranking (Table 11).

In Mencho District from the interview of informants, various factors were recorded as the main threats for medicinal plants in the area. These are agricultural expansion, construction, grazing land, fire wood collection, timber and charcoal production.The finding is inline with the result obtained by (Endalew Amenu 2007), which shows that the need foragricultural land use and population pressure severely threatened plant species in general and medicinal plants in particular.

When we see conservation practices of medicinal plants in the study area plants are essential to human survival and daily activity. In the district from the interview of informants, various factors were recorded as the main threats for medicinal plants in the area. In the District conservation of medicinal plants are observed to be very poor. Some traditional practitioners have started to conserve medicinal plants by cultivating at homegardens, though the effort was unsatisfactory. According to the healers, nowadays searching of medicinal plants require long time and moving long distance even going to neighboring District to collect the plants. Even some healers have started to grow some medicinal plants in the coffee plant as a fence and in their homegarden as a result of scarcity of plants in the wild. For example, about (20.8%) plant species were collected from homegardens and (19.4%) plant species were collected from cultivated land. These plants include;*Echinops kebericho, Zingiber officinale, Ocimum lamiifolium, Withania somnifera, Rutachalepensis,Dicliptera laxata, Rosa rubiginosa* and *Pentas lanceolata.* So, this implementation had shown that very small effort of medicinal plant conservation.The same information was document by Usmane *et al.* (2016), Amsalu *et al.* (2018). Similarly, Lulekal *et al.* (2008): Jima and Megersa (2018) indicated that only 5.7%- 13.8% of medicinal plants were cultivated in the homegarden in Mena Angetu, and Gozamin Districts shown that minimal effort of medicinal plant conservation.

6. CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

Overall the current study showed a variety of medicinal plants and knowledge about how to use, prepare and administer by the local community of the Mencho District.The medicinalplants species that have been identified, 56 are known to treat human ailments, 11 are used to treat livestock ailments and 5 species to treat both livestock and human ailments. From identified plant species, 43 medicinal plants were collected from the wild vegetation, 15 species from homegardens and 14 species from cultivated land identified. The wild has the greatest diversity of these therapeutic plants, which are found in a variety of settings.The majority of collected medicinal plants are herb species, followed by shrub and tree. The most popular plant part for preparation of medicines for people and animals is the leaf, followed by the roots. The primary method for administering medications was via oral ingestion, followed by dermal application. The healers prefer not all medicinal plants equally for the treatment of all ailments.

The main threat for medicinal plants in the area arises from agricultural expansion, construction, Grazing land, firewood collection, timber and charcoal production. Threat comes to medicinal plants due to the utilization of these plants for medicinal purpose is through over exploitation. Whereas threats that erode indigenous knowledge originates from secrecy, oral based knowledge transfer, unwillingness of young generation to gain the knowledge, unavailability of the species and influence of modern education and awareness factors are the major ones. Therefore, awareness rising should be made among the healers so as to avoid erosion of the indigenous knowledgeand to ensure its sustainable use. Further researchshould also be conducted on the reported medicinal plant species of the study area so as to utilize them in drug development.

6.2 RECOMMENDATIONS

The following suggestions for the sustainable use of medicinal plants were made in light of the study's findings:

- In-situ and ex-situ conservation activities should be practiced in the District through training model farmers to ensure the continuity of threatened medicinal plants.This can be achieved by:
    - Encouraging people to grow medicinal plants in homegardens, mixing with crops in farm lands and live fences.
    - Promoting the establishment of local botanical garden at least at District level.
    - Encouraging people to protect and enclose ritual and spiritual areas with higher distribution of medicinal plants in the locality.
- To increase the awareness of young people, the role of medicinal plants should be integrated into formal and non-formal education systems.
- Training the local people,on resourceuse value, management and conservation at kebele or District level by agricultural experts or development agents, as it facilitates an integration of resource conservation with sustainable use.
- Resources, especially plant resources are integral to the life of all biota, as they are the primary food producers. Life of world biota is directly or indirectly dependent on plant resources. Thus, local people of the study area should be involved in conservation and management plans of plant resources or their indigenous knowledge in their locality.

