

**ETHNOBOTANICAL STUDY ON TRADITIONAL MEDICINAL
PLANTS USED BY LOCAL PEOPLE OF GORO DISTRICT, BALE
ZONE OF OROMIA REGION, ETHIOPIA**

M.Sc. THESIS

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**Ethnobotanical Study on Traditional Medicinal Plants Used by Local People
of Goro District, Bale Zone of Oromia Region, Ethiopia**

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DEDICATION

I dedicated this manuscript to my beloved mother, **Jamila Adem**, and my brother **Ahmed Adem**, it is your help and encouragement output through the almighty ALLAHA.

STATEMENT OF THE AUTHOR

By my signature below, I declare and affirm that this thesis is my own work and I have followed all ethical and technical principles of scholarship in the preparation, data collection, data analysis and compilation of this thesis. Any scholarly matter that is included in the thesis has been given recognition through citation. This thesis has been submitted in partial fulfillment of the requirement for degree of master science in botany from the Postgraduate Program Directorate at Haramaya University.

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BIOGRAPHICAL SKETCH

The author, Kedir Adem, was born to his father Adem Usman and his mother Jamila Adem in July 8, 1995, in Waltaye Mana kebeles, Goro District, Bale Zone of Oromia Region, Ethiopia. He attended his elementary and junior school education at Waltaye Mana Primary School from 2002 to 2008. He attended his Preparatory program and his secondary education at Goro Preparatory and Secondary School from 2009 to 2013. In 2014, he joined Hawassa University and attended his education in biology. He was awarded a Bachelor of Science Degree in biology in 2016. In 2017, he joined Haramaya University School of Post Graduate Directorate Program to pursue his Master of Science degree in the School of Biological Sciences & Biotechnology in the program of Botany.

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ABBREVIATIONS AND ACRONYMS

ANOVA	Analysis of Variance
EARO	Ethiopian Agricultural Research Organization
FL	Fidelity Level
ICF	Informant Consensus Factor
IK	Indigenous Knowledge
MASL	Meters above Sea Level
TMP	Traditional Medicinal Plants
UNESCO	United Nation Educational, Scientific and Cultural Organization.
WHO	World Health Organization

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ETHNOBOTANICAL STUDY ON TRADITIONAL MEDICINAL PLANTS USED BY LOCAL PEOPLE OF GORO DISTRICT, BALE ZONE OF OROMIA REGION, ETHIOPIA

ABSTRACT

*Ethiopia has rich flora with different plant species having use in health care system based on local indigenous knowledge. In this study, plants of traditional medicinal use and their associated indigenous knowledge in Goro district were investigated. A total of 100 informants (age \geq 25) were selected to collect information on medicinal plant use from three sampled kebeles. Of these, 10 key informants were selected purposively based on recommendation by local elders and authorities. The rest were selected randomly. Data were collected using semi-structured interviews, field observations and group discussions with local traditional medicine practitioners. Jaccard's similarity index, Informant consensus factor, fidelity level, preference ranking and direct matrix ranking were calculated to assess the agreement of informants on the medicinal value of plants. Knowledge about medicinal plants was found to be affected by age, sex and educational level. A total of 84 plant species distributed in 75 genera and 45 families were collected and identified. Family Asteraceae consisted of the largest number of species. Habit wise, 30 were herbs followed by shrubs (27), tree species (24) and climbers (3) species. The most frequently used plant parts were leaves followed by roots and seed respectively. The popular methods of preparation were crushing, pounding; chewing, squeezing and remedies were mostly prepared in fresh form from single plant or multiple plants with or without some additives. Route of administration was mainly oral followed by dermal. For example, the seed of *Myrsine africana* L is crushed and mixed with honey and drunk to treat endoparasite like Tape worm & Ascaris. Disease categories such as Gastrointestinal and Dermatological problem had the highest ICF values >0.80 . In general, the study area revealed that people in the study area have different depth and width of indigenous knowledge on traditional medicinal plants. In order to conserve medicinal plants and indigenous knowledge, formal and non-formal education system should be designed to create positive attitude among local people.*

Key words: Ethnobotany, Goro, traditional medicine, Species, indigenous knowledge

1. INTRODUCTION

Ethnobotany is the study of relationship between people and plants for their use as medicines, food, shelter, clothing, fuel, fodder and other household purposes (Samar *et al.*, 2015). The traditional use of plants to fulfill daily needs dates back to the beginning of human civilization and continues to dates (Jain, 1995). In Ethiopia, utilization of medicinal plant remedies in preventing or curing various ailments still plays a significant role in most parts of the countries (Birhan *et al.*, 2011; Giday & Teklehaymanot, 2013). Particularly, traditional herbal healing is widely practiced throughout the rural population as their primary healthcare system (Seid & Tsegay, 2011).

Traditional medicine is still the predominant means of health care in developing countries where about 80% of their total population depends on it for their wellbeing ((Abebe, 2001). Knowledge of medicinal plants is, however, rapidly dwindling due to the influence of western lifestyles, reduction in the number of traditional healers and lack of interest of the younger generations to carry on the tradition and associated knowledge (Zewdu *et al.*, 2015).

The Ethiopian flora is estimated to contain between 6500 and 7000 species of higher plants of which about 12% are endemic (Ermias *et al.*, 2013). It is, therefore, not surprising that some of these plants have chemical compounds of therapeutic value that may be used in the treatment of major diseases such as malaria, cancer, etc. The geographical diversity of Ethiopia has favored the existence of different habitats and vegetation types that medicinal plants are also an integral component. This geographical diversity coupled with multiplicity of ethnic groups with complex cultural diversity makes the country as the home for high diversity of traditional knowledge, practice and uses of traditional medicine (Dawit and Ahadu, 1993; Zemedede, 2001; Miruste, 2001). The practice of traditional medicine in the country is not only concerned with curing of diseases but also with the protection and promotion of human physical, spiritual, social, mental and material wellbeing (Mekonnen, 1990). Traditional medical practice has been in existence before the development of modern medicine in the country. It is accessible and affordable in many developing countries like Ethiopia (Getachew *et al.*, 2001). The history of herbal medicine is almost as old as human civilization (Choudhary *et al.*, 2015).

The current demand for herbal remedies in both developed and developing countries is increasing (Bussamann and Sharon, 2006). In developed countries, this may be partly due to dissatisfaction with the conventional medicine while in the developing countries this is due to the lack of medical doctors, shortage of pharmaceutical products and their unaffordable prices (Ermias, 2005). In Ethiopia, modern drugs are in short supply and are inaccessible and unaffordable to the vast majority of the populations. The provision of essential drugs, their equitable distribution and rational uses are still serious problems (Mesfin 2006; Tekalign *et al.*, 2010).

In many developing countries, medicinal plants have not been well studied, tested or documented (Tesfaye, 2004). Most of the information is still in the hands of traditional healers and knowledge of healers is either lost or passed to generation by the word of mouth (Ermias *et al.*, 2008). Thus, in order to reserve it for future use, ethnobotanical research should be conducted. In Ethiopia many researches (Getu *et al.*, 2015; Abebe, 2001)) have been done on Ethnobotany based on indigenous knowledge. However, there are also places where such studies are lacking. One of such place is Goro district, which is found in southeast, Oromia Region. Therefore, this study is designed to carry out ethnobotanical investigation on medicinal plants of this district with the following general and specific objectives.

General Objective: The main objective of this study was to conduct ethnobotanical study on traditional medicinal plants used by local people of Goro district.

Specific objectives

- To collect, identify and document traditional medicinal plants that are used by the local people for the treatment of human and livestock ailments in the study area (Goro Woreda);
- To document the indigenous knowledge of the local people on the use of medicinal plants.
- To identify plant parts used for medicinal purposes, condition & methods of preparation and ways of administration.

2. LITERATURE REVIEW

2.1. Meaning and Development of Ethnobotany

The term Ethnobotany was coined and defined by John Harsh Berger in 1896 to delimit a specific field of botany as the use of plants by aboriginal peoples. Prior to the use of the term Ethnobotany, many botanists were already including the use of plants by people within their studies. However, it was Harsh Berger who proposed that a discipline of Ethnobotany might be developed with its own definition, scope, objectives and methodologies (Cotton, 1996). As evident in Harsh Berger's definition the early definitions of Ethnobotany restricted the field to the study of how aboriginal people used plants.

The different botanists, anthropologists, explorers, missionaries and other people who traveled around the globe would see a plant, identify, classify and name the plant for the purposes of science, ask a person the name of the plant in the local language and list the local uses of the plant. Although Harsh Berger's definition still provides the core for the science of Ethnobotany, it has also been reformulated through the practice of Ethnobotanists during the Twenty Century. Over this century the field Ethnobotany has moved from the natural history of plant uses by primitive peoples to a wide range of interests of plants in cultural and environmental context. A slight change in emphasis can be seen through in the various definitions given by different authors (Ford and Jones, 1978; Martin, 1995).

Yet during the centuries which had intervened, considerable attention has focused to not only how plants are used, but also how plants are perceived and managed, and on the reciprocal relationships between plants and human societies on which they depend (Cotton, 1996). Thus, Ethnobotany is considered to encompass all studies which concern the mutual relationship between plants and traditional peoples. As the number of expeditions and scholarly communication became wider, there has been an intensified and continuous search by researchers in different fields to disclose traditional use of plants in different parts of the world by indigenous societies (Balick, 1996). The study of folklore medicine falls within the discipline of Ethnobotany. Folklore medicine is taken to mean knowledge and practice that have survived through only traditions in certain human societies, particularly among the

primitive and rural societies. It practiced or applied by anyone in the culture having prior experience (Belachew *et al.*, 2003). Ethnobotany is human evaluation and manipulation of plant materials, substances, and phenomena, including relevant concepts in primitive (Von Reis and Schultes, 1995). Ethnobotanical data collection requires a systematic approach and information can be collected through actual field observation and interviews depending on the particular objective of the research (Martin, 1995). Alcorn (1984) also stated that Ethnobotanists collect information on the indigenous knowledge not only to preserve them but also to perceive their relevance to development and conservation.

In general, Ethnobotany is the scientific investigation of plants as used in indigenous cultures in food, medicine, rituals, building, household utensils and implements by musical instruments, fire wood collection, pesticide, clothing, shelter and other purposes. It tries to find out how people have traditionally used plants, for whatever purposes, and how they are still doing so (Tesfaye and Sebsebe, 2009a).

2.2. The Scope of Ethnobotany

The scope of Ethnobotany has expanded enormously encompassing botanical aspects of a number of ethnoscientific fields including ethnomedicinal, ethnotaxonomy and ethnoecology as well as anthropological and botanical study of material culture and subsistence mode. Since early ethnobotanical studies was only in aboriginal plant use (Cotton, 1996). In addition to its theoretical significance, Ethnobotany is emerging as a subject of great practical value. Its application can lead to a strengthening of cultural diversity and conservation, greater sustainability in the exploitation of plant resources and the development of new plant products (Hamilton, 2003). Many previous studies focused on the descriptions and documentations of the local names and uses of plants (Cunningham, 1996). As the studies progressed for many decades in particular, Ethnobotany has tended to become more analytical, quantitative, cross-disciplinary and multi-disciplinary (Phillips, 1985). Ethnobotanists are now much more engaged with questions of conservation, sustainable development, cultural affirmation and the intellectual property rights of local and indigenous people.

