Ethnobotanical Study of Medicinal Plants Used by Local Communities in Kebena District Gurage Zone, Southern Nations, Nationalities and Peoples Region, Ethiopia

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This is to certify that the thesis prepared by Michael Tsegaye entitled: Ethnobotanical Study of Medicinal Plants Used by Local Communities in Kebena District, of Gurage Zone, Southern Nations Nationalities and Peoples Region, Ethiopia and submitted in partial fulfillment of the requirements for the Degree of Master of Science in Plant Biology and Biodiversity Management complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Abstract

Ethnobotanical Study of Medicinal Plants Used by Local Communities in Kebena District, of Gurage Zone, Southern Nations Nationalities and Peoples Region, Ethiopia

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An ethnobotanical study of the knowledge on use and management of medicinal plants by local people in Kebena district was conducted from October 2020 to March 2021. The objective of the study was to gather and analyze information on the use, management and conservation of medicinal plants as well as status of indigenous knowledge of the local people. Data were gathered from local people, local healers and knowledgeable elders of the study area. A total of 80 informants (50 men and 30 women) aged between 25-80 years were selected via purposive and snowball sampling from ten Kebeles. Relevant information was collected by using semi-structured interview, market survey, field observation and focus group discussion. The Lamiaceae and Asteraceae stood first by contributing 6 (9.23%) species each; followed by Fabaceae and Solanaceae 5 (7.69%) species. From the total collected plants, 59 species were used for the treatment of 41 human ailments and 6 species were used to treat both livestock and human ailments. Herbs were the most utlized growth form followed by trees and shrubs. The most frequently used plant parts were leaves (46.05%). The common route of administration was oral (58%) followed by dermal and nasal. There were plants with higher informant consensus factor due to the wide range of human and livestock diseases that they are claimed to treat. There is high preference for Urtica simensis Steudel for treating anthrax, while paired comparison showed Lepidium sativum L. to be the most preferred species for treatment of human stomach ache. In addition, the apparent disinterest of the young generation in traditional medicine has become a major problem for the continuity of the knowledge of medicinal plants. The effort of local people in conserving medicinal plants is minimal since much of the medicinal plants were easily available and people have beendiscouraged to use traditional medicine. To tackle the depletion of knowledge from further loss and the loss of medicinal plants, recognition of traditional healers and cultivation of medicinal plants, participating government offices and NGOs is recommended.

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Key words: Ethnobotany, indigenous knowledge, medicinal plants, sampling, multipurpose species

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List of abbreviations

^{0}C	Degree Centigrade
EFY	Ethiopian Fiscal Year
FGD	Focused Group Discussion
FL	Fidelity Level
IK	Indigenous Knowledge
KWADO	Kebena Woreda Agriculture and Development Office
KWHO	Kebena Woreda Health Office
MSc	Master of Science
NGO	Non Governmental Organizations
TM	Traditional Medicine
TCAM	Traditional and Complimentary Medicine
TMP	Traditional Medicinal plants
PhD	Doctor of Philosophy
WHO	World Health Organization

1. Introduction

1.1 Background of the study

The history of plants being used as a source of traditional medicine traces back up to 5000 to 4000 BC in China, and 1600 BC by Syrians, Babylonians, Hebrews and Egyptians (Derry *et al*., 1999). Ethnobotany is a broad term referring to the study of direct interrelations between humans and Plants (Martin, 1995; Balick and Cox, 1996). Ethonbotany is also defined as a unit of ecological study specializing in the interaction of people and the plant world (Ford, 1978). It is also described as the interaction of local people with their natural environment: how they classify, manage and use plants available around them (Martin, 1995).

Ethiopia is a country characterized by a wide range of climate and ecological conditions, possessing enormous diversity of fauna and flora (Pankhurst, 2001). The Ethiopian flora is estimated to contain 5757 species of higher plants of which about 10% of the Ethiopian flora is estimated to be endemic (Ensermu Kelbessa and Sebsebe Demissew, 2014), many of which are of medicinal value (Endalew Amenu, 2007). It is also true that, Ethiopia is also a home to many languages, cultures and beliefs which in turn have contributed to the highest diversity of traditional knowledge and practices of the people in using medicinal plants. Knowledge about traditional medicine is transferred secretly from generation to generation orally especially in countries like Ethiopia (Jansen, 1981).

The customary act of transferring traditional knowledge verbally makes the rate of knowledge loss high due to the limitations of verbal knowledge transfer like: forgetfulness, acquiring of inadequate information. Due to this in Ethiopia there is little availability of written documents

and records of traditional knowledge and medicinal plants (Jansen, 1981), so this research will contribute a significant part by investigating and documenting the traditional medicinal plants used by indigenous people and associated knowledge for the treatment of human and livestock aliments in Kebena District.

1.2 Statement of the problem

A number of studies had been carried on different aspects of medicinal plants in Ethiopia (Ermias Lulekal, 2014, Tadese Beyene, 2015, Alemtsehay Teka *et al*. 2020) though still there is a gap in the document and records on medicinal plants in the country. More over since kebena district is found in Gurage zone. It is highly susceptible to traditional knowledge and medicinal plant loss due to development of modern education, migration from urban to rular region, and industrialization. Untill now there was only one study has been conducted on the ethnobotany of medicinal plants in Kebena district (Alemtsehay Teka *et al*, 2020). Yet that study deals the ethnobotany of medicinal plants in kebena district along with other five districts in Gurage zone. Thus, the researcher believes it is necessary to study the ethnobotany of medicinal plants in kebena district specifically. The finding of this study will help people of the study area to be aware of problems associated with medicinal plants and give attention for the threatened medicinal plants. And also the documentation of the indigenous knowledge of medicinal plants can be part of the information source for running further research on the highly valued medicinal plants for the development of modern drug; hence this study is initiated to fill gaps in the documentation of ethnobotanical knowledge of the Kebena district.

1.3 Objectives of the study

1.3.1 General Objective

To investigate and document the traditional medicinal plants and related knowledge in Kebena district, Gurage Zone, Southern Nations Nationalities and Peoples Region, Ethiopia

1.3.2 Specific objectives

- To collect, identify and document traditional medicinal plants that are used by the people of the study area for the treatment of human and livestock ailments in the study area.
- To identify and document plant parts used, for medicinal purposes, methods of preparation and mode of administration of remedies
- To document land form classification, indigenous vegetation classification and soil classification of the local communities.
- To assess current status of medicinal plants and the indigenous knowledge of the people in the study area.
- To provide information that contributes to the development of strategies for conservation and sustainable utilization of traditional medicinal plants.

1.4 Research questions

The main focus of this study was to investigate the traditional uses and remedies of various plants which are used by Kebena district people. The findings of the study have tried to answer the following main research questions.

- Are there traditional medicinal plants used by the local people in Kebena District?

- Which medically important plants species are used by the local people to treat their own health problem and livestock ailments in the study area?
- Which part of the medicinal plants are useful to treat ailments and how do the local people prepare herbal remedies from plants?
- What are the modes of plant remedy administrations and dosage determinations?
- What is the current status and major threats and conservation practices of the medicinal plants?

2. Literature review

2.1 Ethnobotany

The use of plants as sources of both preventive and curative traditional medicine preparations for human beings and livestock goes back to ancient times. Historical accounts of traditionally used medicinal plants depict that different medicinal plants were in use as early as 5000 to 4000 BC in China and 1600 BC by Syrians, Babylonians, Hebrews and Egyptians (Derry *et al.*, 1999). Considerable indigenous knowledge system, from the earliest times, is linked to the use of traditional medicine in different countries (Farnsworth, 1994).

Ethnobotanical work was started by Christopher Columbus in 1492, at a time when he brought tobacco, maize, spices and other useful plants to Europe from Cuba (Cotton, 1996) and when other immigrants to the new world documented food, medicine and other useful plants of the Aztec, Maya and Inca peoples (Martin, 1995). The term "Ethnobotany" was first used by J. W. Harshberger in 1895 to indicate plants used by the aboriginals: From "ethno"-study of people and "botany"- study of plants. According to (Fakim, 2006) the term was broadened by Robbins, Harrington and Freire-Marreco, in 1916 and they suggested that the science of ethnobotany should include the investigation and evaluation of the knowledge of all phases of life amongst primitive societies and of the effects of the vegetal environment upon the life customs, beliefs and history of these tribal peoples. Twenty five years later, in 1941 Jones advanced a more concise definition: "The study of the interrelationships of primitive men and plants". Shultes in 1967, expanded this to include "the relationships between man and his ambient vegetation". Ethnobotany is considered as a branch of ethnobiology. Ethnobotany deals with the study and

evaluation of plant-human relations in all phases and the effect of plant environment on human society (Sharma and Kumar, 2011).

It is both an interdisciplinary and multidisciplinary science (Jain, 1986, Martin, 1995) In ehnobotanical study to achieve more detailed and reliable information of plants and plant use, the involvement of specialists from various disciplines, such as plant ecologists, plant taxonomists, anthropologists, linguist's, economic botanists, pharmacologists and others is necessary. With such interdisciplinary and multidisciplinary approaches focuses on compiling, analyzing, documenting and use of indigenous knowledge on plants as well as the proper utilization, conservation and management strategies (Martin, 1995). It also focuses on how plants have been or are used, managed and perceived in human societies and includes plants used for food, shelter, medicine, divination, cosmetics, dyeing, textiles, for building, tools, ornamentation, currency, clothing, rituals, social life and music (Choudhary *et al*., 2008).