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APPENDICES

Appendix1:Format for collecting ethnobotanical information Jimma University
School of Graduate Studies.

College of Natural Science and Department of Biology

Dear respondents, I am _____and study Biology in Jimma University. I prepare some questions. The purposes of these questioners are to collect relevant and first hand information on the ethnobotanical study of medicinal plants used by indigenous people in your District. Your response is vital for my study. The information from respondents will keep confidential and will not affect any body in any way. So you are kindly requested to give your honest opinion with genuine ways. I assure that your response is only for academic purpose. Please read it carefully and respond only factual responses. Please don't hide the important information for the questioners.

PART ONE: General information and personal data

Indicate your response either by circling or by giving short answer on the space provided.

1. Date _____ Month _____Year _____
2. Name of respondent _____
3. Respondent's Sex: A. Male B. Female
4. Age: A. 25-40 B. 41-65 D. Above 65
5. Community/Nation _____ Language_____ Occupation _____
6. Respondent's address: Region ___ Zone ___ District ___ Kebele __ Village ____
7. Respondent's religion: A. Protestant B. Orthodox C. Muslim D. Other specify _____
8. Educ. status: A. Uneducated, B. Educated.
9. Respondent's marital status: A. Single B. Married
10. Family size: Men _____ Female _____

11.The role of respondent in the household: A. Husband, B. Wife, C. Son/Daughter, D. other

PART TWO:Ethnobotanical data for medicinal plants used by indigenous people

1. What are the main human health problems in your locality or Kebeles?
2. What are the main livestock health problems or ailments?
3. Do you use plants to treat ailment x in your locality?
    3.1. Name the plant----------

3.2. Habitat of the plant-----

3.3. Habit of the plant----------

3.4. Part of the plant used-------

3.5. Preparation methods---------

3.6. Amount used (dose) ---------

3.7. Application method----------

3.8. Treats to the above plant------

3.9. Method of conservation of the plant-----

3.10. Other uses of the plant----------

5. How do you prevent /control those ailments?

6. How do you treat human health problems?

7. How do you treat livestock problems?

8. Which plants do you use for treating those particular ailments?

9. Local name(s) of the plants?

10. Habit of the plant -t/s/h/c/hp?

11. Habitat of the plant-forest/home garden/road side//rocky area/agricultural Field/grazing land?

12. How widespread is the medicinal plants from your residence?

13. Plant parts used: Root/stem/root bark/leaves/ with Leaves/flowers/Others----------

14. Used alone mixed with other materials, concoction/decoction, others----------

15. Preparation for medicinal use: crushed and powdered/ crushed pounded/extract with /boiled/juice/ latex/: other----------

16. Dose/amount?

17. Does the dose differ among males, females, children, elders?

18. Any noticeable side effects?

19. How do you preserve traditional medicines?

20. Are there restrictions /taboos in collecting medicinal plants?

21. Are medicinal plants marketable?

22. Are there threats to those medicinal plants?

23. How do you conserve traditional medicinal plants?

Appendix2:List of human and livestock ailment in the study area.

No	English name	Local name
1	Evil eye	Budaa
2	Tonsillitis	Huba qonqoo
3	Cough	Qofaa
4	Teeth infection	Dhukkuba ilkanii
5	Eye infection	Dhukkuba ija
6	Wound	Madaa
7	Skin infection	Dhukkuba gogaa
8	Rabies	Dhukkuba saree
9	Stomachache	Dhukkuba garaa
10	Blood pressure	Dhibba dhiigaa
11	Tape worm	Koosoo
12	Diarrhea	Garaa kaasaa
13	Swelling	Dhiitoo
14	Snake bite	Cininnaa bofa
15	Ring worm	Roobbii
16	Bone break	Caba lafee
17	Abdominal pain	Garaa cininnaa
18	Blood clothing	Itituu dhiigaa
19	skin rush	Shiffee
20	Hemorrhoid	Dhukkuba kintarootii
21	Febrile illness	Michii
22	Bleeding	Dhangala'uu dhiigaa
23	Kidney infection	Dhukkuba kalee
24	Streptothricosis	Bacteria
25	Spider	Hadhaa shararriitti
26	Tetanus	Mura sibiilaa danda'aa
27	Blackleg	Sinchii
28	Anemia	Hiri'ina ayiranii
29	Typhoid	Taayifoyidii
30	Anthrax	Abasanga
31	Mule malaria	Busaa gaangee
32	Bloating	Bokoksaa
33	Leeches	Dhulaandhula
34	Goiter	Qufa mormaa
35	Gonorrhea	Dhukkuba coophxoo
36	Ascariasis	Raammoo minii
37	Maggots	Raammoo Foonii
38	Digestve problem	Sirna bula'insa nyaataa