The scope of the subject has now expanded to include studies of modern cultures, greater interdisciplinary and more recently, greater attention to its applications to conservation and sustainable development (Hamilton *et al.*, 2003).

2.3. Traditional Medicine

Traditional medicine is defined as “the sum total of all the knowledge and practices, whether explicable or not, used in diagnosis, prevention and elimination of physical, mental or social imbalance and relying exclusively on practical experience and observation handed down from generation to generation, whether verbally or in writing” (Ampofo and Johnson, 1978). Traditional medicinal practices are important part of primarily health care delivery system in most developing countries. It has maintained its popularity in all regions of the developing world.

The World Health Organization (WHO, 2013) has estimated that 80% the population of the developing countries is unable to afford pharmaceutical drugs and depend on traditional herbal medicines to sustain their primary health care needs. The greater part of traditional therapy involves the use of plant extracts or their active principles. The use of traditional medicine is still wide spread in Ethiopia, where about 90% of the populations use it for their health care needs. Which means, plants have provided a source of emerging modern medicines and drug compounds for medicines that derived from plants have made large contributions to human health and in the development of new drugs (Zewdu *et al.*, 2015).

Traditional medicine is based largely on herbs and it still supports the primary health care of more people worldwide than ‘conventional’ or western medicine (Shrestha *et al.*, 1997). Thus, simultaneously the need for basic scientific investigations on medicinal plants using indigenous medical systems becomes ever more relevant (Heinrich *et al.*, 1998).

2.4. Indigenous knowledge and medicinal plants

Indigenous knowledge (IK) is the local knowledge that is unique to a given culture or society. It is usually unwritten and preserved in the culture through oral tradition (UNESCO, 2009). Indigenous knowledge refers to the accumulation of knowledge, rule, standards, skills, and mental sets, which are possessed by local people in a particular area (Quansah, 1994). It is the result of many generations' long years' experiences, careful observations and trial and error experiments. Traditional people around the world possess unique knowledge of plant resources on which they depend for food, medicine and general utility including tremendous botanical expertise (Martin, 1995).

Over centuries, indigenous people of different localities have developed their own specific knowledge on plant resource use, management and conservation (Cotton, 1996). Systematic application of IK is important for sustainable use of resources and sustainable development (Thomas, 1995). Various animal and mineral products contribute to human welfare; the plant kingdom is most essential to human well-being especially in supplying basic human needs. So, the knowledge and application of traditional medicine is one of the widely used IK systems.

According to Warren (1990), the basic component of any country's knowledge system is its indigenous knowledge. It encompasses the skills, experiences and insights of people, applied to maintain or improve their livelihood. However, the integration of indigenous knowledge into science requires the extraction of relevant knowledge through a process of scientific validation and evaluation in order to identify the useful information, objective from subjective and the indigenous science from indigenous belief. Therefore, Indigenous knowledge is developed and adapted continuously to gradually changing environments and passed down from generation to generation and closely interwoven with people's cultural values (Kebu *et al.*, 2004). The majority of people in developing countries will continue to rely on non-Western medicine for much of their primary healthcare. In parallel ways, there will be continuing declines in traditional knowledge about medical plants and in traditional medical systems. As each generation matures, skills perceived as immediately useful are gained while others with a lesser perception of immediate value may be lost (Hamilton, 2003).

Medicinal plants have been used as a source of medicine to treat illness since time immemorial. In Africa up to 80% of the population uses traditional medicine to help their health care needs (Yayesh *et al.*, 2015). All cultures from ancient times to the present day have used plants as sources of medicines. A medicinal plant is any plant, which in one or more of its organs contains active ingredients which can be used for therapeutic purposes or contain foundation compounds that can be used for the synthesis of useful drugs (Sofowora, 1982). This close interaction and dependency of humans on plants is studied under the field of Ethnobotany. Such knowledge, known as ethnomedicinal knowledge involves traditional diagnosis, collection of raw materials, preparation of remedies and its prescription to the patients.

The documentation of traditional knowledge, especially on the medicinal uses of plants, has provided many important drugs of modern day (Balick and Cox, 1996). IK on remedies in many countries including Ethiopia passes from one generation to the other generation verbally with great secrecy. Such secrete makes indigenou Knowledge vulnerable to distortion and in most cases, some of the lore is lost at each point of transfer; hence, there is a need for systematic documentation of such useful knowledge through ethnobotanical research.

2.5. The Role of Medicinal Plants in Healthcare System

According to Fassil (2001), about 75-90 % of the rural population in the world (excluding western countries) relies on traditional medicines as their only healthcare system. More than 35,000 plant species are being used around the world for medicinal purposes (Lewington, 1993) and, in Ethiopia there are 800 or more plant species employed as medicinal agents (Tesema *et al.*, 2002); which according to the data base of the National Herbarium has grown to 1000 and more will be added to the list as new studies bring as new medicinal plants from various cultures. Traditional medicine remains the main resource for a large majority (80%) of the people in Ethiopia to treat their illnesses and veterinary diseases and maintain their health and traditional medical consultancy including the consumption of the medicinal plants has a much lower cost than modern medical (Asfaw *et al.*, 1999). However, this is not only because of poverty where people cannot afford to buy expensive modern drugs, but traditional systems are also more culturally acceptable and meet the psychological needs.

Apart from their use in the traditional system of medical care at the local level, medicinal plants are currently used in the production of modern drugs as a source of raw materials for the manufacture of complex semi-synthetic compounds and as taxonomic markers in the search for new compounds (WHO, 1998). In fact, approximately 25% of modern drugs used in the United States have been derived from plants (Carrubba and Scalenghe, 2012).

Most pharmaceutical companies recently have developed mechanisms to involve indigenous people collect plant samples on the recommendation of traditional practitioners. Medicinal plants have got special attention and regional offices were established by World Health Organization to coordinate basic and applied research activities on medicinal plants (WHO, 1978). This was linked to the establishment to record medicinal plants to improve accessibility and dissemination of information on medicinal plants (Tsige and Kaleab, 2001).

2.6. Diversity and Distribution of Medicinal Plant in Ethiopia

The greater concentration of medicinal plants are found in the south and south western Ethiopian parts of the country following the concentration of biological and cultural diversity (Edwards, 2001). The various citations made from various written records of medicinal plants from central, north and northwestern part of Ethiopia are thus small fractions of medicinal plants present in Ethiopia. Study on the Bale Mountains National Park in the South East Ethiopia revealed that the area, as much as it is a biodiversity hotspot, also turned out to be a medicinal plant hotspot with 337 identified medicinal species of which 24 are endemic (National Herbarium, 2004; Ermias, 2005; Haile, 2005). The species comprised of 283 used as human medicine, 47 used as livestock medicine and 7 species used for both human and livestock by the community healers, harvesters, traders and users. This work further suggested spots that could be considered medicinal plant micro hotspots within the Bale Mountain area. Different vegetation types that are found in the various agroecological zones of Ethiopia accommodate various types of medicinal plants (Edwards, 2001).

According to Maffi *et al.*, (1999), the number of different languages spoken in Ethiopia approaches 90 and each corresponds to its unique socio cultural population thus amounting to the high human cultural diversity. Each of these cultural domains has its own set of written and/or oral pharmacopoeias with the medicinal use of some species being restricted to that given culture. Jansen, (1981) asserts that Ethiopia has rich medicinal plant lore and points out that almost all plants of the Ethiopian flora are used somewhere somehow medicinally. Other workers on the other hand estimated about 60% of the flora to be medicinal, and most sources give about 10% of the vascular flora to be medicinal (Friis, 2009). The list covers plants that are widely used by the local communities in lowlands and highlands for treating human ailments and some of them for livestock ailments as well as for prevention of pests and vectors.

Most researchers indicated that the various parts of medicinal plants have been used such as leaves, roots and barks of the stem (Haile, 2005). But, leaves are regarded as the most cited plant parts used by healers for the preparation of traditional medicines (Mengistu, 2010; Mulatu, 2015; Yeshambel *et al.*, 2017). The various literature available Mekonnen (1990) and Tesema *et al.*, (2002) show the significant role of medicinal plants in primary healthcare delivery in Ethiopia where 70% of human and 90% of livestock population depend on traditional medicine similar to many developing countries particularly that of Sub-Saharan Africa countries.

2.7. Medicinal Plants in Human Healthcare System

In Ethiopia, plants have been used as a source of traditional medicine from early time to combat different ailments and human sufferings (Asfaw *et al.*, 1999). Due to its long period of practice and existence traditional medicine has become an integral part of the culture of Ethiopian people (Pankhurst, 1990, Mirgissa, 2017). It is common for people living in rural and urban centers to treat some common ailments using plants available around them. For example, the flowers of *Hagenia abyssinica* used to expel tapeworm, *Ruta chalepensis* leaves used to treat various health problems (Abbink, 1995). The continued dependence on herbal medicine alongside modern medicine is largely conditioned by economic and cultural factors (Abbiw, 1996). Modern healthcare has never been and probably never will provide for the

foreseeable future adequate and equitable health service anywhere in Africa, due to the financial limitations related to rapid population growth, political instability and poor economic performance. Due to incomplete coverage of modern medical system, shortage of pharmaceuticals and unaffordable prices of modern drugs, the majority of Ethiopian still depends on traditional medicine. The problem of ensuring the equitable distribution of modern healthcare has become more serious, as the gap between supply and demand has continued to widen. Hence, in present-day Africa including Ethiopia, the majority of people lack access to healthcare, and where available, the quality is largely below acceptable level (Abbiw, 1996). It is also noted that since medicinal plants are often with an easy reach compared to modern drugs that are dispensed in remotely located health institutions.

Most people in Ethiopia rely on the medicinal plants for their healthcare. Thus, medicinal plants continue to be in high demand in the healthcare system as components to the modern medicine (Cunningham, 1996). This indicates the need for in-depth investigation and documentation of plants of traditional value to rationally use and conserve the plant resources in indigenous knowledge (Dawit and Ahadu, 1993).

2.8. Ethnoveterinary Medicine in Ethiopia

According to the Ethiopian Agricultural Research Organization (EARO), 1999 as cited in Mirutse and Gobena, (2003), Ethiopia has the highest livestock population from Africa. In Ethiopia, livestock production directly constitutes important sources of livelihood, in addition to its contribution to crop production (Tafesse and Mekonnen, 2001). Beside this, most developing countries including Ethiopia, animal disease 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. Mc Corkle and Mathias (1996) explained that Ethnoveterinary medicine involves the use of medicinal plants, surgical techniques and livestock management practices to prevent a range of animal disease. Pharmacotherapy is one of the most important means of controlling livestock disease, but it is possible only if livestock owners can afford to cover the cost of treatments. Livestock owners cannot rely on veterinary services for control of various important livestock diseases.

This is due to the insufficient number of veterinarian drugs and the high cost of most of drugs which is out of the reach of the Ethiopian farmers and pastoralists (Mirutse, and Gobena, 2003). This and other similar factors make Ethiopian livestock raisers develop their own ways of keeping their animals healthy and productive using locally available materials, predominantly plants. Knowledge of medicinal plants can empower livestock owners to solve animal health problems. Herbal medicine is the branch of traditional medical practices that is most amenable to scientific investigation. Plants are also invaluable subject of international development.