2.2 Traditional medicinal plants

Traditional medicine is defined as health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses and maintain well-being (WHO, 2001). It is estimated that more than 80% of the world's population relies on medicinal plants for treatment of various ailments (Ekor, 2014).

The oldest written record of the use of medicinal plants for the preparation of medicines was identified on a Sumerian clay slab from Nagpur, about 5000 years old. It consisted of 12 recipes for the preparation of medicines relating to over 250 different plants, some of them alkaloids, such as poppy, henbane and mandrake (Petrovska, 2012).

The Chinese Root and Grass Book "Pen T'Sao," written by Emperor Shen Nung about 2500 BC, describes 365 medicines (dried sections of medicinal plants), many of which are still used today, such as Rhei rhisoma, camphor, Theae folium, Podophyllum, the great yellow gentian, ginseng, jimsonweed weed, cinnamon bark, and ephedra (Petrovska, 2012).

The Ebers Papyrus, written circa 1550 BC, represents a collection of 800 proscriptions referring to 700 plant species and drugs used for therapy such as pomegranate, castor oil plant, aloe, senna, garlic, onion, fig, willow, coriander, juniper, common centaury, etc. (Petrovska, 2012).

It is estimated that there are between 750,000 and 1,000,000 plant species on the world. The 500,000 of them have been identified and named. Around 2000 new flowering plant species are identified and named in each year. The number of plants which have been used for treatment since ancient times shows a steady increase. According to a report released by the WHO, the number of plants used for treatment is estimated to be around 20,000. The studies on medicinal plants and active substances derived from them have increased the interest in these plants in recent years (Keskin, 2018).

Africa is a continent greatly endowed with an abundance of medicinal plants, which indigenous people are familiar with and have used over time (Getachew Alebie and Abas Mehamed, 2016). Around 80% of African population uses traditional medicinal plants for the treatment of various diseases, and ethnobotanical surveys have shown that traditional medicines have been deemed effective against those diseases, which are a great concern to most of the sub-Saharan African nations (WHO, 2002a)

In Ethiopia also the use of traditional medicine is still wide spread and its acceptability, availability and popularity is no doubt as about 80% of the populations use it for health care needs (WHO, 2001).

The extent of the knowledge of traditional medicine practice based on medicinal plants should be documented through ethnobotanical surveys. Botanical collection and documentation of the associated ethnobotanical knowledge should be carried out before such rich heritages are lost due to various anthropogenic and other natural causes. In addition, the conservation of ethnobotanical knowledge as part of living cultural knowledge and practice between communities and the environment is essential for biodiversity conservation (Martin, 1995).

Lack of scientific evidence regarding effectiveness of traditional medicine limits its use (Rukangira, 2001). Evaluation of traditional medicine should be preceded and guided by information-gathering on purported efficacy and safety. Observational studies should be conducted to generate further information on safety and assess preliminary indicative efficacy (WHO, 2002b). New practical and acceptable research tools need to be developed in accordance with the minimum regulatory requirements that WHO has developed, for registration and use of traditional medicines in Africa with respect to quality, safety, and efficacy. Results should be shared with the primary beneficiaries of the studies as well as disseminated to the community and other stakeholders. Accessibility to the traditional treatment should be ensured by using local ingredients (WHO, 2002b).

2.3 Indigenous knowledge

In a broad context indigenous knowledge is, the knowledge used by local people to make a living in a particular environment (Warren, 1991). In other definition, indigenous knowledge is the

accumulation of knowledge, rules, standards, skills and mental sets that are possessed by local people in particular area (Quanash, 1998). The high reliance of local people on natural resources in the accumulation of indigenous knowledge that helped people to adapt to and survive in the environment in which the live. It is local knowledge that is unique to a given culture or society and the base for agriculture, healthcare, food preparation, education, environmental conservation and host of other activities (Thomas, 1995).

Recently IK is considered to be cultural knowledge in its broadest context, including all of the social, political, economic and spiritual aspects of a local way of life. Sustainable development researchers, however, have found the following categories of indigenous knowledge to be of particular interest: resource management knowledge and the tools, techniques, practices and rules related to pastoralism, agriculture, agroforestry, water management and the gathering of wild food; classification systems for plants, animals, soils, water and weather; empirical knowledge about flora, fauna and inanimate resources and their practical uses; and the worldview or way the local group perceives its relationship to the natural world (Emery, 1996).

Traditional medicinal knowledge is a type of the indigenous knowledge that deals with knowledge, and practices that are related with medicinal uses of plants, minerals, animals as well as spiritual healing, traditional midwifery, hydrotherapy, massage, cupping, counter-irritation, surgery, and bone setting (WHO, 2001).

2.3.1 Forms of Traditional Medical Knowledge

2.3.1.1 Codified Medical Systems

These are also known as great traditions. Ayurveda, Siddha and Unani medical systems in Indian subcontinent or Traditional Chinese medicine and Acupuncture in China, have evolved in a

historical period spanning over 3─4 millennia with their own unique worldviews, conceptual, theoretical frameworks and elaborate codified literature. For example the oldest medical text of Ayurveda, Caraka samhita is estimated to be written and redacted through various versions from 1,500 BC─200 AD. Such codified medical traditions have unique understanding of physiology, pathogenesis, pharmacology and pharmaceuticals, which is different from Western bio-medicine (Bodeker and Burford, 2007).

2.3.1.2 Folk Medicine

The folk knowledge traditions which are mostly orally transmitted, are more diverse, ecosystem and ethnic community specific with household level health practices (home remedies for primary health care, food recipes, rituals, customs), specialized healing traditions like bone setting, poison healers, birth attendants, veterinary healers, general healers etc. These are generated over centuries by communities and use components of ecosystems (plants, animal and mineral/metal derivatives) that are primarily locally available, easily accessible and often cost effective. It varies hugely owing to social, ecological and historical circumstances. (Payyappallimana, 2010) Hence, countries with similar ecosystems are often found to nurture similar health practices indicating the strong linkages between environment and health. These are also known as indigenous medicine, ethno medicine, bush medicine, little traditions etc. In most countries where traditional medicine is not formalized, it largely remains in the non-codified folk knowledge form. Diversity, collective ownership guided by customary laws, adaptability to changing contexts and oral transmission are some of the prominent characteristics of this knowledge. Unlike common understanding, it is highly dynamic thus contemporary and not pertaining to a period in time. While knowledge generation and transmission might vary with cultures, there are several similarities in the value systems and modes of transmission of

knowledge among communities. Often it is not recognized as 'valid knowledge' by scientists as it is combined with beliefs and values. (Payyappallimana, 2010)

2.3.1.3 Allied Forms of Health- caring Knowledge

There are allied forms of health knowledge such as yoga, tai-chi, qigong, kalari, judo-seifuku, various forms of meditations, breathing techniques, and massage techniques, among many others which are related to well-being. Though these are not purely medical systems they have been adapted as health applications and contribute to health sector immensely (Payyappallimana, 2010)

2.3.1.4 New Forms of Alternative Health-caring Knowledge

There is also new knowledge generated in the west and other developed countries with a mix of ancient and contemporary scientific knowledge such as phyto-medicine, health supplements and macrobiotics among many others which are of relatively recent origin. There are other therapies such as reiki or shiatsu (the term and form as it is practiced today) which are of 20th century origin. Often some of these are also a blend of one or more of older medical knowledge systems. Some consider homeopathy and chiropractic systems not as traditional medical systems as they were developed in Europe post 18th century after the introduction of modern medicine (WHO 2002b). Many other new forms of TCAM therapies can be grouped under this category. Since some of the new forms of alternative health knowledge are often guided by modern knowledge issues related to their acceptance may be different (Payyappallimana, 2010)

Ethiopia is among the countries which have high indigenous knowledge accumulation. The traditional societies in Ethiopia have good plant use and management knowledge, which will

have valuable contribution to conservation activities in the country. This knowledge is still underutilized resource in the development process of Ethiopia. But, Indigenous knowledge of medicinal plants in Ethiopia is unevenly distributed among community members (Zemede Asfaw, 2001). Thus, a great effort is needed to understand and disseminate this knowledge via ethnobotanical studies (Tilahun Teklehaymanot and Mirutse Giday, 2007).

2.4 Ethnoveterinary medicine

Millions of people around the world have an intimate relationship with their livestock. Many people depend on their livestock: animals provide them with food, clothing, labor, fertilizers and cash, and act as a store of wealth and a medium of exchange. Animals are a vital part of culture and in many societies are regarded as equal to humans. To keep animals healthy, traditional healing practices have been applied for centuries and have been passed down orally from generation to generation (Raikwar and Maurya, 2015).

The term ethnoveterinary medicine was for the first time applied and use by Dr Constance McCorkle in 1986. She used it to refer to the 'systematic investigations of folk beliefs and practices in veterinary medicine,' by then. And later, defined it as local or indigenous knowledge and methods for caring for, healing, and managing livestock. This included social practices and ways in which livestock are incorporated into farming systems (Wanzala *et al.*, 2005). Historical records reveal people's association with and treatment of animals to be over 14,000 years ago, first with a dog, followed by sheep and goats by 9,000 BC in the fertile Nile Valley, and then with cattle in Egypt from 4000 BC and in Anatolia around 6000 BC (Wanzala *et al.*, 2005).