Appendix 3:List of Medicinal Plants collected and identified in the study area with their family, local name, ailments they treat, Preparation, dosage and their habits.

Scientific name	Family name	Local name	Use	Habits	Disease treated	Partused,methods of preparations and routes of application
Vacheliaabyssinica Hochst.ex.Benth	*Fabaceae*	Laaftoo	Hu	T	Goiter	Fresh leaf of *Vachelia abyssinica* is damaged and the sap was applied to the goiter for three days
					Teeth infection	Fresh bulb of it crushed and squeezed and roasted on fire and chewed on affected teeth
					Skin rash	Pounded bulb of it and put on the area
Acmella caulirhiza Delile	*Asteraceae*	Gutiichaa	Hu	H	tonsillitis	Crushed by teeth and swallowing when the problem is happen
Afrocarpusfalcatus (Thunb.) R.B. ex Mirb	*Podocarpaceae*	Birbirsa	Hu	T	Evil eye	Stem of this plant is burned and smoke inhale orally
Albizia gummifera (J.F.Gumel.) C.A.Sm	*Fabaceae*	Hanbabeessa	Hu	T	tonsillitis	Chewed and swallowing
*Allium sativum*L. (Willam Woodvlle)	*Alliaceae*	Qulubbii adii	L		Blackleg	The barks are pounded and given to cattle
				H	Typhoid	Dried or fresh bulb with *Allium cepa* and *Nigella sativa* is soaked in water, filtered and given orally for three days.
					Stomachache	*Allium sativum, Ginger officinale & Nigell satva* crushed & mixed with water give one cap for three days
Artemisia abyssinica Sch. Bip.ex A. Rich	*Asteraceae*	Gooddoo gurracha	Hu	H	Evil eye	Crushed the leaf and mixed with water then drinking
Bersama abyssinica Fresen	*Melianthaceae*	Lolchisaa	Hu	T	Snake bite	Fresh pulverized immediately during the problem happen
Beta vulgaris L	*Chenopodiaceae*	H/ diimaa	Hu	H	Anemia	The root of this plant is cooked and eat with any food
Bidens macroptera MesfinTadesse.	*Asteraceae*	Tuufoo	Hu	H	Blood clothing	Leaves crushed and squeezed on bleeding part put on dermal
Calpurnia aurea (Aito.) Benth	*Fabaceae*	Ceekaa	Hu	Sh	diarrhea	Leaf paste mixed with water is applied
*Cardia africana*Lam	*Boraginaceae*	Wadeessa	Hu	T	Streptothricosis	Fresh leaves are pounded and then juice is added and applied on the skin surface. juice is added and applied on three days
Caricapapaya L.	*Caricaceae*	Paapaayee	Hu	T	Wound	Damage fresh leaf of *carica* papaya and paint its juice on affected area.
Carissaspinarum (Forssk.ex Endl.	*Apocynaceae*	Hagamsa	Hu	Sh	Evil eye	Dried root of it would be crushed and roasted on fire and the smoke would be inhaled
Catha edulis (Vahl) Frossk.ex.Endle	*Celastaceae*	Caatii	Hu	Sh	Coughing	Boil the leaves and stem of *Catha edulis* and added to water then add with honey and Sometimes add to butter, finally drink when it cool.
Citrus aurantifolium (L.)Burn.f	*Rutaceae*	Loomii	Hu	Sh	Blood pressure	Juice of it consumed