2.9. Threats to and Conservation of Medicinal Plants in Ethiopia

Ethiopia's traditional medicine as elsewhere in Africa is faced with problems of continuity and sustainability (Ensermu *et al.*, 1992). Nowadays herbal practitioners have to walk greater distances for herb collections that once grew in the vicinity of their homes. This is because of availability of plants in general and medicinal plants in particular have been affected by a dramatic decrease in areas of native vegetation (Cunningham, 1996). The primary causes of this problem are loss of taxon of medicinal plants, loss of habitats of medicinal plants and loss of indigenous knowledge (Ensermu *et al.*, 1992). Most researchers (Mirutse, 2003) found that the practice of using plant remedies by Zay people to treat different ailments has been declining from time to time mainly as a result of continued deforestation in the area.

Besides, researchers argue that medicinal plants are considered to be at conservation risk due to over use and destructive harvesting (Zemedede, 2001). Tewolde Berhan Gebre Egziabher (1991) explained that the problem is further compounded by the fact that traditional knowledge on traditional medicine is also being lost at an alarming rate. There are two sources of threats to medicinal plants, i.e. human-made and natural causes. Rapid increase in population, the need for fuel, urbanization, timber production, overharvesting, destructive harvesting, invasive species, commercialization, degradation, agricultural expansion and habitat destruction are human caused threats to medicinal plants. Likewise, natural causes include recurrent drought, bush fire, disease and pest out breaks (Ensermu *et al.*, 1992). Additionally, most of the medicinal plants utilized by Ethiopian people are harvested from wild habitats (Mirutse, 2003). Hence, this increase the rate of loss of taxa with related

indigenous knowledge and loss of widely occurring medicinal plant species. The result is also bad in such a way that, when the plants that have been serving as the raw material for the preparation of different remedies are being destroyed, the traditional practices associated with them would also diminish. Traditional herbal practitioners are important custodians of indigenous knowledge on the utilization of medicinal plants. They are skilled 'botanists' and have a great talent for locating the correct plant among the many plants species found around them as result of their experience. But, many are less cooperative to show their knowledge and skill on traditional medicine to others.

According to Pankhurst (2001), the knowledge on medicinal plants and method of use circulated mainly among practitioners and the beneficiaries of such practices. This has made the knowledge and skill on traditional medicinal plants and traditional medicine more hidden and less available to the public (Abbink, 1995). Because of the impact of modern education, increase in health coverage and urbanization, indigenous knowledge and usage of medicinal plants are being lost globally at a fast rate (WHO, 2002).

The issue is being even more serious in developing countries where such important information is not recorded in writing but passed on from one generation to the other orally; few are available in written records. To make matters worse, the younger generations of today, unfortunately, often have different ambitions and priorities. As a result, this traditional skill is doomed to be lost even faster than the plants themselves (Sofowora, 1982). Most researchers showed that medicinal plants species are grown in the natural ecosystem (Frankel *et al.*, 1995).

In support of this, the work of Tesfaye and Sebsebe (2009b), suggests that most of the medicinal plants in Ethiopia are collected from the wild while some are cultivated and some others are grown in home gardens either purposely for medicinal use or non medicinal purpose (Zemedu and Ayele, 1995). About 6% of plant species cultivated in Ethiopia at home gardens for the purpose of medicine (Zemedu, 1997). Local forests are also sources of plant species processes into therapies used in traditional medical system (Balick and Cox, 1996). Endashaw (2007), Showed that the natural ecosystems like forests, grass lands, wet lands, contains a significant number of medicinal plant species.

There is some conservation actions that have been undertaken around the world designed to protect threatened medicinal plants from further damage (Cunningham, 1996). This includes *in-situ* and *ex-situ* conservation measures. Both *in-situ* and *ex-situ* conservation efforts are implemented to capture medicinal plant genetic resources. *In-situ* conservation is conservation of species in their natural habitat. Some traditional medicinal plants have to be conserved *in-situ* due to difficulty for domestication and management. Medicinal plants can also be conserved by ensuring and encouraging their growth in special places, as they have been traditionally (Zemedede, 2001), this can be possible in places of worship (churches, mosques, grave yards, etc), sacred grooves, farm margins, riverbanks, road sides, live fences of gardens and fields.

Ethiopia has policies and strategies that support the development and utilization of plant resources in a sustainable manner. These policies reflected under various sectors including environmental protection, development of the natural resources and diversification of the domestic and export commodities (Mulgeta, 2014). The country also has developed policy and a guide line for intellectual property rights protection of traditional medicine. The policy encourages and promotes the appropriate use and protections of traditional medicine knowledge in Ethiopia taking into account the need of the traditional medicinal knowledge holders and the communities who benefit from the use of the knowledge.

Medicinal plants fit in the development activities that support public efforts in meeting livelihood requirements (Endashaw, 2007). According to Zemedede Asfaw (2001), medicinal plants can be conserved using appropriate conservational methods in gene banks and botanical gardens. This type of conservation of medicinal plants can also be possible in home gardens, as the home garden is strategic and ideal farming system for the conservation, Production and enhancement of medicinal plants. For poor rural people, medicinal plants represent affordable and locally available resources to address many diseases and health Problems. There is a need to conserve not only homegarden but also wild plant community, because most of our medicinal plant found there.

3. MATERIALS AND METHODS

3.1. Description of the Study Area

3.1.1. Geographical Location

The study was carried out in Goro Woreda; Bale Zone of the Oromia Region, located 490 km southeast from Addis Ababa and 60 km from the Zonal Capital, Bale Robe (Fig 1). The study area lies between $6^{\circ} 0'29''$ - $7^{\circ}15''$ N latitude and $40^{\circ}10''$ - $40^{\circ}45''$ E longitude and it covers a total area of 451,009 ha, with elevation ranging from 500–2610 meters a.s.l. (Zenebe, 2013). Goro Woreda bordered on the southwest by Guradamole, on the west by Berbere, on the northwest by Sinana Dinsho, on the northeast by Ginir, and on the southeast by the Somali Region. It is separated from Guradamole and Berbere by Weyib River. Other towns in this Woreda include Meliyu, Buta, and Rayitu. Dawe Kachen Woreda was separated from Goro Woreda recently.

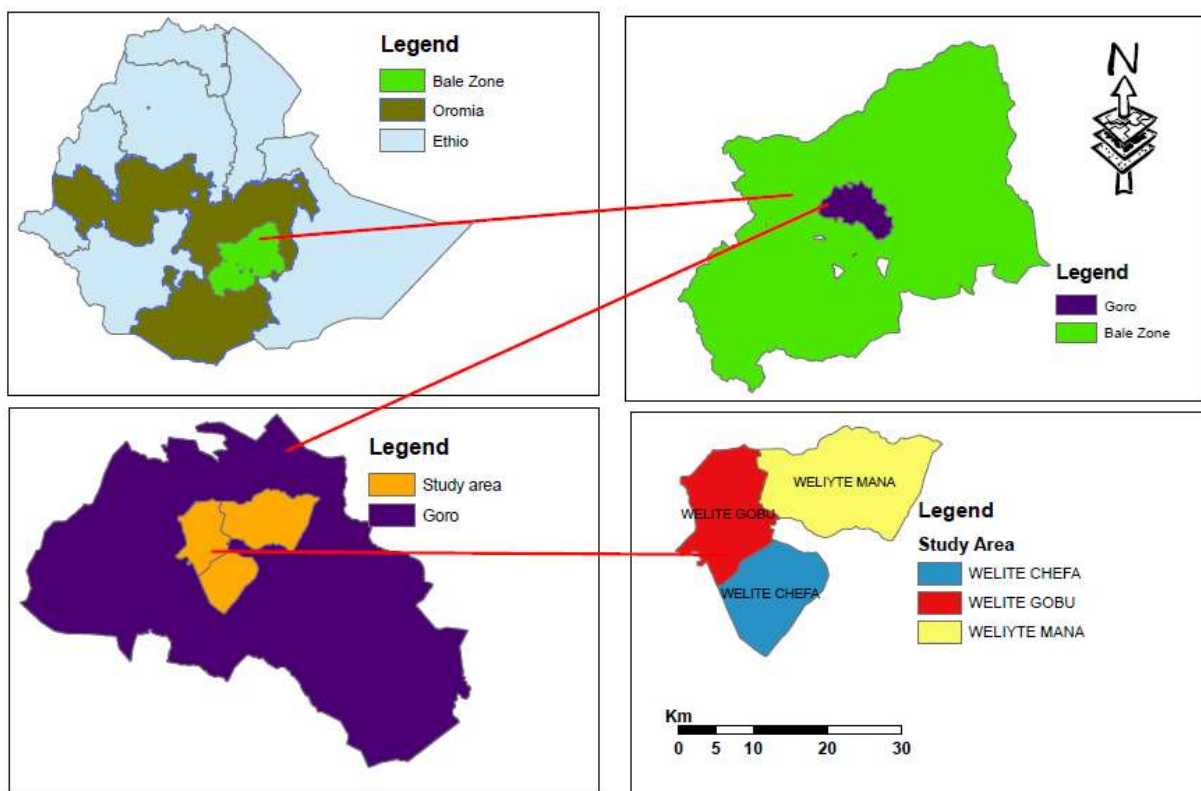


Figure 1. Map of study site (GIS software in 2017)

3.1.2. Demography and Climate of the Study Area

Based on 2015 national census (CSA, 2015), Goro Woreda has a total population of 83,106, of whom 43,501 were men and 42,605 were women; 8,531 or 10.27% of its population was urban dwellers. The majority (81.23%) of the population follow Islam, while 18.43% of the population practiced Ethiopian Orthodox Christianity. The two largest ethnic groups reported in Goro Woreda were the Oromo (89.45%), and the Amhara (9.8%); all other ethnic groups made up 0.75% of the population. Oromiffa was spoken as a first language by 97.29%, and 2.41% speak Amharic; the remaining 0.3% speak all other languages.

The climate of the study area varies with altitude. Goro district is divided into three agro ecological zones, namely the lowlands locally called “gamoojjii” it covers a total area of 64%, Middle altitude or “Badda Dare” covers 20% and high altitude areas or “Badda” covers 16%. There are two rainfall and cropping seasons. The main rainy season is from March to May, and the short rainy season from August through November. The mean annual rainfall of the Woreda in both seasons is about 345 to 500 mm. The annual mean temperature varies. It ranges from 25°C to 30°C for lowland areas and from 16°C to 20°C for highland area (Zenebe, 2013).

3.1.3. Vegetation and Major Cultivated Crops

The vegetation of the study area consists of various trees, shrub and herbaceous species. Some of the common plant species include *Cordia africana* (waddesa), *Acacia abyssinica* (laafto), *Croton macrostachyus* (Bakkanisaa), *Eucalyptus* spp. (Bargamoo), *Juniperus procera* (Hindheessa), *Ficus* spp.(Odaa), *Olea europea* (Ejersa), *Carissa spinarum* (Hagamsa), *Calpurnia aurea* (Ceekataa), *Vernonia* sp.(Ebicha) etc. Goro Woreda has an ideal agro-ecology for agriculture such as crop production, livestock rearing and cultivating different annual plants. The common crop cultivated in the study area include *Zea mays* (Maize), *Eragrostis tef* (Tef), *Hordeum vulgare* (Barley), *Triticum aestivum* (Wheat), *Pisum sativum* (Field peas), *Vicia faba* (Broad beans/ field beans) etc.