Ethnoveterinary medicine often provides cheaper options than comparable modern drugs, and the products are locally available and more easily accessible. As a consequence of these and other

causes, there is growing interest in the field of ethnoveterinary research and development (Tabuti *et al.,* 2003)

Worldwide interest in documenting and validating ethnoveterinary practices arose in the early 1980s, as people started to realize that ethnoveterinary knowledge was disappearing. Elderly community members with this knowledge were dying and the introduction of modern practices made it difficult for the younger generations to appreciate and use the beliefs and practices of their ancestors (Raikwar and Maurya, 2015).

As common as it is, the science of ethnoveterinary medicine lagged behind that of its equivalent (modern veterinary medicine) primarily because the procedure was done secretly and its knowledge was concealed in the gray literature (Mathias, 2004). Ethnoveterinary practice also has its own limits. Over-harvesting affects the range of habitats namely semi-arid woodland and savanna habitat. Diversity is also affected by rising deforestation and over-exploitation levels (Wanzala *et al.*, 2005). Efforts are needed to propagate and cultivate those species most at risk. A better scientific understanding of where these plants grow and how they work will optimize their collection and sustainable use. Also all plants are not necessarily harmless, so a better understanding of their chemistry can help to evaluate the associated risks (Marandure, 2018).

2.5 Traditional medicine and modern drug development

Human beings have depended on nature for their simple necessities as being the sources for medicines, shelters, food stuffs, fragrances, clothing, flavors, fertilizers and method of transportation throughout the ages. Determining the exact time of using plants as drug is very difficult (WHO, 1998). The development of traditional medicinal systems incorporating plants as

means of therapy can be traced back to the Middle Paleolithic age some 60,000 years ago as found from fossil studies (Solecki and Shanidar,1975).

For the large proportions of world's population medicinal plants continue to show a dominant role in the healthcare system and this is mainly true in developing countries, where herbal medicine has continuous history of long use. The development and recognition of medicinal and financial aids of these plants are on rise in both industrialized and developing nations (WHO, 1998).

The pillars of traditional systems of medicine, which have been in operation for thousands of yea rs, have been built from plants. The plants remain to offer mankind with new medicines. (Fakim, 2006).Some of the beneficial properties attributed to plants have been identified as defective and the treatment of medicinal plants is based on experimental findings from hundreds to thousands o f years. The earliest reports carved on clay tablets in cuneiform date from about 2600 BC are from Mesopotamia; among the materials that were used were oils of *Commiphora* species (Myrrh), *Cedrus* species (Cedar), *Glycyrrhiza glabra* (Licorice), *Papaver somniferum* (Poppy juice) and *Cupressus sempervirens* (Cypress) are still used today for the cure of diseases extending from colds and coughs to inflammation and parasitic infections (Fakim, 2006).

In the western world documentation of use of Natural substances for medicinal purposes can be found as far back as 78 A.D., when Dioscorides wrote "De Materia Medica", describing thousands of medicinal plants (Tyler, 1988). Ethiopian medical texts such as METSEHAFE FEWS and METSEHAFE MEDHANIT both written in Ge'ez (the working language of the Ethiopian Orthodox Tewahdo Church) and Etse-Debdabe written in Amharic are also notable traditional pharmacopoeias indicating the long history of medicinal plant use in the country

(Ermias Lulekal, 2014). According to Pankhurst (1976), these medical texts are speculated as copies of older Ethiopian pharmacopoeias that might date back to the 13th or 14th century. (Ermias Lulekal, 2014)

In recent times, developed countries are turning to the use of traditional medicinal systems that involve the use of herbal drugs and remedies (Lanfranco,1992) and according to the World Health Organization (WHO), almost 65% of the world's population has incorporated the value of plants as a methodology of medicinal agents into their primary modality of health care (Farnsworth, 1985).

It is often noted that 25% of all drugs prescribed today come from plants (Raskin and Ripoll, 2004). This estimate suggests that plant-derived drugs make up a significant segment of natural product– based pharmaceuticals. Out of many families of secondary metabolites, or compounds on which the growth of a plant is not dependent, nitrogen-containing alkaloids have contributed the largest number of drugs to the modern pharmacopoeia, ranging in effects from anticholinergics (atropine) to analgesics (opium alkaloids) and from antiparasitics (quinine) to anticholinesterases (galantamine) to antineoplastics (vinblastine/vincristine) (Raskin *et al.*, 2002).

In spite of the success of different drug discovery programs from plants in the past 2–3 decades, future endeavors face many challenges. Natural products scientists and pharmaceutical industries will need to continuously improve the quality and quantity of compounds that enter the drug development phase to keep pace with other drug discovery efforts (Rout *et al*., 2009). In addition, the increasing use of medicinal plants and their importance in drug discovery, their future, seemingly, is being threatened by negligence concerning their conservation. Reserves of

herbs and stocks of medicinal plants in developing countries are diminishing and in danger of extinction as a result of growing industrialization (Rout *et al*., 2009).

2.6 Role of traditional medicinal plants in primary health care

Now a days many countries in the world use traditional medicine (TM) to meet some of their primary health care needs (Ermias Lulekal, 2014). There are many systems of TM in the world such as: Traditional Chinese Medicine, Indian Ayurveda, Arabic Unani Medicine; and a variety of other indigenous TM system developed throughout history by Asian, African, Arabic, Native Americans, Oceanic, Central and South American and other cultures (Tefera, 2003).

WHO estimate that 70-80% of people in developing countries including Africa depend on traditional medicine for their health care (Cunningham, 1994). This wide spread use TM is not only due to inadequate modern health services but there are also other reasons such as, affordability and cultural acceptability of TM (Tefera, 2003)

Even though, Traditional medicines are vastly used in developing countries developed countries also use them in their health care system. In developed countries, TM meets an additional set of needs. People increasingly seek natural products and want to have more control over their health. They turn to TM to relieve common symptoms, improve their quality of life, and protect against illness and diseases in a holistic, non-specialized way. Incidentally, nearly a quarter of all modern medicines are derived from natural products, many of which were first used in a traditional medicine context. In developed countries TM is thus a resource for primary health care, but also for innovation and discovery (Fan *et al*., 2014).

Table 1 Utilization of TACM in Developed countries (Bodeker and Burford, 2007)

Country	**Utilization**
Australia	48%
Canada	70%
Denmark	33%
France	49%
Germany	75%
United Kingdom	47%
United States	62%/36%*
*Note: 62% when definition included prayer specifically for health reasons: 36% when prayer was excluded.	

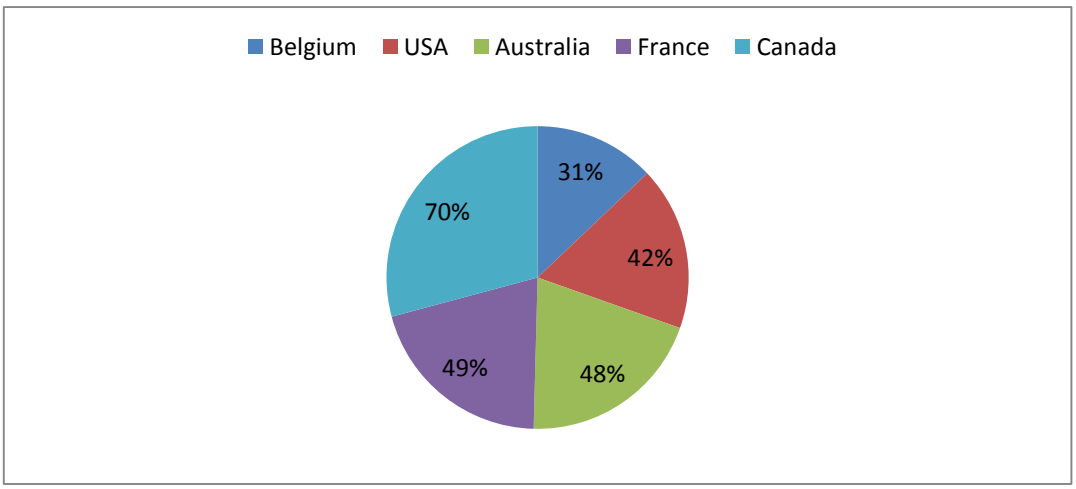

Figure 1 Populations in developed countries who have used TCAM at least once (Tefera, 2003)

The role of traditional medicinal plants in modern healthcare services is best-amplified in countries which practice to integrate the two systems (Ermias Lulekal, 2014). The World Health Organization (WHO) formulated a policy in 1978 about integration of traditional and modern healthcare systems, the central point of which states that 'it is only through the integration of the two systems that the motto 'Health for all' could be turned into a global reality as the majority of the world's populations are too poor to afford modern medical services' (WHO, 2002b).