Clausena anisata (Willd.) Benth	*Rutaceae*	Ulmaayii	Hu	Sh	snake bite	Fresh leaf of it crushed and mixed with water and given immediately for the wounded people.
			L		skin infection	Fresh leaf of it together with *Justica schimperiana* would be exudates and cream on skin
Coffea arabica L	*Rubiaceae*	Buna	Hu	Sh/T	Diarrhea	The seed of it roasted and crushed then given to the patient by mixing with sugar and salt for three days
					wound	Roasted and creamed and powder of it on damaged area
Colocasia esculenta (L.) schott	*Araceae*	Goodaree	Hu	H	Homebodies	Squeezed fresh leaves of it and roasted on fire and packed to affected area
Crotonmacrostachyus Del.	*Euphorbiaceae*	Bakkanisa	Hu	T	swelling	The fresh leaf of it damaged and roasted of fire and squeezed on affected area.
					Ring worm	The fresh bulb juice of *crotonmacrostachys* squeezed and applied on damaged area.
					Tetanus	Crushed fresh bulb of it and squeezed juice of it on affected part
					Tonsillitis	Compressed fresh bulbs juice of it and dropped on the area
Cucurbitapepo L	*Cucurbitaceae*	Dabaaqula	Hu	H	Tape worm	Dried seed is given for eating before food
Cupresus lusitanica Miller	*Cupressaceae*	Gaattiraa	L	T	Abdominal pain	Leaves crushed ,mixed with water and given for cattle
Datura stramonium L.	*Solonacceae*	Asaangira	Hu	H	skin infection	Powdered seeds applied directly on the skin
					Wound	The leaf crushed and mixed with water, then one to three drop of its fluid dropped on the wound continuously
Daucus carota L.	*Appiaceae*	Kaarootii	Hu	H	Eye infection	Fresh root of *Davcus carrota* eat until decrease its effect
Dicliptera laxata Hochst.ex A.Rich.	*Acanthaceae*	Togoo	Hu	H	Eye infection	Fresh pulverized for once a days
Echinopskebericho Mesfin	*Asteraceae*	Qaraabicho	Hu	H	Evil eye	Dried bark of it and crushed and put on fire and sniffed
					Abdominal pain	Chewed fresh bark of it with salt and swallowed its juice
Ekebergiacapensis Sparm.	*Meliaceae*	Sombo	Hu	T	Wound	Bark of *Ekebergiacapensis* is powdered and half a spoon is added to wound.
Ensete ventricosum (Welw.)Cheesmana	*Musaceae*	warqee	Hu	H	Bone break	The of root of *Ensetventricosumis* cooked and eat with yoghurt for bone break
Erythrina brucei Schweinf	*Fabaceae*	Walleensu	Hu	T	eye infection	The drayed seed of it powdered and mixed with water and one cup of the mixture would be taken
					Teeth infection	Fresh bulb of it stayed and roasted on fire and chewed on affected teeth for 3 days
Eucalyptus globulus Charles louis	*Myrtaceae*	Bargamo adii	Hu	T	Cough	Pulverized seed of it and mixed powdered with water and drunk one glass of water
Euphorbia amplyphla Gmel.	*Euphorbiaceae*	Adaamii	L	T	Mule malaria	Roasted fresh leaves of it on fire and fumigating the mule
Feoniculum vulgare Miller,	*Appiaceae*	Wallaagoo	Hu	H	Gonorrhea	The leaves of *Foeniculum vulgare* boiled and drink when there is such problem