3.2. Reconnaissance Survey

A reconnaissance survey of the study area was conducted from September 12 to 21, 2017 to select potential kebeles based on the availability of traditional medicinal plants, traditional healer, and altitudinal variation between kebeles. Based on this information, three kebeles were selected out of 26 kebeles. These are Gobu, W/mana and Chefa.

3.3. Ethnobotanical Data Collection

Before ethnobotanical data collection, respondents were selected from the selected kebeles. Totally, 100 respondents (aged >25), 90 ordinary residents and 10 key informants (seven male and three female) were participated in this study. Key informants were selected purposively based on the information gathered from the local people while other respondents were randomly selected. Data were collected from October 15, to December 30, 2017.

Data collection methods were through semi-structured interviews, group discussions, and guided field walks with key informants for field observations. Healers were interviewed individually to mention about the local names of the plants, their use to treat diseases, diseases treated, and part of plants used, methods of preparation, route of application, dosage, uses of the plants other than medicine and management methods. Then, based on the check list questions, group discussions were made with key informants in seeking to understand the traditional medicinal system of the people and to know how knowledge is maintained and transferred from one generation to other generations. Field trips were then made with key informants to observe and collect medicinal plants specimens.

Similar procedures were also being applied with randomly selected non-practitioners of traditional medicine. Voucher specimens were collected, pressed, and dried for identification. For some species, preliminary identification was done in the field using keys and illustrations (picture). In addition, further identification of all specimens was done from December to January by comparison with authentic specimens, illustrations and taxonomic keys from Flora of Ethiopia and Eritrea edited by different authors and with the assistance of experts at Haramaya University Herbarium. Finally, the identified specimens were deposited in Haramaya University Herbarium.

3.4. Data Analysis

A descriptive statistical method was employed to summarize Ethnobotanical data. Jaccard's Similarity index (JI) was conducted to determine species composition similarity among three different study areas. It was calculated between paired Kebeles (the study area). JI was calculated as follows (Kent and Coker, 1992).

$$JIS = \frac{c}{a + b + c}$$

Where JI = Jaccard's Coefficient index

a = Number of species found only in habitat A

b = Number of species found only in habitat B

c = the number of species shared by the study sites

Anova and t-test

Anova and t-test were used to analyze socio-demographic factor on medicinal plants and Anova used to analysis of variance to compare more than two groups, while t-test apply to compare two variables.

Informant consensus factor (ICF) was calculated for categories of ailments to identify the agreements of the informants on the reported cures using the formula used by Tilahun Teklehaymanot and Mirutse Giday, (2007). ICF was calculated as follows: the number of use citations for each ailment (n_{ur}) minus the number of times a species used (n_t), for that ailment, divided by the number of use citations for each ailment minus one.

$$ICF = \frac{n_{ur} - n_t}{n_{ur} - 1}$$

The ICF values range from 0 to 1, with high values (i.e. close to 1) indicates a high intracultural consensus i.e., more healers use the same Species and value close to zero indicates a high variation in the use of plant species to be used to treat a category of ailments.

Fidelity Level: The relative healing potential of each reported medicinal plant used against human and livestock ailments were evaluated using the fidelity level (FL) index. The fidelity level (FL), the percentage of informants claiming the use of a certain plant for the same major purpose was calculated for the most frequently reported ailments using the following equation (Alexiades, 1996)

$$\mathbf{FL(\%)} = \frac{\mathbf{NP}}{\mathbf{N}} \times \mathbf{100}$$

Where Np is the number of informants that claim the use of a plant species to treat a particular disease, and N is the number of informants that use the plants as a medicine to treat any given disease.

Preference ranking Preference ranking was computed following Martin (1995). Ten key informants have been selected to assess the degree of effectiveness of six medicinal plants against stomachache. The medicinal plant believed to be most effective to treat the illness has got the highest value (5), and the one with the least effective got the lowest value (1). The value of each species was summed up and the rank for each species was determined based on the total score. This helped to indicate the most effective medicinal plants used by the community to treat the disease.

Direct matrix ranking: was conducted in order to compare multipurpose medicinal plants commonly reported by informants following Cotton (1996). Based on the relative benefits obtained from each plant, six multipurpose species were selected out of the total medicinal plants and six use diversities of these plants were listed. Each key informant was asked to assign use values (5 = best, 4 = very good, 3 = good, 2 = less used, 1 = least used and 0 = not used). The six use-values include medicinal, fodder, firewood, construction, charcoal, and furniture making. Based on information gathered from informants, average value of each use-diversity for a species was taken and the values of each species summed up and ranked

4. RESULTS AND DISCUSSION

4.1. Age, Sex, Education, Religion and Marital Status of Respondents

Age and sex distribution of respondents of the study area is given in (Table 1). Informants were categorized into 3 age categories; 20-40 (young group), 41-60 (adult group) and >60 years (old age) to see how the knowledge varies with age. As indicated in the (Tables 1), majority of the informants, above 3/4 had illiterate & basics of write & read; while 15% of them grade 8-12 students and very few of them were at higher level of education.

Table 1. Summary of Information about the Informants in the Study Area

No	Character	Percentage
1	Age	
	20-40	19
	40-60	57
	>60	24
2	Sex	
	Male	69
	Female	31
3	Educational level	
	Illiterate	53
	Basics write and read	24
	Grade 8-12	15
	> Grade 12	8
4	Marital status	
	Married	75
	Single	16
	Divorced	9
5	Religion	
	Muslim	71
	Christianity	29

4.2. Socio-Demographic Factors Influencing Indigenous Medicinal Knowledge.

Statistical analysis showed that there was a significant ($P < 0.05$, ANOVA) difference between age categories in their traditional medicinal plant knowledge (Table 2). The results revealed that knowledge on medicinal plants increases with age. This indicates that the elders are rich

with indigenous knowledge than the young generation. This could be because of the fact that the elders have accumulated knowledge through their life-long experiences of interactions with their environments, and due to the fact that the young generation are under the influence of modernization and globalization. The same result was reported by different researchers (Anteneh *et al.*, 2012 and Berhane *et al.*, 2014). Traditional medicinal knowledge also varied significantly ($P < 0.05$, independent samples T-test) between male and female with males reporting higher number of medicinal plants than females (Table 2). Educational level had also significant impact on traditional medicinal knowledge of the study area ($P < 0.05$, ANOVA) (See Table 2). The same result was reported by different investigators (Sintayehu, 2011; Anteneh *et al.*, 2012; Gidey and Samuel, 2012). Around (70%) of the respondents were farmers and housewife whereas 16% student and marchents, government employees, mosque administrators and healers together constituted only 14% of the respondents.

Table 2. Traditional medicinal plants knowledge difference of the respondents among age, sex and education levels

Age of the informants	Mean value	p-value of Anova
25-40	2.95	0.00
40-60	4.07	
>60	5.75	
Sex of the informants		P-value of t-test
Male	4.75	0.007
Female	3.19	
Educational level of informants		P-value of Anova
Illiterate	5.00	
writing & reading	4.04	0.002
8-12 grade	3.00	
Higher level education	2.50	

4.3. Medicinal Plant Species of the Study Area

From the three surveyed kebeles of the study area, totally 84 medicinal plant species were collected. These plant species are grouped under 75 genera and 45 families (Appendix Table 1) and are used for the treatment of 58 different health problems of humans and livestock.

Sixty-three of these plants were reported as used for treating human ailments, whereas 17 and 4 species were used to treat livestock and, both livestock human ailments, respectively (Appendix table 1). Analysis of species diversity by family showed that Asteraceae is the most diverse family being represented by 6 spp., followed by Fabaceae represented by 5 spp., Euphorbiaceae, Solanaceae and Anacardiaceae each represented by 4 spp., Rutaceae, Myrsinaceae, Myrtaceae and Moraceae represented by 3 spp., each and all the rest families consist of two or one representative species (Appendix Table 1). According to Fassil Kibebew (2001), about 75-90 % of the rural population in the world (excluding western countries) relies on traditional medicines as their only healthcare system. The same situation has also seemed to exist in this study area as seen from considerable number of medicinal plants reported from only three kebeles.

Table 3. List of medicinal plant families, genera and their species with their percentage

No	Family	Number of genera	Percent	Number of species	Percent
1	Asteraceae	5	6.67	6	7.14
2	Fabaceae	4	5.33	5	5.95
3	Solanaceae	4	5.33	4	4.76
4	Euphorbiaceae	3	4	4	4.76
5	Anacardiaceae	3	4	4	4.76
6	Rutaceae	3	4	3	3.57
7	Myrsinaceae	3	4	3	3.57
8	Myrtaceae	2	2.67	3	3.57
9	Moraceae	1	1.33	3	3.57
10	Apocynaceae	2	2.67	2	2.38
11	Alliaceae	1	1.33	2	2.38
12	Rubiaceae	2	2.67	2	2.38
13	Boraginaceae	2	2.67	2	2.38
14	Cucurbitaceae	2	2.67	2	2.38
15	Poaceae	2	2.67	2	2.38
16	Sapindaceae	2	2.67	2	2.38
17	Flacourtiaceae	2	2.67	2	2.38
18	Verbenaceae	2	2.67	2	2.38
19	Oleaceae	2	2.67	2	2.38
20	Rhamnaceae	2	2.67	2	2.38
21	Polygonaceae	1	1.33	2	2.38
22	The remaining 25 species	1	33.33	1	29.76

The majority of medicinal plant species were obtained from forest area followed by farm land, home garden, road side, around river side and grazing fields (Figure 2).