Integrating traditional medicinal plants in modern healthcare services is the best way to emphasize the role of traditional medicinal system(Ermias Lulekal, 2014) The two systems of traditional and modern medicine need not clash. Within the context of primary health care, they can blend together in beneficial harmony, taking advantage of the best features of each system and compensating for certain weaknesses in each as well. In an ideal world, TM would be an option, a choice, offered by a well-functioning, people-centred health system that balances curative services with preventive care. The challenge is to give TM its appropriate place in an integrated health system, to help all practitioners understand its unique and valuable contribution, and to educate consumers about what it can and cannot do. In other words, we need to modernize this rich resource and cultural heritage, and put it in its proper place in today's world by proper integration with modern healthcare services (Fan *et al*., 2014).

2.7 Traditional medicine in Africa

African traditional medicine is the oldest, and perhaps the most assorted, of all therapeutic systems. Africa is considered to be the cradle of mankind with a rich biological and cultural diversity marked by regional differences in healing practices (Gurib-Fakim, and Mahomoodally , 2013)

Traditional medicine is dominant in the African health care system. This can be attributed to major factors. The first one is inadequate access to allopathic medicines and western forms of treatments, whereby the majority of people in Africa cannot afford access to modern medical care either because it is too costly or because there are no medical service providers. Second, there is a lack of effective modern medical treatment for some ailments such as malaria and/or HIV/AIDS, which, although global in distribution, disproportionately affect Africa more than other areas in the world. (Mahomoodally, 2013)

Medicinal plants are the most commonly practiced traditional medicine in Africa. Medicinal plants are easily accessible health resource to the community in many parts of Africa. In fact, Africa has enormous biodiversity resources and it is estimated to contain between 40 and 45,000 species of plant with a potential for development and out of which 5,000 species are used medicinally. This is due to Africa is located within the tropical and subtropical climate (Manach *et al*., 2004)

However its rich biodiversity, the documentation of medicinal uses of African plants and traditional systems is becoming a pressing need because of the rapid loss of the natural habitats of some of these plants due to anthropogenic activities and also due to an erosion of valuable traditional knowledge. It has been reported that Africa has some 216 million hectares of forest, but the African continent is also notorious to have one of the highest rates of deforestation in the world, with a calculated loss through deforestation of 1% per annum. In addition, the continent also has the highest rate of endemism, with the Republic of Madagascar topping the list by 82%, and it is worth to emphasize that Africa already contributes nearly 25% of the world trade in biodiversity (Atawodi, 2005).

Recently, the amounts of scientific literature that are focused towards evaluating the efficacy of medicinal plants from Africa are growing. However, there is still a lack of updated (Mahomoodally, 2013).

2.8 Traditional medicine in Ethiopia

2.8.1 Research on medicinal plants of Ethiopia

In Ethiopia, plants have been used as a source of traditional medicine starting from ancient times to cure and prevent different human ailments (Asfaw Debela *et al*., 1999). This long history of medicinal plant usage is reflected in various medico-religious manuscripts produced on parchments (Fassil Kibebew, 2001). Traditional medicine has become an integral part of the culture of Ethiopian people due to long period of practice and existence (Mirgissa Kaba, 1998). Commonly people use medicinal plants in religious ceremonies as well as for magic and medicinal purposes in different parts of Ethiopia (Amare Getahun, 1976).

Modern studies on traditional medicinal plants in Ethiopia started in 1973 when the then Haile Selassie 1st Prize Trust granted Addis Ababa University a fund to employ a traditional healer to work with botanists(Mesfin Tadesse, Brook Mesfin, 2010).

Initially, the work involved collection, identification and recording of the uses of medicinal plants. This resulted in a departmental publication with a limited number of copies (Tewolde-Berhan *et al*., 1976) which was later expanded into a book (Gelahun Abate, 1989). Ever since this time, a lot has been written about medicinal and other useful Ethiopian plants. The Department of Biology of Addis Ababa University has continued to engage its staff and graduate students in this activity. The Department of Chemistry and the School of Pharmacy have also

contributed to the elucidation of the chemical constituents and reported medicinal properties of some selected plants and plant products.

There is a large magnitude of use and interest in medicinal plants in Ethiopia due to acceptability, accessibility and biomedical benefits. (Dawit Abebe 2001), Even today, it is common for people living in rural and urban areas to treat some common ailments using plants available around them (example, *Hagenia abyssinica* to expel tapeworm, *Ruta chalepensis* for various health problems) (Abbink, 1995)

There are number of research out puts indicating the presence of vast number of plant species used as traditional medicines in Ethiopia. However, information on the total number of medicinal plants is limited. Hence, there is a need to bring the different ethnobotanical research reports together to get the exact figure (IBC, 2005). Tessema Tanto *et al.,* (2003) reported the presence of 887 medicinal plant species in Ethiopia of which 2.7% are endemic and mostly found in the wild habitats. However, there are many areas in Ethiopia which have medicinal plants but do not studied yet.

Recently, there are PhD and MSc students who focus on Ethnobotany in Ethiopia, especially at Addis Ababa University (College of Natural and Computational Sciences) and Haramaya University. In addition, many ethnobotanical studies have been conducted in many parts of Ethiopia. In addition, Universites like Debrebrehan and Wolkite University are doing significant work in the field of ethnobotany. Therefore, it is possible to say that ethnobotanical studies are flourishing in the country and showing some steps forward (Tadese beyene, 2015). And researchers and researches in this area should be assisted to know more and to get better benefit from Ethiopian medicinal plants.

2.8.2 Conservation and threats to medicinal plants of Ethiopia

There is a worldwide decline in natural vegetation, including medicinal plants, due to human activities, and more than half the habitable area of the planet has already been disturbed. Over utilization of natural resources and pollution of the soil, water and the atmosphere have all reduced biodiversity (Debela Hunde, 2001).

Ethiopia's traditional medicine, as elsewhere in Africa, is faced with problems of continuity and sustainability (Ensermu Kelbessa *et al*., 1992). There are various causes of this sustainability problem. The major causes of this problem are loss of species of medicinal plants, loss of habitats of medicinal plants and loss of indigenous knowledge. The majority of the medicinal plants utilized by Ethiopian people are harvested from wild habitats (Tesfaye Awas and Zemede Asfaw, 1999) and hence this aggravates the rate of loss of species with related indigenous knowledge and loss of widely occurring medicinal plant species. Other than this, people use many wild species of plants for food, closing, shelter, fuel, fiber, income generation and the fulfilling of cultural and spiritual needs throughout the world in addition to medicinal value (Zemede Asfaw, 2001)

These threats to medicinal plants can be categorized into anthropogenic and natural causes. (Ensermu Kelbessa *et al*.,1992). Nowadays human-induced extinction of species and habitat degradation are prevailing. Rapid increase in population, the need for fuel, urbanization, timber production, over harvesting, 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 outbreaks (Ensermu Kelbessa *et al*., 1992).

3. Materials and methods

3.1 Description of the study area

3.1.1. Geographical location

The study was conducted in Kebena district, Gurage zone, south west Ethiopia which is located at 154 km South West from Addis Ababa, capital city of Ethiopia and 430 km North East from Hawassa the capital city of SNNPR. It is bordered by Oromia region in North, Cheha district in South, Gedebano gutazer wolene and Muhure akilil district in East and Abeshege district in West. Administrative town of Kebena district is Wolikete town and takes its administrative duties and responsibility with one municipality urban Kebele and 23 rural Kebeles.

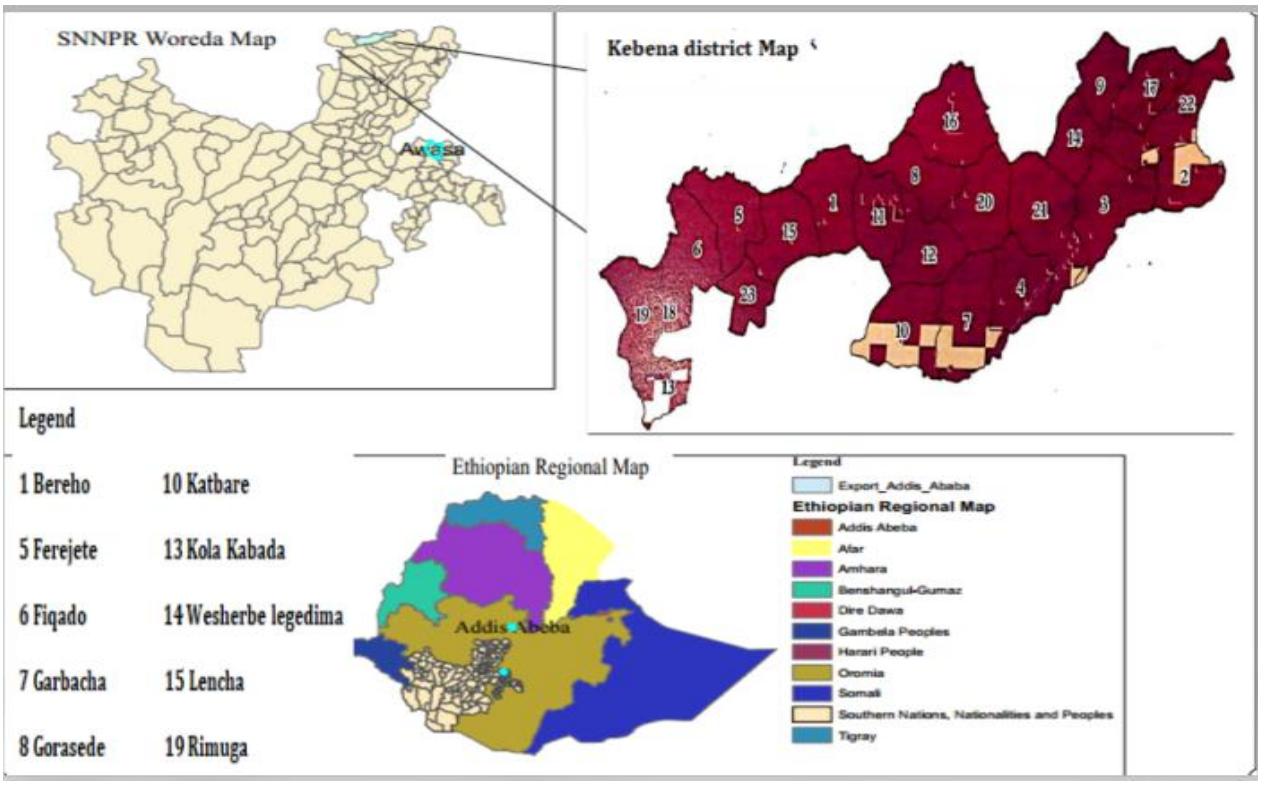

Figure 2 Map of Kebena district.