					Digestive problem	The leaves of *Foeniculum vulgare* boiled and drink when there is such problem
Ficus sur Forssk**.**	*Moraceae*	Harbuu	L	T	skin infection	Leaves of it would be crushed on affected part the bodies.
Ficus vasta Forssk	*Moraceae*	Qilxuu	Hu	T	Hemorrhoid	Sap dried root from it and powdered root of Pterolobium stellatum are mixed together and creamed to external hemorrhoid
			Hu		Rabies	Bark of *Ficus vasta Forssk*and root of *Prunus africana* are powdered together and backed with teff
*Guizotiaschimperiana(*Hochst.ex Walp.)	*Asteraceae*	keelloo	Hu	H	Eye infection	Fresh flower juice is mixed with water applied in to the eye Squeezed juice of it on affected area
Hagenia abyssinica (Bruce) J.F. Gmel.	*Rosaceae*	Koosoo	Hu	T	Maggots	Pulverized seed of it and mixed powdered with water and drunk one glass of water
			L		Maggots	Pulverized seed of it and mixed powdered with water and drunk one glass of water
Justicia schimperiana (Hochst.exNees)T Anders.	*Acanthaceae*	Dhumugaa	Hu	Sh	Rabies	The fresh root of it pounded and mixed with water and given at the bottom of cup on odd days for 3 weeks
			L		Rabies	The fresh root of it pounded and mixed with water and given at the bottom of cup on odd days for 3 weeks
*Kalanchoeslenceolat*A. Rich	*Crassulaceae*	Bosoqqee	Hu	H	Wound	The leaf put get fire then immediately fresh put to the affected part
Lepidium sativum Rottler ex.wight (L.)	*Brassicaceae*	Shinfaa(Feexoo)	L	H	Bloating	Seed is powdered, mixed with salt and given to cattle
Linum usitatissimum L.	*Linaceae*	Talbaa	Hu	H	Stomachache	Mixed seed of it with water and baking and given a glass of water
*Lippia abyssinica*L.	*Verbenacecae*	Koseret	Hu	H	Blood pressure	The leaf of *Lippia abyssinica* dried & powdered & three spoon of *Lippia* powder added to tea & give to human.
Lippia adonesis Hochst.ex.walp. var	*Verbenaceae*	Kusaayee	Hu	Sh	Ring worm	The leaf of *lippia adone*s is directly rubbed and on affected skin
Moesalanceolata Forssk	*Myrsinaceae*	Abbayii	Hu	T	Tape worm	Dried fruit soaked with local beer is given orally
Mentha spicata L	*Lamiaceae*	Nanaayee	Hu	H	Kidney infection	Crushed and drunk at empty abdomen for 5 continuous day.
					Blood pressure	The bulb of *Alliumcepa* crushed properly and added to water then filtered and drunk when there is hypertension
*Nicotianatabacum*L.	*Solanaceae*	Tamboo	L	H	Leeches	The crushed leaf will be mixed with water and salt the given to cattle when the problem is happen.
*Nigella sativa*L. (Black cumin)	*Runancculaceae*	Abasuuda	L	H	Abdominal pain	Seed is powdered ,mixed with water and given to cattle
Ocimum lamiifolium. Hocst. ex Benth	*Lamiaceae*	Damakase	Hu	Sh	Febrile illness	The crushed leaf will be mixed with coffee and tea then drunk
					Cough	Leaves of *Ocimum lamifolium* crushed and boiled with water for half day and then cooled and
Olea europaea L. (Walle.Don)	*Oleaceae*	Ejersa	Hu	T	Evil eye	Crushed leaf of it and boiled with water for one hour and drunk one spoon for 5 days