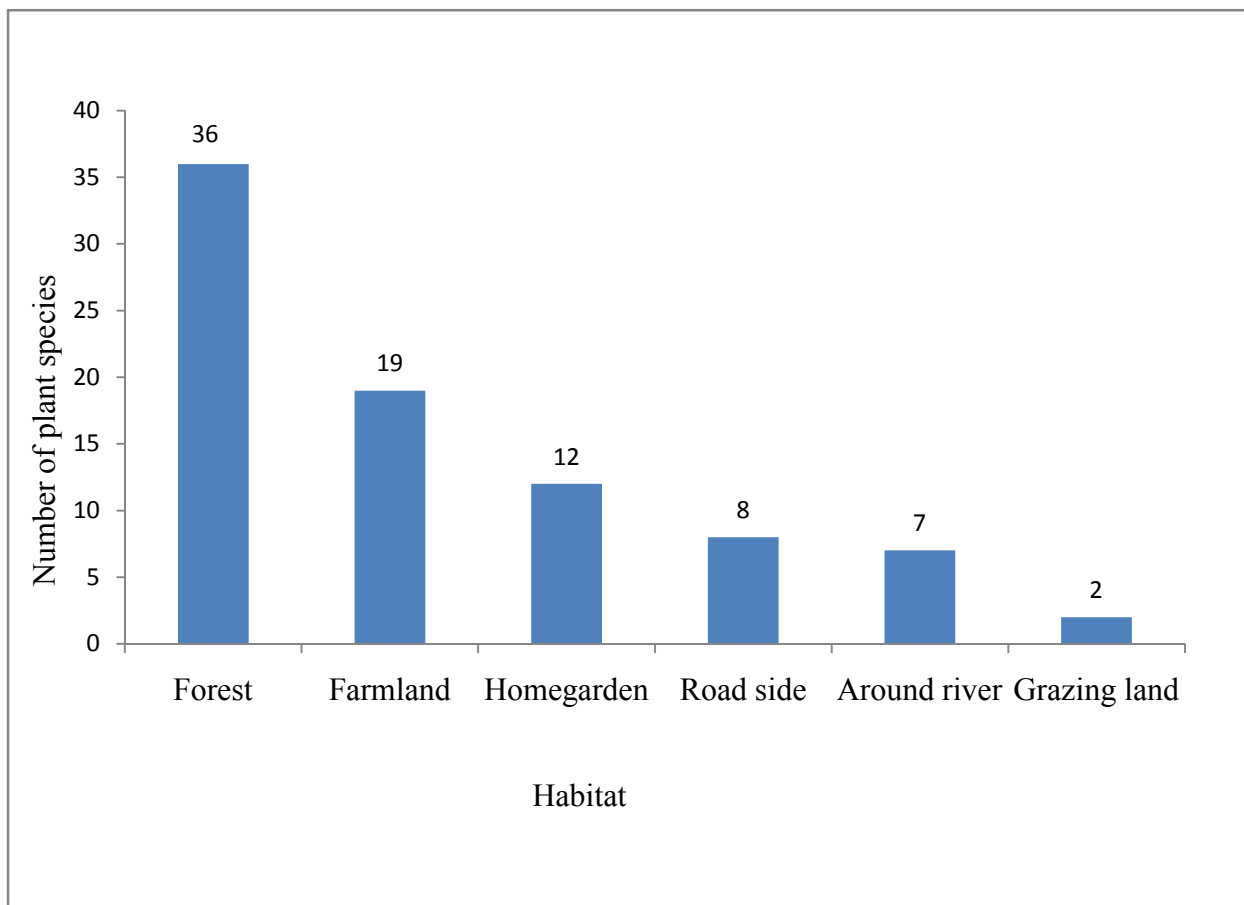


Figure 2. Plant Habitat distribution

4.4. Plant Habit, Part(s) Used, Condition of Preparation and Route of Administration

In terms of life form composition, herbaceous plants were the dominant life form of the total medicinal plants identified followed by shrub, tree and climbers (Fig. 3). Though dependent on the environmental situations, where values are varying in some other studies, most of the reports consulted show that herbs are the dominant medicinal plants species used by local people of most part of Ethiopia, for example of that of (Debela *et al.*, 2004).

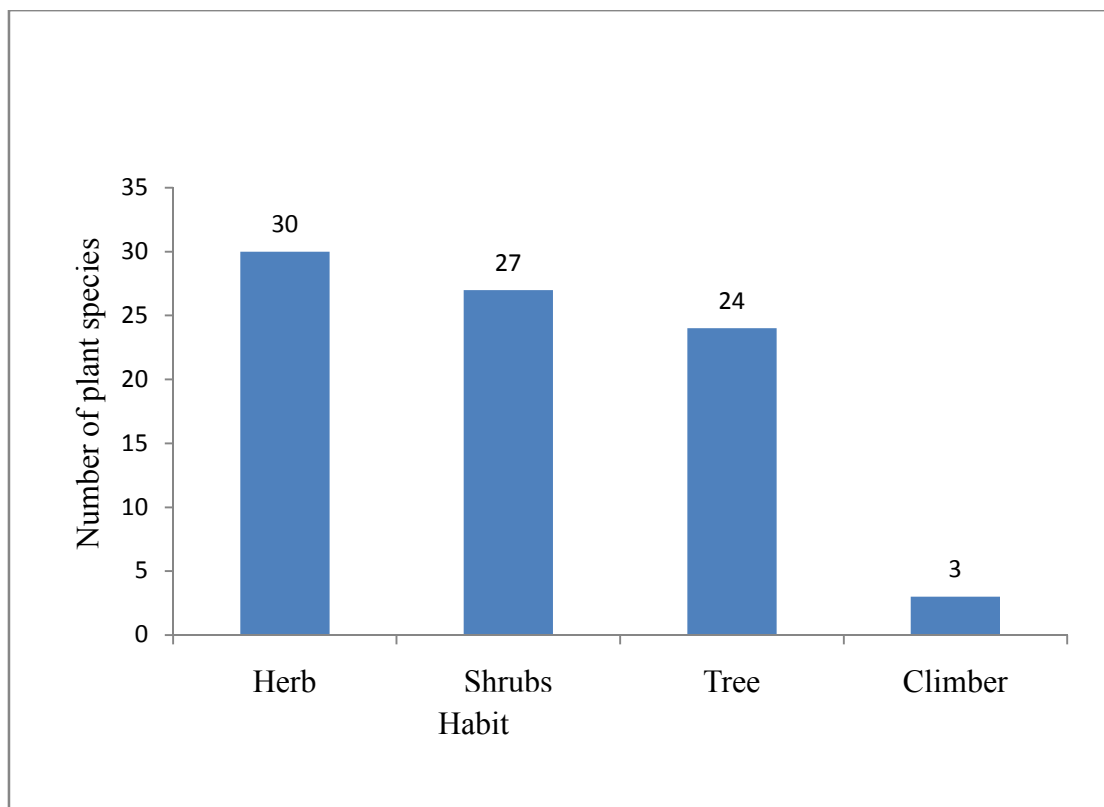


Figure 3. Distribution of medicinal plants growth form in the study area

People of the study area use different plant parts for the preparation of traditional medicine. Results of this study showed that leaf is the most reported plant part which was cited 39 times followed by root cited 19 times and seed cited 15 times. Other plant parts such as sap, bulb pods, bark, stem & fruit were also cited, but with no more than seven citations. These results agree with some previous studies conducted in different parts of the country (Mengistu, 2010; Mulatu, 2015; Yeshambel *et al.*, 2017). In most cases, these plant parts are used fresh for the preparation of remedies (Fig. 4). Results of most other investigations (Teshale *et al.*, 2004) also report the same, suggesting the fresh is the plant part used, the more would be its efficacy.

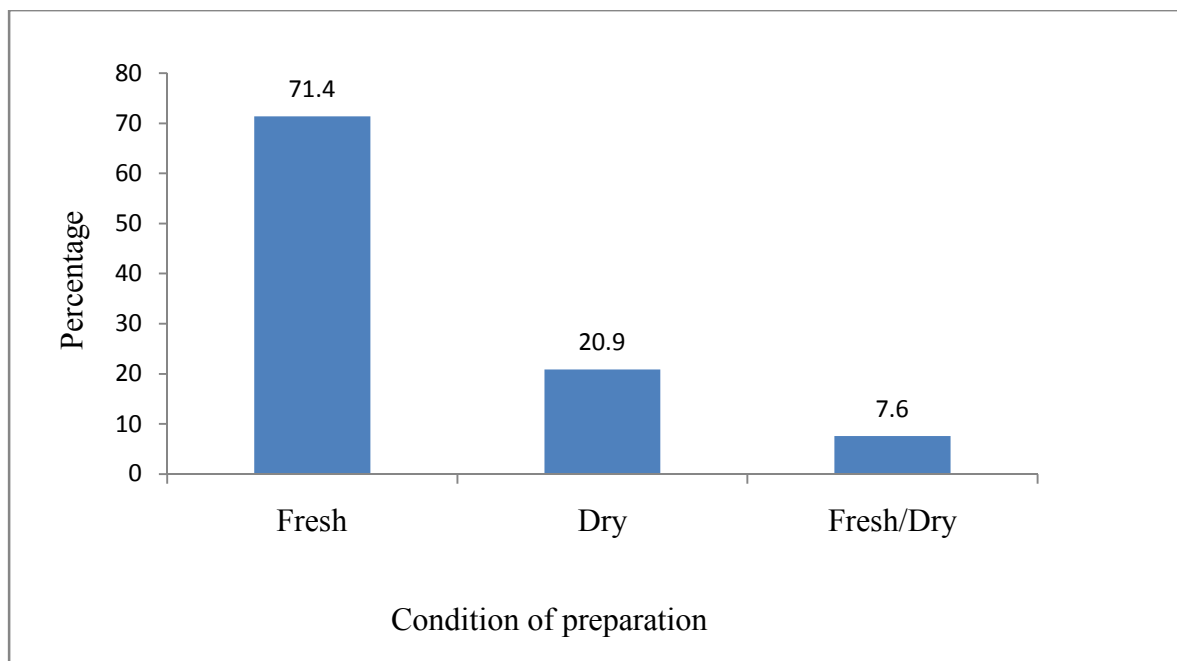


Figure 4. Condition of preparation

In general remedies are prepared in different forms and administered through different routes. This in most cases depends on the type and site of the disease over the body. The most methods of remedy preparation were pounding, chewing, squeezing and crushing; others like dry, smoking, boiling also used and the prepared remedies are administered mainly through mouth (62.26%) followed by dermal (28.3%), nasal (6.6%), through the ear (1.88%) and eyes (0.94%) (Appendix table 1). This fact in turn may show that internal systems disease and dermal diseases are the most common health problems in the study area, whereas ear and eye diseases are less common healthy problem in the study area and less treated by traditional means

4.5. Additives to the Remedies and their Dosage

In most of remedy preparations, respondents use water as a solvent to take with. However, remedies are also taken mixed with butter, honey, milk, local alcohols such as “*tella*” and “*tej*”, coffee, tea or Citrus juice. These additives are added to minimize discomfort, improve the taste and reduce adverse effects such as, vomiting and diarrhea, and enhance the efficacy and healing conditions as explained by informants. For example, the seed of *Myrsine africana* L is crushed and mixed with honey and drunk to treat endoparasite like Tape worm and

Ascaris of human to improve its taste. The dried seed of *Ricinus communis* L is pounded and mixed with butter and creamed onto the ulcerated skin of donkey (locally known as biichee harree). Most medicinal plants prescribed and given to patients are applied without any standardized doses. Hence there is no precision on the dosage of the remedy. However, approximate dosages (although no fixed standards) were reported to be determined based on age, sex and physical appearance of patients visiting local healers. For example, by pounding the leaves of *Teclea nobilis*, the two water glasses of the suspension will be given to mature cattle, whereas only very small amount for calves to treat black leg disease (Locally known as Dhibee Abagorba). For medicinal plants that are taken dermally they do not have clear cut dosage. Dawit and Ahadu (1993) reported that lack of precision in the dosage is one of the major drawbacks of practicing traditional remedy.

4.6. Similarity in Medicinal Plants Knowledge between Surveyed Kebeles and Agreement of Respondents on their Therapeutic Value

4.6.1 Jaccard's Similarity Index (JI)

Analysis of Jaccard's similarity index conducted using a number of medicinal plants reported from each kebeles to show their traditional medicinal plant knowledge similarity between kebeles revealed that communities in the three kebeles are closer in their knowledge regarding traditional medicine. The JI values range between 0 and 1, whereby a value of 1 indicates complete similarity. Approximately, however, similarity between Gobu and W/mana kebeles was higher followed by the similarity between Chafa and Gobu, suggesting that the traditional medicinal knowledge is almost the same in between the two communities (Table 4). These results indicate that almost all sites are similar in medicinal plant knowledge as each of them was comparable. This can be explained by the geographical proximity among the three sites and the same ethnic group with the same cultural background inhabiting the three kebeles.