3.1.2 Temperature and Rainfall

Kebena district is one of the rural districts in Gurage Zone characterized by tropical climate of heavy rainfall and warm climate. The district has a mean annual temperature of 17-20 ^{0}c. Its altitude ranges from 1700 to 2008 m above the sea level, with 906 mm of annual rainfall. (KWADO, 2013 E.C).

3.1.3 Livelihood and Demography

The staple foods in the area include cereal, enset, and vegetables. The majority of the communities are engaged in mixed farming. According to 2007 central statistical agency census data; the projected total population of Kebena district in 2010 EFY estimated to be 67587. Out of these male accounts 33117 and female 34470 (FDREPCC, 2008).

3.1.4 Land use

Kebena district has a total area of 27574 hectares of which 73.6% is under cultivation for growing both annual and perennial crops, while 10.33%, 5.5%, 5.3%, 4.6% and 3.2% of the total land area is occupied by grassland and bare land, water bodies, pasture, forest and shrub, and villages respectively. In Kebena district, there are four rivers which are Wabe, Legedima, Demekasha, and Rebu (KWADO, 2013 E.C).

3.1.5 People, Population and Healthcare Status

According to the report of Kebena district Health Office (KWHO, 2013 E.C.), the first ten major diseases in the area are: diarrhea, Unitary tract infection, Pneumonia, Typhoid fever, Typhus Fever, AURI (Acute Upper Respiratory Infection), malaria, Dyspepsia (Inability to swallow), Tonsillitis, and Arthritis (Table 2).

Table 2 Top ten Diseases in Kebena district in 2012 EC (KWHO, 2013).

Top ten Diseases in Kebena district in 2012 EC.		
	Disease	Number of cases in 2012 EC.
1	Diarrhea	867
2	Urinary tract infection	854
3	Pneumonia	713
4	Typhoid fever	710
5	Typhus fever	705
6	AURI (Acute Upper Respiratory Infection)	628
7	Malaria	333
8	Dyspepsia (Inability to swallow)	322
9	Tonsillitis	221
10	Arthritis	219

3.1.6 Vegetation and Major Cultivated Crops

The vegetation of the study area consists of various trees, shrubs and *herbaceous* species.

Table 3 Major cultivated crops in Kebena district (KWADO, 2013)

Crop category	Scientific name	English name
Cereals	*Sorghum bicolor*	Sorghum
	Zea mays	Maize
	Eragrostis tef	Tef
	Eleusine coracana	Finger millet

	Triticum aestivum	Wheat
Vegetables	*Capsicum frutescens* *Allium cepa* *Lycopersicon esculentum* *Cucurbita pepo* *Allium sativum* *Brassica oleracea*	Chili Shallot Tomato Pumpkin Garlic Cabbage
Fruits	*Citrus sinensis* *Citrus aurantifolia* *Musa x paradisiaca* *Mangifera indica* *Carica papaya* *Persea americana*	Orange Lemon Banana Mango Papaya Avocado
Pulses	*Pisum sativum* *Phaseolus vulgaris* *Vicia faba*	Field peas Haricot beans Horse beans
Cash crop	*Coffea arabica* *Saccharum officinarum* *Catha edulis* *Ensete ventricosum*	Coffee Sugar cane Khat Enset
Oil crop	*Linum usitatissimum* *Guizotia abyssinica* *Brassica napus*	Lin seed Niger seed Kale seed
Root crop	*Ipomoea batatus*	Sweet potato

3.2 Reconnaissance survey and selection of study sites

A reconnaissance survey of the study area was conducted from February 4-14, 2020 and the data was collected from October 20, 2021 and November 19, 2021. Kebena District has a total of 18 kebeles. Out of these, 10 kebeles found in different altitudinal ranges were selected for ethnobotanical data collection. The traditional healers and knowledgeable elders, involved as key informants, were identified with the assistance of local authorities, elders and knowledgeable persons.

3.3 Sampling of informants

A total of 80 informants, which comprises of 20 key informants, were selected by purposive sampling via the recommendations of local authorities, knowledgeable elders and developmental agents. The other 60 informants were selected through snowball sampling from the local people of the study Kebeles.

3.4 Data collection

The techniques that were used in ethnobotanical data collection include group discussion, semi-structured interviews, and field observations or guided field walks with informants and market survey.

3.4.1 Group discussion

Brief group discussions were made prior and during ethnobotanical data collection according to Martin (1995). The first GD was conducted during the reconnaissance survey with the district officials. In the GD three men and two women officials were participated. During the GD we discussed about the reason why we went in to the district, the current status of medicinal plants

and traditional knowledge. Also we told them our plan on how to conduct the research and we noted some recommendations on how to conduct the research from the district officials.

The Second FGD was conducted during the actual data collection. It was held with five key informants. In the FGD we had discussed about the current and previous status of medicinal plants and traditional medicinal knowledge in the district, how they classify vegetation, soil, and land form locally, their view on the integration of modern medicine and traditional medicine and also they told us some medicinal plants that they used to treat different ailments.

Figure 3 Focus Group Discussion with District officials during the reconnaissance survey

3.4.2 Semi-structured interviews

Interviews were based on, around a semi-structured checklist of topics consisting 18 main questions prepared beforehand in English, and translated on the spot in to Amharic. In addition for three informants some questions were clarified by their mother tounge kebengna language. The questions were prepared with the following main components: (a) personal data of the respondents which includes the name, address, age, and gender, (b) information on medicinal plants such as vernacular name, parts of the plant used, time and season of collecting plant

material, preparation, dosage, administration, side-effect and antidote and contraindication(s) of the various remedies (Appendix 6)

Figure 4 interviewing an informant

3.4.3 Guided Field Walk

Guided field interviews were made with informants and all relevant data including the vernacular names of plants, habit, habitat of the plant, the parts used, the preparation methods and modes of administration and disease conditions treated as well as the strategies they use for the conservation of medicinal plants and the preservation of the indigenous knowledge on medicinal plants were recorded. Field observations were performed with the help of local guides, as well as informants in the study area.

Figure 5 Guided field walk

3.4.4 Market survey

Market survey was done in Welkite and Wosherebe town to observe and collect data on the marketability and trade of medicinal plants, also other aspects of of herbal drugs sold in the local markets of the study area. A semi-structured interview (Appendix 6) was conducted with Traditional medicine sellers, producers and consumers during the market survey.

3.5 Specimen collection and identification

Medicinal plants were collected from wild and cultivated areas. The local names, habits and associated plants were collected. The collected voucher specimens with labels were taken to the National Herbarium of Ethiopia (Addis Ababa University). The identification was done from February to March, 2021 by using taxonomic keys and various volumes of the Flora of Ethiopia and Eritrea and lastly the identified specimens were confirmed by the advisor of the researcher.

3.6 Data analysis

The gathered data were computed by preference ranking, paired comparison and direct matrix ranking according to Martin (1995), Alexiades (1996) and Cotton (1996). Informant consensus factor and index of fidelity level (FL) was computed (Heinrich, 1998, Alexiades, 1996).

3.6.1 Preference ranking

Preference ranking was conducted to rank five selected medicinal plants that cited to treat anthrax based on degree of their remedial effectiveness. Following the methods of Martin (1995), each informant was asked to think; order and rank the items based on their personal preference, community importance, or any other criteria set by him/her and this helps to indicate the most effective medicinal plants used by the community to treat anthrax.

3.6.2 Direct Matrix Ranking

Direct matrix ranking exercise was done following Martin (1995) and Cotton (1996) to compare multipurpose use of a given species and to relate this to the extent of its utilization versus its dominance. Based on information that was gathered from informants, five multipurpose plant species were selected out of the total medicinal plants and use diversities of these plants were listed for selected key informant to assign use value to each species. 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). Accordingly, each key informants use values for the selected multipurpose medicinal plant species, average value of each use diversity for a species was taken and the values of each species summed up and ranked.