Pavonia urens Cav.Premnaresinosa	*Asteraceae*	Maxannee	Hu	H	Teeth infection	Roots are boiled and decoction then when cold during pin
Pentas lanceolata (Forssk.) Deflers	*Rubiaceae*	Surma	Hu	Sh	Bone break	Crushed the leaf will be mixed with water and sugar to give the people with the cup once a day
*Phytolacadodecandra*L.Herit	*Phytolacceae*	Handoodee	Hu	Cl	Rabies	pounded fresh root of it and mixed with water and 3 spoons is given on odd days for 3 weeks
			L		Rabies	pounded fresh root of it and mixed with water and 3 spoons is given on odd days for 3 weeks
Prunus persica (L.) Batsch	*Rosaceae*	Kookii	Hu	T	Swelling	Dried leaf powder mixed with food is given orally
Prunus africana (Hook.f.)Kalkm.	*Rosaceae*	Hoomii	Hu	T	Teeth infection	Pounded fresh bark of it and chewed on affected area
*Psidium guajava (*Linnaeus)	*Myrtaceae*	shafaffee	Hu	Sh/T	teeth infection	The fresh leaf is crushed and given orally
Pycnostchyus abyssinnica. Fresen	*Lamiaceae*	Yeeroo	Hu	Sh	Fibrililness	Boiled and washed with leaves of *Crotonmacrostachyus* and *Ocimumlamiifolium*
Ramnusprinoides L. Herit.	*Rhamnaceae*	Geeshoo	Hu	Sh	tonsillitis	Chew the leave until it stop the sense of illness
Ricinus communis L**.**	*Euphorbiaceae*	Qobboo	Hu	Sh	Evil eye	Chewed fresh or dried root of it with small amount of salt and swallowed its juice
			L		Blackleg	Leaves pounded, mixed with water and given to cattle
Rosa rubiginosa Mill.	*Rosaceae*	Tsigereda	Hu	Sh	Bleeding	The flower of this plant is crushed and added its juice in to nose after bleeding.
Rumexnepalensis Spreng	*Polygonaceae*	Baaruuda	Hu	H	Abdominal pain	The fresh root is crushed and given orally for five days
Ruta chalepensis L.	*Rutaceae*	Cilaaddami i	Hu	H	diarrhea	The pounded seed will be mixed with coffee tea then drunk
Salix mucronata Willd.	*Salicaceae*	Alaltuu	Hu	Sh/T	Tape worm	Dried fruit soaked with local beer is given orally
Sennadidymobotrya Fresen.	*Fabaceae*	Sanamaakii	L	Sh	Blackleg	Leaves are pounded and given to cattle
					Snake bite	The fruits or leaves are pounded while fresh and the juice is taken
*Sida schimperiana*L.	*Malvaceae*	Girincee	Hu	H	cough	The root of *Sida schimperiana* is crushed & mixed with water & give three cup of tea for five day morning.
					Eye infection	Fresh leaf juice drop is applied through eye
Solanum marginatum L.f	*Solanaceae*	Hiddii	Hu	Sh	Tonsillitis	Fresh fruit juice is applied topically
Thymusschimperi Ronniger	*Lamiaceae*	Xoosinyii	Hu	H	Ascariasis	The leaf will be crushed and boiled then drunk with tea
					Cough	The whole part is powdered and mixed with water then drunk during pain time with empty abdomen.
Trigonellfoenumgraecu L.(Fenugreek)	*Fabaceae*	Sunqoo	Hu	H	Stomachache	Seed is powdered ,mixed with water and five spoon of sugar and drunk a glass of water in the morning for 5 days
			L		Stomachache	Seed is powdered ,mixed with water

Urtica simensis Hochst	*Urticaceae*	Doobbii	Hu	H	skin infection	The root of *Urtica simensis* is crushed and mixed powders of barley then cooked and eat.
Vernoniaamygdalina Delile	*Asteraceae*	Ebbicha	L	T	Anthrax	The root will be crushed and mixed with water then give to cattle
			L		Skin infection	the leaf will be crushed and mixed with water then give to cattle
			H		Skin infection	The leaf is pounded and the patient body washed by the plant or the leaf of *Vernonia amygdalina*
Vernoniaauriculifea L.Herit.	*Amaranthaceae*	Reejjii	Hu	Sh	Blood clothing	Dressing with crushed leaves
Vigna vexillata (L.)A.Richard.	*Fabaceae*	Gurra hantuutaa	Hu	H	spider	Leaves crushed and rubbed on affected part
Withania somnifera (L.) Dunal	*Solanaceae*	Gizaawaa	Hu	Sh	Evil eye	The leaf will be crushed and put on fire then taken smoke
Zingiber officinale Roscoe	*Zingiberaceae*	Zingibila	Hu	H	Cough	Crushed and boiled then drunk like tea and coffee
					Tonsillitis	Chewing the rhizome and swallowing the juice

KEYS:Hu = Human, H =Herbs,Sh = Shrubs,T= Tree L = Livestock

Appendix 4: List of plants collected in the study area.