Table 4. Jaccard's similarity index of medicinal plant knowledge among selected sites

No	kebeles	W/mana	Gobu	Chaffa
1	W/mana	1	0.89	0.64
2	Gobu	0.89	1	0.73
3	Chaffa	0.64	0.73	1

4.6.2. Informant Consensus Factor and Fidelity Level Index

All cited human and livestock diseases were categorized into 8 categories based on system specific involvement of diseases, condition of the disease and on sources of the disease (Table 5). Informant consensus was calculated for all diseases that were common health problems of humans and livestock in the study area. There was greater agreement between informants on the treatment of Gastrointestinal and dermatological problems each with ICF>0.80 (see Table 5).

Table 5. Informant consensus factor of major categories of human and livestock disease

No	Disease categories	Number of species used (n_t)	Use citation (N_{uc})	ICF
1	Gastrointestinal problem	18	115	0.86
2	Dermatological problem	17	111	0.85
3	Dental problem, Tonsillitis & Throat pain,	9	40	0.79
4	Asthma, Common cold and Cough	7	27	0.76
5	Ectoparasite and Endoparasite	10	18	0.47
6	Snake bite and Spider poison	6	25	0.79
7	Fever and emergency disease	9	36	0.77
8	Organ disease & Bloating	13	61	0.80

For some commonly used medicinal plants, FL was calculated so as to evaluate the extent of specificity of that plant in effectively treating a particular ailment. These medicinal plants were *Aloe ruspoliana* and *Nicotiana tabaccum* used for the treatment of Wound and leech, respectively, was the highest (100%) followed by *Calpurnia aurea* and *Coffee arabica* (92%) each, used for the treatment of Ectoparasite and Fire burn respectively (see Table 6). Basically, the medicinal plants that are widely used by the local people to treat one or very few ailments have higher FL values than those that are less popular (Tilahun and Mirutse, 2007). High FL could also be an indication of efficiency of the reported plant to cure a specific ailment

Table 6. Fidelity level index of the most frequently reported medicinal plants

No	Botanical Name of Medicinal Plants	Ailment treated	N _p	N	FL	FL (%)
1	<i>Aloe ruspoliana</i>	Wound	42	42	1	100
2	<i>Nicotiana tabaccum</i>	Leech	13	13	1	100
3	<i>Calpurnia aurea</i>	Ectoparasite	34	37	0.92	92
4	<i>Coffee arabica</i>	Fire burn	44	48	0.92	92
5	<i>Datura stramonium</i>	Scabies and ear lesion	30	34	0.88	88
6	<i>Eucalyptus globulus</i>	Common cold	21	26	0.81	81
7	<i>Croton macrostachyus</i>	Malaria	12	17	0.71	71
8	<i>Opuntia ficus-indica</i>	Jaundice	9	14	0.64	64

4.6.3. Preference Ranking and Direct Matrix Ranking

Not all medicinal plants are equally important in treating a given ailment. Therefore, in case of more than plants reported to treat a given ailment, a choice can be made by healers between the plants. Therefore, preference ranking of six medicinal plants that were reported for treating stomachache was conducted after selecting ten key informants. The informants were asked to compare the given medicinal plants based on their efficacy, and to give the highest number (5) for the medicinal plant which they preferred most the lowest number(1) for the least preferred plant(Table 7). Result showed that *Achyranthes aspera* scored 40 and known to be the most preferred plant followed by *Solanum incanum* in treating stomachache, whereas *Cucurbita pepo* was least preferred.

Table 7. Preference Ranking of Medicinal Plants used to Treat Stomachache

Medicinal plants	R ₁	R ₂	R ₃	R ₄	R ₅	R ₆	R ₇	R ₈	R ₉	R ₁₀	Total	Rank
<i>Achyranthes aspera</i>	5	4	5	3	4	5	4	3	3	4	40	1 st
<i>Solanum incanum</i>	5	4	3	5	3	3	4	5	3	2	37	2 nd
<i>Ruta chalepensis</i>	2	5	3	4	5	2	3	4	4	3	35	3 rd
<i>Trigonella foenum-graecum</i>	4	2	1	3	5	4	4	5	1	1	30	4 th
<i>Eucalyptus camaldulensis</i>	2	4	3	5	4	3	1	3	3	1	29	5 th
<i>Cucurbita pepo</i>	3	4	2	1	1	2	4	5	3	1	26	6 th

Key R=Respondents

Some medicinal plants are harvested for purposes other than medicinal value. Direct matrix ranking was done using six use categories and result showed that *Cordia africana* ranked first and hence it is the most utilized plant by local people for various purposes (Table 8). From its rare distribution, it was noted that this plant sp. appears to be over-exploited. *Eucalyptus globules*, *Olea africana*, *Dodonaea angustifolia*, *Croton macrostachyus*, and *Calpurnia aurea* ranked as 2nd, 3rd, 4th, 5th and 6th, respectively (Table 8).

Table 8. Direct Matrix Ranking

Use Categories	Plant species					
	<i>Calpurnia aurea</i>	<i>Cordia africana</i>	<i>Croton macrostachyus</i>	<i>Eucalyptus globulus</i>	<i>Olea africana</i>	<i>Dodonaea angustifolia</i>
Firewood	5	4	2	4	5	4
Medicinal	4	5	5	5	4	3
Construction	3	4	3	5	4	2
Fodder	2	5	2	3	3	4
Charcoal	0	2	3	2	2	3
Timber	0	5	4	5	2	2
Grand Total	14	25	19	24	20	18
Rank	6 th	1 st	5 th	2 nd	3 rd	4 th

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary

With the objective of documenting traditional medicinal plants and local people's knowledge on medicinal plants use, ethnomedicinal study was conducted in Goro Woreda, Bale Zone of Oromia Region, Ethiopia. Data were collected using semi-structured interviews, group discussion and guided field walk. Collected data were analyzed by descriptive statistics; independent sample t-test, ANOVA and Jaccard's similarity index were computed. Totally 84 medicinal plant species of which most, 30 species were herbs, followed by shrubs with 27 species and trees & climber with 24 and 3 species respectively were recorded in Goro Woreda and of these 84 medicinal plant species, 63 plant species (75%) were employed as remedies for human, 17 plant species (20.24%) for livestock medicine, and 4 plant species (4.76%) for both human and livestock remedies. In terms of family distribution, Family Asteraceae was with largest species 6 spp followed by Fabaceae 5 spp., Euphorbiaceae, Solanaceae and Anacardiaceae each represented by 4 spp., Rutaceae, Myrsinaceae, Myrtaceae and Moraceae represented by 3 spp each and all the rest families consist of two or one representative species. Of mentioned plant parts, leaf is the most reported plant part which was cited 39 times followed by root cited 19 times and seed cited 15 times. Medicines were reported to be used in fresh mostly from single plants or multiple plants with some additives or alone to be administered mainly through oral and dermal. In order to conserve traditional medicinal plants and indigenous knowledge, awareness on conservation of medicinal plants should be given to the locals.

5.2. Conclusion

In general, the study area revealed that people in the study area have different depth and width of indigenous knowledge on traditional medicinal plants. As this study indicates that the knowledge of traditional medicine mainly resides in the hand of illiterate and elder groups. Indigenous people of the study area have their own ways of managing health problems of human and livestock as they are endowed with specific culture, beliefs and ethical norms.

5.3. Recommendations

Based on the result of the study, the following recommendations were forwarded:-

- Traditional medicinal plants are central to the indigenous cultures and material needs. Therefore, formal and non-formal education systems should be designed to create positive attitude among the young by integrating into the curricula about the traditional use of plants in general and medicinal plants in particular;
- Training the local people, on resource use value, management and conservation at kebeles or Woreda level by agricultural experts or development agents, as it facilitates an integration of resource conservation with sustainable use;
- Recognitions and intellectual property rights should be given to traditional healers, either through certification or through organizing them at community or Woreda level, which popularizes their indigenous knowledge and medicinal plants value.

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7. APPENDICES

Appendix Table 1. List of medicinal plants used to treat human and livestock ailments

No	Scientific Name, Habit & Collection No	Local name	Families	HB	Disease treated	CP	Route of administration	Part used, Preparation and application
1	<i>Acacia albida</i> Del., Tree (KA11)	Garbii	Fabaceae	Fl	Diarrhea	F	Oral	Bark. The internal part of the bark is extracted & crushed, then the filtrated solution will be drunk
					Dandruff	D	Dermal	Pods. <i>Acacia albida</i> pods have been pounded & used as a soap
2	<i>Acacia etbaica</i> schweinf., Tree (KA02)	Doddotii	Fabaceae	Fo	Abdominal pain	F	Oral	Root. Fresh root of this plant is Chewed & swallowed
3	<i>Achyranthes aspera</i> , ** Herb (KA08)	Derguu	Amaranthaceae	Fo	Stomach ache	F	Oral	Root. The root of <i>Achyranthes aspera</i> is chewed and swallowed during feeling of ache
					Wound	F	Dermal	Leaf. The leaf is crushed with <i>Allium sativum</i> bulb then creamed on wounded part.
					Blood clot	F	Dermal	Root. Crushed its root and tied on bleeding part of all animals.
					Tonsillitis	F	Dermal	Leaf. Crushed its leaf & added coffee powder, then tied on neck with clean cloth
4	<i>Acokanthera schimperi</i> : Tree (KA04)	Qaraaru	Apocynaceae	Fo	Scabies & spider poison	F	Dermal	Leaf. Chopping the leaves, mix with butter & applying on the infected part of the body.
5	<i>Allium cepa</i> L., Herb (KA05)	Shunkur ti diima	Alliaceae	Fl	Asthma	FD	Oral	Bulb. The bulb boiled together with leaf of <i>zingiber officinale</i> & the filtrate will be drunk

Table 1: Continued

6	<i>Allium sativum</i> L., Herb (KA03)	Qullubi	Alliaceae	Fl	Malaria	FD	Oral	Bulb. Crushed its bulb and mixed with honey then eat two spoon each morning until recovery
					Cough	F	Oral	Bulb. It will be peeled and consumed
7	<i>Aloe ruspoliana.</i> , Herb (KA06)	Hargiisaa	Aloaceae	Rs	Wound	F	Dermal	Sap. Its sap is collected & creamed on wound of human & cattle until recovery.
					Snake bite	F	Oral	Sap. The sap/jelly of the fresh leaf will be mixed with honey & drunk.
8	<i>Bidens pilosa</i> L., Herb (KA01)	Cogee	Asteraceae	Fo	Ear problem	F	Ear	Leaf. leaf will be powdered & mixed with butter then dropped in to the ear
9	<i>Cadia Purpurea.</i> , *ShrubKA10	Hinjirree	Fabaceae	Fo	Coughing & Sneezing of donkey	F	Nasal	Leaf. chopping the leaves making s/n & added one coffee cup through the nostril of the animal
10	<i>Calpurnia aurea</i> (Ait.) Benth.,* Shrub (KA12)	Ceekata	Fabaceae	Fo	Ectoparasite (louse)	F	Dermal	Leaf. Leaf will be crushed & mixed with kerosene then smear on the skin of cattle & calves until it removed
11	<i>Carica papaya.</i> , Tree (KA18)	Papaye	Caricaceae	Fl	Amebiasis	F	Oral	Seed. Seed will be powdered and mixed with honey then consumed
12	<i>Carissa spinarum.</i> , Shrub (KA13)	Hagamsa	Apocynaceae	Fo	Diarrhea	F	Oral	Leaf. The leaf of <i>Carissa spinarum</i> is chopped, boiled with <i>Coffea arabica</i> and the filtrate will be drunk
					Evil eye	F	Oral	Root. Its root burnt and fumigate is taken to prevent diseases epidemic