3.6.3 Informant Consensus Factor

Informant Consensus Factor (ICF) was calculated for categories of diseases to identify the agreements of the informants on the reported cures using the formula used by (Tilahun Teklehaimanot and Mirutse Giday,2007).

$$ICF = \frac{nur - nt}{nur - 1}$$

Where, ICF= Informants Consensus Factor

nur = number of use citation in each category

nt = number of species used

3.6.4 Fidelity Level

Fidelity Level index (FL) was calculated using the following formula indicated in Alexiades (1996) as follows.

$$FL\ (\%) = \frac{IP}{IU} \times 100$$

Where, IP is the number of informants independently suggested the use of a species to treat a particular disease category and IU is the total number of informants mentioned the plant for any major disease. FL was used to quantify the importance of a given species for a particular purpose in a given cultural group.

3.6.5 Descriptive statistics

Descriptive statistical methods such as percentage and frequency were employed to analyze and summarize the data on medicinal plants, associated knowledge, management methods, use and conservation. The most useful information that was gathered on medicinal plants reported by local people include medicinal value, application, methods of preparation, route of application, disease treated, dosage, part and habit used were analyzed through descriptive statistical analysis according to Martin (1995), Alexiades (1996) and Cotton (1996).

3.7 Ethical considerations

Data collection from the study sites was performed after getting official permission from Kebena District Administrative offices. The consent of key informants and focus group participants who were involved during the study were obtained after clarifying about the study for the participants.

4. Results

4.1 A summary of informant description in Kebena district

4.1.1 Ages of informants

The distribution of informants with respect to age class shows that, the majority of informants (31.23%) were in the age class of 31 to 40 (Table 4).

Table 4 Ages of informants in Kebena district

Informant's age	**No. of informants**	**Percentage (%)**
16-30	6	7.5
31-40	25	31.23
41-50	18	22.5
51-60	15	18.75
61-70	9	11.25
71-80	7	8.75
Total	80	100

4.1.2 Marital Status of Informants

Of the total informants, 82.5% were married, but 13.75% and 3.75% were single and divorced respectively (Table 5)

Table 5 Marital Status of Informants in Kebena district

	Sex		Total	Percentage (%)
Marital Status	F	M		
Married	27	39	66	82.5
Single	2	9	11	13.75
Divorced	1	2	3	3.75
Total	30	50	80	100%

4.1.3 Educational status of informants

The result shows that 39 (48.75%) were illiterate followed by those who can only write and read 26.25% and the least is above elementary 2 (2.5%) and others (Table 6). This shows that there is a negative relationship between the educational level of informants and their ethnobotanic knowledge. As educational level increases ethnobotanic knowledge decreases.

Table 6 Educational status of informants in Kebena district

Educational status	Grade	Percent of total
Not read and write	39	48.75
Read only	11	13.75
Only Read and write	21	26.25
Elementary school	7	8.75
Above elementary	2	2.5
Total	80	100

4.2 Land form classification in Kebena district Gurage Zone

People in Kebena divide land form into four main types:-

- **Wotageba:-** Land not used for grazing land or agricultural activities.
- **Giraba:-** Mountain area characterized with higher altitude and covered with vegetation e.g., *Olea europaea* subsp. cuspidata, *Hagenia abyssinica*, and *Acacia abyssinica*,
- **Letiti huleta:-** Meaning level-land that serves especially for grazing but it also serves for cropping. It is cultivable or cultivated land for growing different crops.

- **Kokobat:-** Refers to a smaller elevation (hills) compared to Terrarama, sometimes on which agriculture, grazing and other practices can be performed

4.3 Indigenous vegetation classification

People in Kebena also have techniques of classifying vegetation into three main types:-

- **Dubu**: - This type of vegetation is with densely populated plant species and composed of a range of larger trees, where several wild animals stay.

- **Dufi huleta**: - Open woody and shrub land with patches of trees, bushes, shrubs and herbaceous species. It is common near agricultural margins and mountain escarpments.

- **Letiti:** - Refers to an area covered by grass and serves especially as grazing land.

4.4 Soil classification by indigenous people

The local people classify soil based on soil characteristics such as color of the soil, fertility of the land, and other criteria. The following three soil types have been identified by local people:-

- **Gembel bucha:** This soil type refers to black soil and with better fertility and production in contrast to other soil types. The people use this soil to grow crops like *Eragrostis tef*, *Zea mays*, and *Triticum aestivum*.

- **Disha bucha:** This soil is red soil type; it is less fertile in comparison to the black soil. But, it can enable to grow crops of various types by applying fertilizer. The people use this soil to grow crops like *Triticum aestivum* and *Zea mays*.

- **Wajo bucha:** This type of soil is white soil which is not suitable for any crop production, and it is used for house construction.

4.5 Plants in the homegardens

Kebena district is a place where homegardens are in great use. People in the district get food, spices, medicine and other services from it. During the study different medicinal plants have been obtained in and around gardens of local people in the study area that were used for treating different human and livestock ailments. The people of the study area cultivate diverse medicinal plant species in their homegardens. The number of medicinal plants recorded was 46 species in 38 genera and 28 families. In terms of species Solanaceae and Lamiaceae had five species each then Asteraceae, had four species followed by Euphorbiaceae with three species, and others (Table 7).

Table 7 Numbers of genera, family and plant species in the homegardens

Family	Numbers of genera	Percent	Numbers of species	percent
Solanaceae	3	8.10%	5	10.86%
Lamiaceae	3	5.4%	5	10.86%
Asteraceae	2	5.4%	4	9.3%
Euphorbiaceae	3	8.10%	3	6.97%
Fabaceae	2	5.4%	2	4.65%
Cucurbitaceae	2	5.4%	2	4.65%
Rutaceae	2	5.4%	2	4.65%
Verbenaceae	2	5.4%	2	4.65%
Alliaceae	1	2.70%	2	4.65%
others 19 families	1	34.04	1	44.1%

4.5.1 Habit of plants in home gardens

According to the habit of plants in the homegarden herbs constitute the majority in the category with 22 species (51.1%) followed by shrubs with 12 species (27.9%), and trees with 9 species (20.9%). Yet this plants are found in the homegarden by nature not due to deliberate cultivation.

4.6 Diversity of ethnomedicinal plant resources in the study area

A total of 65 species belonging to 59 genera and 39 families were collected and identified in the study area (Appendix 4). Of these, 22 species were collected from Wild vegetation whereas 43 species were obtained from homegarden.

In terms of family distribution, Asteraceae and Lamiaceae stood first contributing 6 (9.23%) species, followed by Fabaceae and Solanaceae 5 (7.69%) species, Euphorbiaceae 4 (7.14%) species, and other families contribute 39 (59.02%) species (Appendix 3).

4.7 Ethnomedicinal plant species used by people of Kebena district

In the study area a total of 65 medicinal plant species were gathered and documented that were used for the treatment of human and livestock ailments. From these, 59 species (90.90%) were used as only human medicine, and 6 species (9.1%) were reported for treating both human and livestock ailments

4.7.1 Habit

Regarding the habit diversity, herbs were the most common and stood first with 28 species (43.07%), followed by trees 20 species (30.76%), and shrubs 17 species (26.15%) (Figure 5)

4.7.2 Plant parts used

The most widely used plant part for the preparations of remedy were leaves, which accounted for 46.05% followed by roots (11.84%), seed (10.52%) and others (Table 8).

Table 8 Plant Parts used in preparation of remedies in Kebena District

Parts used	**Number of species**	
	Total	**Percentage**
Leaf only	35	46.05
Root only	9	11.84
Seed only	8	10.52
Bark only	4	5.26
Fruit only	4	5.26
Latex/sap only	3	3.94
Bulb	2	2.63
Root and Leaf	2	2.63
Seed and Leaf	2	2.63
Stem only	1	1.31
Whole plant	1	1.31
Fruit and root	1	1.31
Corm	1	1.31
Corm and pseudo stem	1	1.31
Rhizome	1	1.31
Total	76	100

4.7.3 Route of administration

People of the study area mostly administer traditional medicine orally. Oral administration accounts (58%) followed by dermal (28%), both nasal and oral and dermal accounted (6%) and others (Figure 6).

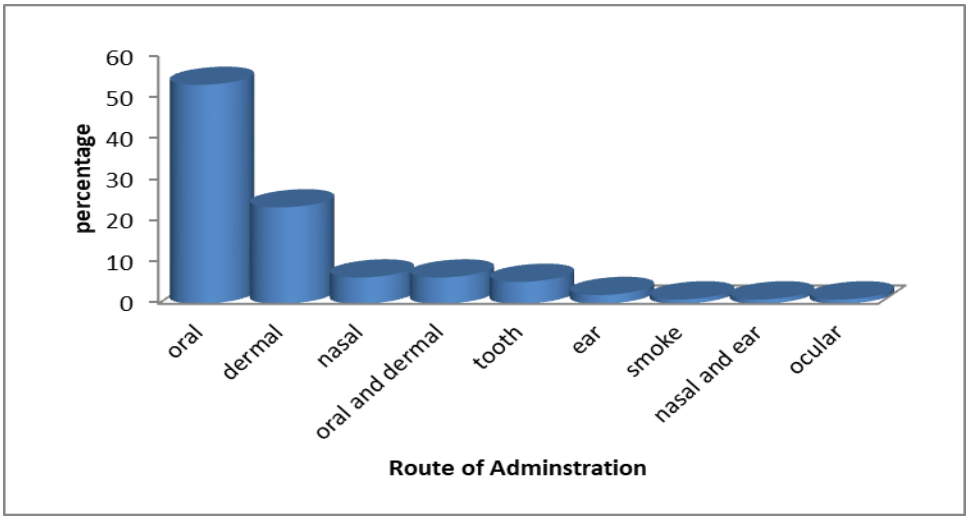

Figure 6 Route of administration of traditional medicine in the study area

4.7.4 Solvents and additives

Some of the remedies were taken with different additive and solvents; the widely used solvent was water (57.3%). Other additives include butter, honey, milk, boiled coffee and tea (Table 9).