No	Scientific name	Family name	Local name	Habit	Code
1	*Acacia abyssinica* (Hochst.ex.Benth)	*Fabacea*	Laaftoo	T	GM 02
2	*Acmella caulirhiza* (Delile)	*Asteraceae*	Gutichaa	H	GM 048
3	*Afrocarpus falcatus* (Thunb.)	*podocarpaceae*	Birbirsa	T	GM 027
4	*Albizia gummifera* (J.F.Gumel.)	*Fabaceae*	Anbabeessa	T	GM 06
5	*Allium sativum* L.	*liliaceae*	Qulubbii adii	H	GM 066
6	*Artemisia abyssinica (*Sch. Bip.)	*Asteraceae*	Gooddo gurracha	T	GM 049
7	*Bersama abyssinica* (Fresen)	*Melianthaceae*	Lolchisaa	T	GM 046
8	*Beta vulgaris* L	*Chenopodiacea*	Hundee diimaa	H	GM 028
9	*Bidens macroptera* (Mesfin Tadesse)	*Asteraceae*	Tuufoo	H	GM 053
10	*Calpurnia aurea* (Aito.) Benth	*Fabaceae*	Ceekaa	Sh	GM 029
11	*Cardia Africana* L.	*Boraginaceae*	Wadeessa	T	GM 043
12	*Carica papaya* L.	*Caricaceae*	Paapaayee	T	GM 04
13	*Carissa spinarum*	*Apocynaceae*	Hagamsa	Sh	GM 035
14	*Catha edulis* (Vahl) Frossk.ex.Endl	*Celastaceae*	Caatii	SH	GM 055
15	*Citrus limon (*L.)Burm.f	*Rutaceae*	Loomii	SH	GM 058
16	*Clausena anisata* (Willd.) Benth	*Rutaceae*	Ulmaayii	SH	GM 036
17	*Coffea Arabica* L.	*Rubiaceae*	Buna	SH	GM 011
18	*Colocasia esculenta* (L.) Schott	*Araceae*	Goodaree	H	GM 034
19	*Crotonmacro stachyus (*Del.)	*Euphorbiaceae*	Bakkanisa	T	GM 01
20	*Cucurbita pepo* L	*Cucurbitaceae*	Dabaaqula	H	GM 031
21	*Cupresus lusitanica* (Mill.)	*Cupressaceae*	Gaattiraa	T	GM 052
22	*Datura stramonium* L	*Solonacceae*	Asaangira	H	GM 072
23	*Daucus carota* L.	*Appiaceae*	Kaarootii	H	GM 041
24	*Dicliptera laxata* (Hochst.exA.Rich)	*Ancanthaceae*	Togoo	H	GM 042
24	*Echinops kebericho* (Mesfin)	*Asteraceae*	Qaraabicho	H	GM 09
26	*Ekebergia capensis*	*Meliaceae*	Sombo	T	GM 056
27	*Ensete ventricosum* (Welw.)Cheesmana	*Musaceae*	worqee	H	GM 062
28	*Erythrina brucei* (Schweins)	*Fabaceae*	Walleensuu	T	GM 05
29	*Eucalyptus globulus*	*Myrtaceae*	Bargamo adi	T	GM 015
30	*Euphorbia amplyphla*(Gmel.)	*Euphorbiaceae*	Adaamii	T	GM 016
31	*Feoniculum vulgare* (Miller)	*Appiaceae*	Wallaagoo	H	GM 045
32	*Ficus sur* Forssk	*Moraceae*	Harbuu	T	GM 024
33	*Ficus vasta* L.	*Moraceae*	Qilxuu	T	GM 023
34	*Guizotaschimpri* (Hochst.)	*Asteraceae*	keelloo	H	GM 07
35	*Hagenia abyssinica* (Bruce)J.F. Gmel*.)*	*Rosaceae*	Koosoo	T	GM 010
36	*Justicia schimperia (*Hochst)T Anders	*Acanthaceae*	Dhumuugaa	Sh	GM 013
37	*Kalanchoes lenceolata* (A. Rich)	*Crassulaceae*	Bosoqqee	H	GM 065
38	Lepidium sativum (Rottlerex Wight.)	*Brassicaceae*	shinfaa	H	GM 064
39	*Linum usitatissimum* L	*Linaceae*	Talbaa	H	GM 040
40	*Lippia abyssinica* L	*Verbenacecae*	Koseret	H	GM 071
41	*Lippia adonesis* (Hochst.ex.walp. var*)*	*Verbenaceae*	Kusaayee	SH	GM 08
42	*Maesallan ceolata* (Forssk	*Myrsinaceae*	Abbayii	T	GM 026
43	*Mentha spicata* L	*Lamiaceae*	Naanaayee	H	GM 017
44	*Nicotiana tabacum* L.	*Solanaceae*	Tamboo	H	GM 063