Table 1: Continued

13	<i>Citrus sinensis</i> L., Shrub (KA14)	Burtukana	Rutaceae	Fl	Wound	F	Dermal	Fruit. The mixture formed from latex of <i>Euphorbia tirucalli</i> and <i>Citrus lemon</i> juice is mixed together & creamed on wounded body
14	<i>Coffea arabica</i> L., Shrub (KA16)	Buna	Rubiaceae	Fl	Common cold	D	Oral	Seed. Powder of roasted <i>coffee seed</i> will be boiled mixed with juice of lemon and ginger then drunk
					Fire burn	D	Dermal	Seed. The Seed of <i>Coffea arabica</i> is roasted, powdered and applied on wounded
15	<i>Cordia africana</i> L., Tree (KA15)	Waddessa	Boraginaceae	Fo	Smell of foot & Dental problem	D	Dermal	Bark. Dried bark is powdered and added on leg and also used as tooth powder to get relief from dental problems
16	<i>Croton macrostachyus.</i> , ** Tree (KA07)	Bakkanisaa	Euphorbiaceae	Rs	Ringworm	F	Dermal	Sap. The fresh sap is applied on the dermal infected part
					Anthrax	F	Nasal	Root. Root of <i>Croton macrostachyus</i> and <i>Carissa spinarum</i> are chopped together & mixed with crushed fruits of <i>Lagenaria siceraria</i> & the filtrate will be applied through the nostrils of cattle & goat.
					Arthritis	F	Oral	Leaf. Leaf of <i>Croton macrostachyus</i> & bulb of <i>Allium sativum</i> crushed together & the filtrate will be drunk with camel milk
					Blood clot	F	Dermal	Sap. Exudates put on the cut skin to stop or reduce bleeding
					Malaria	D	Dermal	Bark is put on fire & the smoke used as to protect from mosquito bite

Table 1: Continued

17	<i>Cucumis dipsaceus.</i> , ** Climber (KA09)	Dabaaqula	Cucurbitaceae	Fo	Retained placenta	F	Oral	Root. Fresh root pounded & Mixed with water then drunk.
					Ear pain	F	Ear	Fruit. Fruit of <i>Cucumis dipsaceus</i> is cut & its sap added to ear canal.
					Eye disease	F	Eye	Leaf. Leaf will be crushed and its juice dropped in the eye
18	<i>Cucurbita pepo</i> L., Climber (KA17)	Hiddi hoolotaa	Cucurbitaceae	Hg	Stomach ache	FD	Oral	Seed. Roasted the seed & boiled in water, then the filtrate will be drunk
19	<i>Cynodon dactylon</i> L., Herb KA36	Saardo	Poaceae	Gl	Snake poison	F	Oral	Stem. Chewed the stem and absorb
20	<i>Datura stramonium</i> mill., Herb (KA19)	Banjii	Solanaceae	Fl	Scabies & ear wound	F	Dermal	Leaf. Crushed the leave mixed with salt then creamed on wounded area
21	<i>Dodonaea angustifolia.</i> , ** Shrub (KA35)	Dhittacha	Sapindaceae	Fo	Scabies	F	Dermal	Leaf. Crush its leaves and mix with butter then creamed
					Bone fracture	D	Dermal	Leaf. Paste of dried leaf powder is tied on fractured bone by bark of <i>Dombeya schimperiana</i>
22	<i>Dombeya schimperiana</i> A.Rich.S.L. Shrub (KA21)	Dannisa	Sterculiaceae	Fo	Abdominal pain	D	Oral	Leaf. Dried leaf will be pounded then mixed with honey and consumed
23	<i>Dovyalis abyssinica.</i> , Shrub (KA34)	Koshimoo	Flacourtiaceae	Hg	Taeniasis	D	Oral	Seed. Dried seed is roasted and mixed with honey & given to eat

Table 1: Continued

24	<i>Ehretia cymosa</i> Thon., Tree (KA20)	Ulaaga	Boraginaceae	Fo	Rheumatism	F	Oral	Leaf. Its fresh leaf boiled together with roots of <i>Rumex nepalensis</i> & the filtrate will be drunk for three days.
25	<i>Elaeagnus commutate</i> berhn., * Herb (KA79)	Hiddi waraabessa	Elaegnaceae	Fo	Coughing	F	Nasal	Leaf. Squeezed & collected the juice in coffee cup then given with nose to cattle
26	<i>Eleusine jaegeri</i> pilger., Herb (KA33)	Coqorsa	Poaceae	Gl	Snake bite poison	F	Dermal	Stem. It will be pounded & rubbed to the affected skin for three days.
27	<i>Embelia schimperi</i> Vatke., Shrub (KA22)	Haanquu	Myrsinaceae	Hg	Tape worm	D	Oral	Fruit. Fruit is pounded, dissolve in water, decant out the decoction and drunk early morning before meal
28	<i>Ensete ventricosum</i> cheesman., Herb (KA23)	Warqee	Musaceae	Fl	Abdominal pain	F	Oral	Leaf. The leaves base are chopped & fermented for 10-12 days, then allowed to eat
					Diarrhea	D	Oral	Root. Dried Root decoction with sugar and salt is given.
29	<i>Eucalyptus camaldulensis</i> Dehnh., Tree (KA32)	Bargamoo diima	Myrtaceae	Hg	Stomach ache	F	Oral	Leaf will be chewed and swallowed
30	<i>Eucalyptus globules</i> Labill., Tree (KA24)	Bargamoo adii	Myrtaceae	Hg	Common cold	F	Nasal	Leaf will be crushed roughly and boiled in water then its smoke will be inhaled until the patient getting sweat and sneezed.

Table 1: Continued

31	<i>Euclea racemosa murr sub spp schimperei</i> (A.DC.) White., Shrub (KA31)	Mi'essa	Ebenaceae	Fo	Gonorrhea	DF	Oral	Roots of <i>Euclea racemosa</i> & <i>Cucumis ficifolius</i> will be crushed & mixed with sparrow's meat & honey then, swallowed
					Toothache	F	Oral	Root will be chewed & held on to the teeth
32	<i>Euphorbia candelabrm.</i> , * Tree (KA25)	Hadamma	Euphorbiaceae	Rs	Wound and Tumors ("nyaqarsa")	F	Dermal	Latex. The sap will be mixed with kerosene and urine then creamed affected part until recovery
33	<i>Euphorbia tirucalli</i> L., Shrub (KA30)	Aannoo	Euphorbiaceae	Rs	Skin infection/ kintarot	F	Dermal	Latex. The fresh latex of <i>Euphorbia tirucalli</i> is collected and creamed on the affected part
34	<i>Ficus capensis</i> L., Tree (KA26)	Odaa	Moraceae	Ar	Toothache	DF	Dermal	Bark. Peel the bark & held on the affected teeth
35	<i>Ficus sycomorus.</i> , Tree (KA29)	Qilxu	Moraceae	Ar	Wound	F	Dermal	Sap. Collect its latex & Mix with many ingredient & Creamed on wounded part
36	<i>Ficus thonningii blume.</i> , Tree (KA27)	Dambii	Moraceae	Ar	Vomiting	F	Oral	Bark. Chewing inner Bark & swallowing fresh bark
					loss of appetite	F	Oral	Root. Chewing root & swallowed
37	<i>Galium hametum</i> Hochst., Herb (KA28)	Maxxanne	Rubiaceae	Fo	Snake Venom	F	Oral	Leaf & Root. Chopping leaves and roots together, mixed with honey then, drunk one cup at morning for three days
38	<i>Grewia ferruginea</i> Hochst., Shrub (KA55)	Dhoqonuu	Tiliaceae	Fo	Dandruff	F	Dermal	Leaf is crushed & used as soap to wash hair
39	<i>Guiztea scabra</i> (vis) chiovenda., Herb (KA37)	Hadaa	Asteraceae	Fl	Liver disease	F	Oral	Root & Bark will be crushed mixed with honey then consumed

Table 1: Continued

40	<i>Guiztea abyssinica.</i> ,* Herb (KA54)	Nuugi	Asteraceae	Fl	Swelling, (Mada gatetti)	F	Dermal	Seed roasted, powdered and creamed on the affected part
41	<i>Hetromorpha trifoliata</i> * (Wendl.) ECKL, Shrub (KA38)	Al-haanqaa	Apiaceae	Fo	Urine mixed with blood	D	Oral	Leaf. Powdered its dry leaves with the leaves of <i>Croton macrostachyus</i> , making s/n & giving one liter orally once a day.
42	<i>Justicia schimperiana.</i> , Shrub (KA52)	Dhummuga	Acanthaceae	Rs	Rabies	F	Oral	Leave of <i>Justicia schimperiana</i> & <i>Phytolacca dodecandara</i> will be powdered mixed well with coffee & white honey and drunk
43	<i>Kalanchoe petitiiana.</i> A.Rich.var.newm annii* (Eng.) Herb (KA40)	Kontoma	Crassulaceae	Fo	Swelling	F	Dermal	Leaf. Heat its leaves & tied on swelling part of livestock
44	<i>Lantana camara</i> L., shrub (KA53)	Qorsoo sinbira	Verbenaceae	Rs	Diarrhea	D	Oral	Seed. Dried seed decoction with sugar and salt is given.
45	<i>Lepidium sativum.</i> L., Herb (KA39)	Shunfaa	Brassicaceae	Fl	Leprosy	D	Oral	Seed. The seed is crushed and soaked in water for two days, then the filtered bitter juice is drunk
46	<i>Linum usitatissimum</i> * L., Herb (KA51)	Telbaa	Linaceae	Fl	Constipation	F	Oral	Seed. The powdered seed will be mixed in water, then the solution is given to animal
					Placenta retention	D	Oral	Seed. powdering seed, making solution, magado salt will be added & given to animal
47	<i>Lycopersicon esculentum.</i> , Herb (KA50)	Timatima	Solanaceae	Fl	Hypertension	F	Oral	Fruit. by consuming processed tomatoes used to treat hypertension

Table 1: Continued

48	<i>Maesa lanceolata</i> Forrsk*, Shrub (KA41)	Abbayyi	Myrsinaceae	Fo	Leech infection	F	Nasal	Leaf. Chopping the leaves, making s/n & applying through the nostrils.
49	<i>Mangifera indica</i> L., Tree (KA50)	Maangoo	Anacardiaceae	Fl	Vomiting	F	Oral	Fruit. Squeezed juice from the fruit will be drunk
50	<i>Myrsine africana</i> L. Shrub (KA49)	Qacamoo	Myrsinaceae	Fo	Endoparasite (Tape Worm \$ Ascaris)	F	Oral	Seed. Seed will be pulverized and mixed with honey then drunk
51	<i>Nicotiana tabaccum</i> * L., Herb (KA48)	Tambo	Solanaceae	Hg	Leeching	D	Oral	Leaf. Leaves of <i>Nicotiana tabaccum</i> is crushed and mix with water then given to cows. The cows will be not drink water for certain minutes until leech come out.
52	<i>Ocimum spp.</i> , Herb (KA42)	Qoricha michii	Lamiaceae	Fo	Headache & fever	F	Oral	Leaf. some leaves will be crushed, mixed with white honey and drunk, others squeezed and the juice will be pulled in through nostrils
53	<i>Olea africana</i> L., Tree (KA46)	Ejersa	Oleaceae	Fo	Common cold	DF	Nasal	Stem and leaf are put on fire and the vapor will be inhaled being in blanket during bed time
54	<i>Oncoba spinosa</i> Forskal., Tree (KA44)	Akukuu	Flacourtiaceae	Ar	Sexual impotency	D	Oral	Bark. Dried stem bark powder is cooked with chicken and consumed once a day at morning
55	<i>Opuntia ficus-indica</i> mill, Shrub (KA43)	Shoonka	Cactaceae	Fo	Jaundice	F	Oral	Fruit its fruit mixed with dry powdered leaf of <i>Phytolacca dodecandara</i> and <i>Solanum marginatum</i> then mixed with milk and drunk.