Table 9 Solvents and additives used in medicinal preparation in Kebena district.

Solvents and additives	**No. of times the solvent or additive was cited**	**Percent of total**
Water	43	57.3%
Milk	7	9.3%
Tea	10	13.3%
Coffee	4	12%
Butter	4	4%
Honey	2	2.6%

4.7.5 Service categories of plants in Kebena district

In Kebena district there are varieties of plant species. These plants serve for different purposes in the day to day lives of the district people. From those plants 34 species were mentioned to be used only for medicinal purpose, 9 used for Medicinal, food, spice and cash income purpose, 6 used for Medicine and cash income purpose and 16 serve for different other purposes. (Table 10).

Table 10 Service categories of plants in the study area

Service category	**Total no. of species**	**Percent**
Only medicinal	34	52.3
Medicinal, food, spice and cash income	9	13.84
Medicine, forage	1	1.53
Medicine, food and cash income	5	7.69
Medicinal and cash income	6	9.23
Medicine, and stimulant	1	1.53
Medicine and fence	5	7.69
Medicine, cash income and stimulant	2	3.07
Medicinal, spice and cash income	2	3.07
Total	65	100

4.7.6 Method of preparation

The local community use different forms of remedy preparations and applications to treat human and livestock diseases.

Table 11 Ways of preparations of medicinal plants used to treat different ailments in Kebena district

Preparation	Number of citation	Percent
Pounding	38	38.77
Crushing	21	21.42
Squeezing	18	18.36
Boiling	15	15.30

4.7.7 Sources of medicinal plants in Kebena district

From the medicinal plants that were used for human ailments, 22 species were collected from the wild vegetation and 43 species from homegardens.

4.8 Medicinal plants used to treat only human diseases

The numbers of ethnomedicinally important plant species that were reported to treat human ailments were 59, and the number of ailments reported to be treated by these species were 43. Medicinal plants used to treat human ailments were categorized in to 53 genera and 36 families. (Table 12).

Table 12 Distribution of collected species in different family

Family	Number of genera	Percent	Number of species	Percent
Lamiaceae	4	7.54	6	8.47
Asteraceae	3	5.66	6	10.16
Solanaceae	4	7.54	5	8.47
Fabaceae	4	7.54	4	6.77
Euphorbiaceae	3	5.66	3	5.08
Cucurbitaceae	2	3.77	2	3.38
Brassicaceae	2	3.77	2	3.38
Rutaceae	2	3.77	2	3.38

Rosaceae	2	3.77	2	3.38
Verbenaceae	2	3.77	3	5.08
Alliaceae	1	1.88	2	3.38
Acanthaceae	1	1.88	1	1.69
Melianthaceae	1	1.88	1	2.38
Apocynaceae	1	1.88	1	1.69
Celastraceae	1	1.88	1	1.69
Rubiaceae	1	1.88	1	1.69
Araceae	1	1.88	1	1.69
Poaceae	1	1.88	1	1.69
Boraginaceae	1	1.88	1	1.69
Flacourtiaceae	1	1.88	1	1.69
Musaceae	1	1.88	1	1.69
Myrtaceae	1	1.88	1	1.69
Myrsinaceae	1	1.88	1	1.69
Apiaceae	1	1.88	1	1.69
Moraaceae	1	1.88	1	1.69
Moringaceae	1	1.88	1	1.69
Ranunculaceae	1	1.88	1	1.69
Oleaceae	1	1.88	1	1.69
Oxalidaceae	1	1.88	1	1.69
Lauraceae	1	1.88	1	1.69
Piperaceae	1	1.88	1	1.69
Phytolacaceae	1	1.88	1	1.69
Rhamnaceae	1	1.88	1	1.69
Urticaceae	1	1.88	1	1.69
Zingiberaceae	1	1.88	1	1.69

4.8.1 Habits of medicinal plants that are used to treat human ailments

This study revealed that medicinal plants used to treat human ailments constitute herbs 26 species (44.6%), shrubs 17 species (28.81%), trees 16 species (27.11%) (Figure 7) This finding shows that the most used plant species for the treatment of human ailment were herbs followed by shrubs.

4.8.2 Parts used

With regard to the plant parts used for treatment of human ailments, different parts of the plants were reported to be used for medicinal purposes. The most frequently utilized plant parts were

leaves 32 (46.96%) followed by roots 8 (12.12%), bark 3 (4.54%), fruit 3 (4.54%), sap/latex, 2 (3.03%) and other 8 parts collectively accounts (28.81%). (Figure 9).

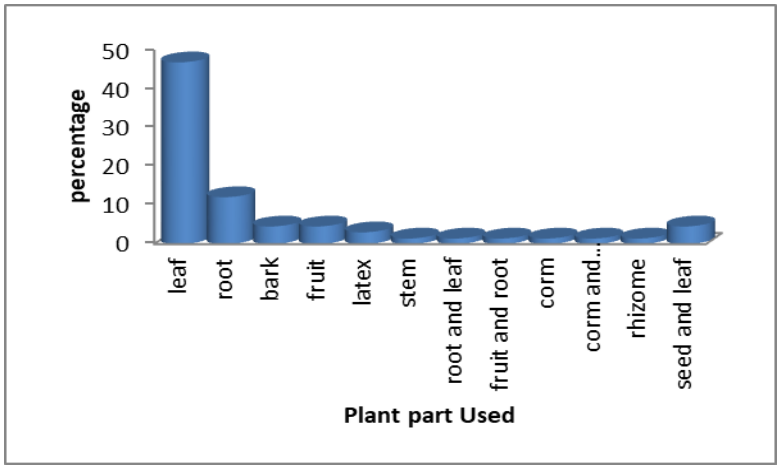

Figure 7 Plant parts used for human ailment treatment in Kebena district

4.8.3 Routes of administration

There are various routes of administration of traditional medicinal remedies prepared by the local community. The major routes of administration in the study area were oral, dermal, nasal, and optical. In the study area oral administration was the dominant route with 56.96% of the cases followed by dermal (26.58 %) and other 6 routes (16.41%) (Figure 10).

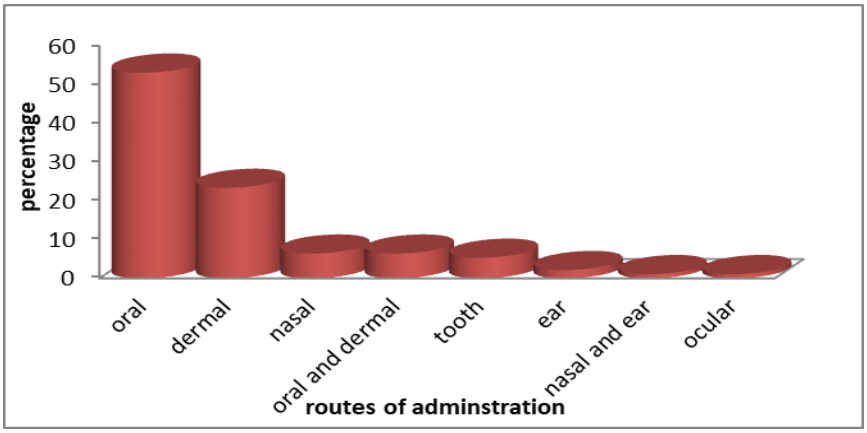

Figure 8 Route of administration of medicinal plants that are used to treat human ailments in Kebena district

4.8.4 Major human diseases and plant species used by local people

There are 41 different diseases of humans were recorded in the study area, which were treated by 59 medicinal plant species. It was observed that a single species can treat a single disease or a number of diseases. According to the informants the largest number of species was used to treat common cold which was treated with 11 (26.8%) species, followed by stomach ache and febrile illness each of them was reported to be treated by 10 (24.39%), malaria and anthrax each of them reported to be treated by 8 (19.51%), tooth ache and anthrax by 7 (17.07%), evil eye and sudden sickness by 6 (14.63%) species.

4.9 Medicinal plants used for the treatment of both human and livestock ailments

A total of 6 species of medicinal plants were reported for threir use to treat both human and livestock in the study area. These belong to 6 families, 6 genera and 6 species. The family Aloaceae, Euphorbiaceae, Fabaceae, Cucurbitaceae, Sapidiaceae, Acanthaceae were represented by one species each (Table 13). These plants were reported as treatment for 23 types of human and livestock diseases in the study area. These species were reported to be harvested from the wild(4 species) and homegarden (2 species).