45	*Nigella Sativa* L.(Black cumin*)*	*Runancculaceae*	Abasuuda	H	GM 069
46	*Ocimum lamifolium*.(Hochst. ex Benth)	*Lamiaceae*	Damakasee	SH	GM 018
47	*Olea europaea* L.(Walle.Don)	*Oleaceae*	Ejersa	T	GM 039
48	*Pavonia urens* (Cav.Premnaresinosa*)*	*Malvaceae*	Maxannee	H	GM 044
49	*Pentas lanceolata* (Forssk.) Deflers	*Rubiaceae*	Surma	SH	GM 070
50	*Persea americana* (Mill)	*Lauraceae*	Avokadoo	H	GM 059
51	*Phytolaca dodecandra* (L.Herit*)*	*Phytolaceae*	Handoodee	Sh	GM 038
52	*Prunus persica* (L.) Batsch,	*Rosaceae*	Kookii	T	GM 047
53	*Prunusafricana* (Hook.f.)Kalkm.	*Rosaceae*	Hoomii	T	GM 037
54	*Psidium guajava* (Linnaeus*)*	*Myrtaceae*	shafaffee	SH	GM 067
55	*Pycnostchs abyssinnca (*Fresen)	*Lamiaceae*	Yeeroo	SH	GM 057
56	*Ramnus prinoides* L.	*Rhamnaceae*	Geeshoo	SH	GM 014
57	*Ricinus communis* L.	*Euphorbiaceae*	Qobboo	SH	GM 012
58	*Rosa rubiginosa* (Mill.)	*Rosaceae*	Tsigereda	SH	GM 060
59	*Rumex nepalensis (*Spreng*)*	*Polygonaceae*	Baaruuda	H	GM 068
60	*Rutachalepensis* L.	*Rutaceae*	Cilaaddami	H	GM 021
61	*Salix mucronata* (Willd.)	*Salicaceae*	Alaltuu	H	GM 032
62	*Sennadi dymobotry* (Fresen*)*	*Fabaceae*	Sanamaakii	Sh	GM 054
63	*Sida schimperiana* L.	*Malvaceae*	Girincee	H	GM 033
64	*Solanum marginatum* L.f	*Solanaceae*	Hiddii	Sh	GM 050
65	*Thymus schimperi* (Ronniger)	*Lamiaceae*	Xoosinyii	H	GM 022
66	*Trigonell foenumgraecum*	*Fabaceae*	Sunqoo	H	GM 025
67	*Urtica simensis* Hochst	*Urticaceae*	Doobbii	H	GM 061
68	*Vernonia amygdalina Del.*	*Asteraceae*	Ebbicha	T	GM 020
69	*Vernonia auriculifera* (L.Herit.)	*Amaranthaceae*	Reejjii	Sh	GM 030
70	*Vigna Vexillata* (L.)A.Richard.	*Fabaceae*	Gurra hantuutaa	H	GM 051
71	*Withania somnifera* (L.) Dunal	*Solanaceae*	Gizaawaa	Sh	GM 019
72	*Zingiber officinale*. Roscoe	*Zingiberaceae*	Zingibila	H	GM 03

KEYS: H = Herbs, Sh = Shrubs, T= Tree