Table 1: Continued

56	<i>Orobache minor</i> smith, * Herb (KA45)	Butte warabessa	Orobanchaceae	Fo	Urine retention	F	Oral	Whole part. Its whole part is pounded, mixed with <i>Ruta chalepensis</i> leaves decocted and given to cattle to drink
57	<i>Osyris quadripartite</i> Secn. Shrub (KA47)	Waatoo	Santalaceae	Fo	Evil eye	D	Nasal	Roots will be crushed and put on fire then the smoke sniffed
58	<i>Pappea capensis</i> , Tree (KA74)	Biiqaa	Sapindaceae	Ar	Liver disease	F	Oral	Bark. The inner part of the bark will be chopped & boiled it, then added milk or butter and drink once a day for five days
59	<i>Persea americana</i> mill. Tree (KA56)	Abukadoo	Lauraceae	Fl	Enteritis & Kidney Infection	F	Oral	Fruit. Its fresh fruit mixed with egg and honey and consumed.
60	<i>Phytolacca dodecandra</i> , Climber (KA81)	Andode	Phytolacaceae	Fo	Itching	F	Dermal	Leaf. leaves of <i>Phytolacca dodecandra</i> & <i>Ruta chalepensis</i> crushed together and washed
61	<i>Podocarpus falcatus</i> (p.gracilior)., Tree (KA73)	Birbirsa	Podocarpaceae	Ar	fever and joint pain	F	Oral	Leaf. Chopping the leaves and make s/n then a Coffee cup filtrate will be drunk
62	<i>Poremna schimperi</i> ., Shrub (KA57)	Urgessa	Verbenaceae	Fo	Gum bleeding	DF	Dermal	Root. Powdered root mixed in water and by putting in cotton rubbed on affected gum.
63	<i>Psidium guajava</i> L., Tree (KA67)	Zeeyituna	Myrtaceae	Hg	Toothache	F	Oral	Fruit. Fresh fruit with salt is held between teeth.
64	<i>Raphanus sativus</i> * L., Herb (KA58)	Zaroo	Cruciferae	Fl	Bloating	D	Oral	Seed will be powdered mixed with residue of local 'tella' or 'areqie' & given to animal

Table 1: Continued

65	<i>Rhamnus prinoides</i> , Shrub (KA72)	Geeshoo	Rhamnaceae	Fl	Tonsillitis	F	Oral	Root and leaves are crushed with <i>Lepidium sativum</i> seeds & bulbs of <i>Allium sativum</i> and its solution mixed with honey then consumed
66	<i>Rhus glutinosa</i> ,* Shrub (KA59)	Xaaxessaa	Anacardiaceae	Fo	Urine Retention	DF	Oral	Leaf. Dried or fresh leaf is mixed with <i>Ruta chalepensis</i> leaves decocted and given to cattle to drink
67	<i>Rhus natalensis krauss.</i> , Shrub (KA66)	Daboobes saa	Anacardiaceae	Fo	Snake bite	F	Oral	Leaf: Leaf will be pounded and the extract will be mixed with coffee and drunk
68	<i>Ricinus communis</i> * L., Shrub (KA82)	Qobboo	Euphorbiaceae	Rs	Ascaris	D	Oral	Root. The pounded root mixed with salt & half cup solution is given to cattle
					Actinomycosis (kurufsisa)	F	Oral	Seed crushed & mixed with salt then one cup of concoction is given to cattle
					Uleceritic Lymphagities	D	Oral	Seed. Its dried seed pounded & mixed with Butter & creamed to the ulcerated skin of donkey
69	<i>Rosa abyssinica</i> , Shrub (KA70)	Gorsana	Rosaceae	Fo	Toothache	F	Dermal	Root will be chewed & held on the teeth
70	<i>Rumex abyssinicus</i> Jacq., Herb (KA60)	Shabbe	Polygonaceae	Rs	Malaria	F	Oral	Leaf. leave of <i>Rumex abyssinicus</i> crushed with root of <i>Hagenia abyssinica</i> and boiled then goat milk added & the filtrate will be cooled & drunk

Table 1: Continued

					Swelling	F	Dermal	Leaf. Leave will be chewed and the bolus will be put on the swollen area
71	<i>Rumex nervosus</i> vahl, Shrub (KA69)	Dhangaggoo	Polygonaceae	Fo	Abdominal Pain	F	Oral	Leaf will be chewed & swallowed directly
72	<i>Ruta chalepensis</i> L., Herb (KA61)	Sillixi (cilaaddama)	Rutaceae	Hg	Stomach ache	F	Oral	Leaf. Fresh leaf crushed with <i>Allium sativum</i> bulb then the s/n is given for human and livestock.
73	<i>Schinus molle</i> *L., Tree (KA63)	Qondaberber e	Anacardiaceae	Hg	Bloating	F	Oral	Leaf. Leaves will be pounded & mixed with hot water & cooled then salt is added and given to the animal during bloating
74	<i>Schrebera alata</i> , Tree (KA77)	Dhama'ee	Oleaceae	Fo	Throat Pain	F	Oral	Bark. Chewing internal part of stem bark & then swallowing its juice.
75	<i>Solanum incanum</i> L., Herb (KA84)	Hiddi	Solanaceae	Hg	Stomach ache	F	Oral	Root tip will be chewed and swallowed
76	<i>Tagetes minuta</i> L., Herb (KA75)	Ajo	Asteraceae	Fl	Ectoparasite	F	Dermal	Leaf & Steam of Plant will be cut & put in a room to prevent arthropod infestation
77	<i>Teclea nobilis</i> ,* Tree (KA76)	Hadheessaa	Rutaceae	Fo	black leg (Abagorba)	F	Oral	Leaf. Pounding the leaves, making s/n and giving two of water glass for cattle and very small amount for calves.

Table 1: Continued

78	<i>Trigonella foenum-graecum</i> L., Herb (KA80)	Shiqoo	Fabaceae	Fl	Stomach ache	F	Oral	Seed. Its powdered seed is mixed with water at night then sugar is added and drunk before breakfast every morning for three days
79	<i>Urtica simensis</i> hochest ., Herb (KA62)	Dobbii	Urticaeae	Ar	Diabetes	D	Oral	Leaf. Dried leaf powder boiled with tea and drunk
80	<i>Verbascum sinaiticum</i> Benth*, Herb (KA68)	Gurra harree	Scrophulariaceae	Fo	Coccidiosis	F	Oral	Leaf. Fresh leaf Squeezed & mixed with <i>Ruta chalepensis</i> leaf and <i>Allium sativum</i> bulb, then given orally to hen
81	<i>Vernonia amygdalina</i> del. *, Shrub (KA71)	Ebicha	Asteraceae	Fo	Placenta retention	F	Oral	Leaves crushed and mixed with remnants of local beer (‘ Tella’) and given orally for delayed placenta
82	<i>Xanthium abiyssanicum</i> wallogth., Herb (KA64)	Qoree abdulakim	Asteraceae	Hg	Fungal disease on skin	F	Dermal	Sap. Take five twigs of <i>Xanthium abiyssanicum</i> then smear on the patient skin
83	<i>Zingiber officinale</i> Roscoe., Herb (KA78)	Zenjibila	Zingiberaceae	Hg	Abdominal pain	DF	Oral	Root. Root are powdered and mixed with milk or “awez” and <i>Allium sativum</i> and then eaten by injera or drunk
84	<i>Ziziphus spina chrsti</i> L. Deft., Tree (KA65)	Qurqura	Rhamnaceae	Fo	Involuntary urination on bed	D	Oral	Root. Dry root will be pounded mixed with sour milk or “ergo” then drunk

Key: Hb = Habitat (Fo =Forest, Hg= Homegerdan, Fl=Farm land, Ar=Around river, Rs=Rod side), Cp = Condition of preparation, F = Fresh, D = Dried, F/D = Fresh/Dried, *=livestock ailment, **=used for both, KA= is name of the collector and the number in parenthesis is collection number

Appendix 2. Semi- Structured Interview for both Traditional Healers and Non-Traditional Healers of Goro Woreda people to get sufficient information about medicinal plants.

Instruction that researcher follows to collect data.

- Greet the respondents in a polite way
- Explain the objective of the study by focusing on its importance for Goro Woreda people
- Make the interview in area where the informants feels happy

1. Personal information for respondents.

- ✓ Name _____ Sex: Male Female Age _____ Date _____
Keble _____ religion _____ Occupation _____
- ✓ Educational status: Diploma Degree Illiterate Basics of write and read
- ✓ Marital status: single Married Divorced

2. Questioners about the disease for respondents

- What are the most common human diseases in this area?
A) _____
B) _____
C) _____
- What are the most common livestock diseases in this area?
A) _____
B) _____
C) _____

3. Questioners about the plant medicines

- Which medicinal plants used to treat those humans ailments & injuries in your area?
A) _____
B) _____

- Which medicinal plants are also used to treat those livestock ailments in your area?
 - A) _____
 - B) _____
 - C) _____
 - Is their medicinal plants used to treat both?
 - What are those plants used
 - A) Name of the plant _____
 - B) Habitat of the plant _____
 - C) Habit of the plant _____
4. Which part of the plant is used as remedy? (Leaf, stem, root, flower, bark, fruit, seed, latex, or Whole plant)
5. What is the method of preparation of those medicinal parts? (Crushed, squeezed, Powdered, concoction, decoction, used alone or mixed with others?)
6. Form of the medicinal plant used
- In fresh
- In dry or
- Fresh/dry
7. The way of administration is internal or external?
- If internal how? _____
- If external how? _____
8. Is the medicinal plant marketable? Yes No
9. Are the medicinal plants easily accessible? If not why?
- _____
10. How is the knowledge of traditional medicine passed to family members/next generation?
- _____
11. How can you diagnose or identify the disease of your patients?

12. Is there difference in dosage among age or sex groups? Yes No

13. If question number (12) yes, how you can determine the dosage of the medicinal plants for your patients?

14. How you get this indigenous knowledge of practicing medicinal plant

15. Do the traditional healer use only a single traditional medicinal plant to prepare the remedies or by mixing with others?

16. At what time do the patients take the traditional medicine?

17. Is there any restriction in collection of medicinal plants in your area?

18. Any other additional information