Table 13 Number of genera and number of plant species used in the treatment of both livestock and human diseases in Kebena district.

Family	Number of genera	Percent	Number of Species	Percent
Acanthceae	1	12.5	1	16.67
Aloeceae	1	8.33	1	16.67
Cucurbitaceae	1	8.33	1	16.67
Euphorbiaceae	1	8.33	1	16.67
Fabaceae	1	8.33	1	16.67
Sapidaceae	1	4.17	1	16.67

4.9.1 Habits

The habits of medicinal plants that were harvested for both the treatment of human and livestock ailments were 3 herbs species, and 3 trees species.

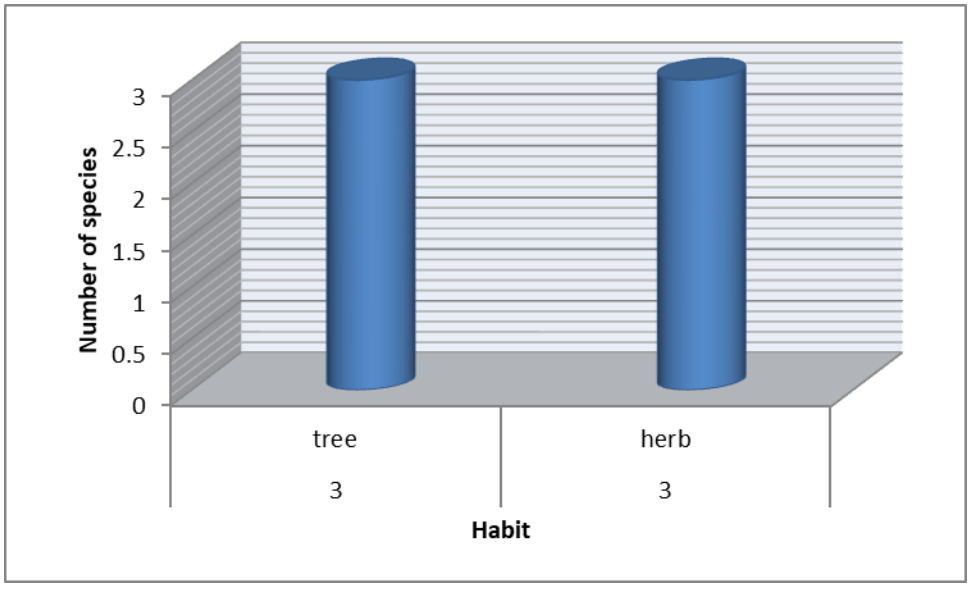

Figure 9 Habits of medicinal plants that are used for the treatment of both human and livestock ailments

4.9.2 Plant parts used

The plant parts used for both the treatment of human and livestock treatment in the area were leaves 14 (60%), root 5 (21.73) and leaf and root 4 (17.39) (Figure 12). Like that of human medicine leaves were the most harvested plant part of remedy preparation for both livestock and human ailments (Figure 12).

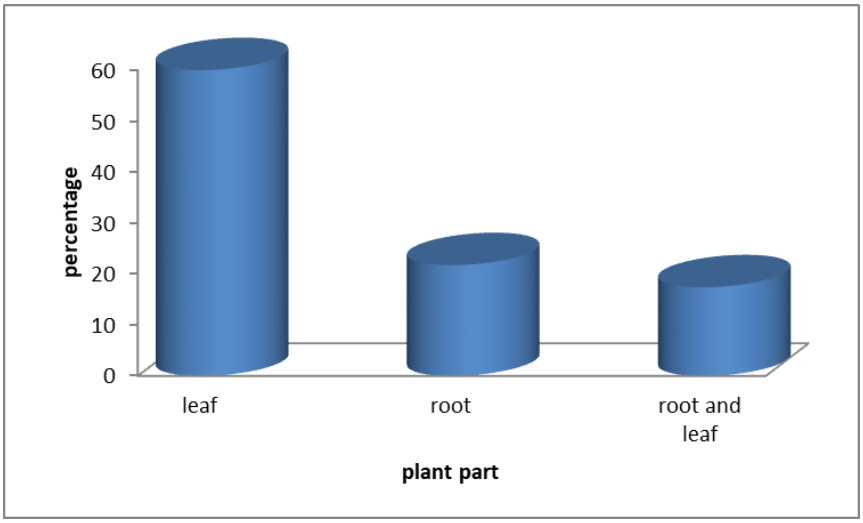

Figure 10 Plant parts used for both livestock and human ailments treatment in Kebena district

4.9.3 Route of administration

Based on the nature of the ailment the remedies were applied through different routes. Oral route was the major route (12 preparations, 52.17%), followed by dermal (6 preparations, 26.08%), ear (2 preparations, 8.69%) and dermal and oral (3 preparation, 13.04%) (Figure 13).

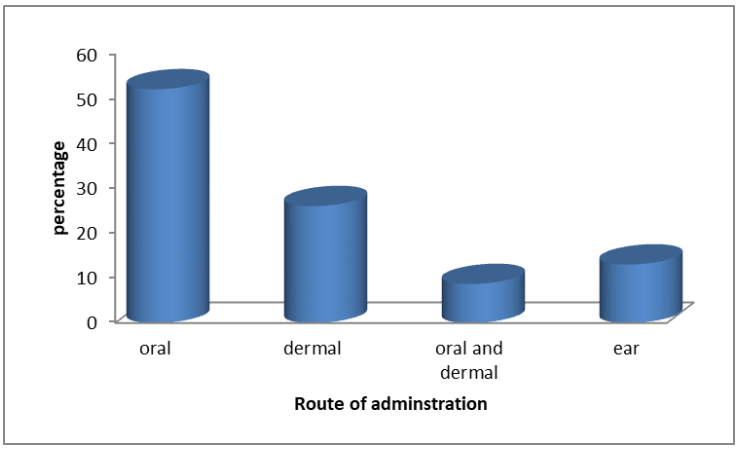

Figure 11 Route of administration of medicinal plants that are used to treat both livestock and human ailments

4.10 Sources of indigenous knowledge

In the study area key informants (knowledgeable elders and traditional healers) were asked from where did they get their knowledge about medicinal plants. The highest number of traditional medicinal plant knowledge was gained from father/mother 7 (35%) followed by from Sister/Brother and others 4 (20%) each , the least is from Wife/Husband and Neighborhood 2 (10%) each. (Table 14).

Table 14 Sources of knowledge on the practice of traditional medicine

Source of knowledge fortraditional healer	**Number**	**Percent oftotal**
Father/ Mother	7	35%
Wife/Husband	2	10%
Sister/Brother	4	20%
Uncle/Aunt	1	5%
Neighborhood	2	10%
Other	4	20%

4.11 Marketed medicinal plants

The local market surveys were conducted within two kebeles in the district namely Wesherbe and Welkite markets to document the medicinal plants sold in local markets. However, there was only one medicinal plant available to be sold in the market by healers.

During the market survey only *Hagenia abyssinica* (Bruce) J.F. Gmel was sold as a medicinal plant by vegetable vendors. Besides there were some medicinal plants sold in the market for different purposes other than their medicinal uses such as *Citrus aurantifolia* (L.) Burm. f., *Allium sativum* L, *Brassica carinata* A. Br, *Carica papaya* L., *Catha edulis*, *Coffea arabica* L, *Nigella sativa* L. (Table15)

Table 15 List of medicinal plants that are widely traded in the market for different uses other than medicinal values in Kebena district

Scientific Name of the medicinal plant	**Local name**	**Use**
Allium sativium	*Tuma*	Spice, Food
Allium cepa	*Key shinkurt*	Spice, Food
Brassica carinata	*Gembel menzuta*	Food
Carica papaya L	*Papaya*	Food
Citrus aurantifolia (L.)	*Lomi*	Food
Nigella sativa L	*Nug*	Food
Coffea Arabica	*Buna*	Stimulant
Eucalyptus globulus	*Nech Bahirzaf*	Fire wood/Construction
Hagenia abyssinica	*Kosso*	Medicinal
Catha edulis	*Chat*	Stimulant

Lepidium sativum	*Feto*	Food
Persia americana	*Abocado*	Food
Olea europaea	*Wetechu*	Weyra
Rhamnus prinoides	*Gesho*	Beverage
Ruta chalepensis	*Tena adam*	Spice
Vicia faba	*Baqela*	Food

4.12 Ranking of medicinal plants in the study area

4.12.1 Informant consensus

There were plants that are cited many times by the informants due to the wide range of human and livestock diseases that they were reported to treat. The result of this study showed the highest informant consensus goes to *Ocimum lamiifolium* Hochst. ex Benth which was cited by 52 informants. *Allium sativum* L, *Ensete ventricosum* (Welw.) Cheesman, *Ruta chalepensis* L., *Ajuga remota,* were cited as second to fifth by 44, 43, 41, 39 informants respectively. (Table 16).

Table 16 List of Medicinal plants and the corresponding informants

Scientific Name	No. of informants	% of Informants
Ocimum lamiifolium	52	65
Allium sativum L	44	55
Ensete ventricosum	43	53
Ruta chalepensis L.	41	51.25
Ajuga remota	39	48.75
Eucalyptus globulus	35	43.75
Croton macrostachyus	35	43.75
Citrus aurantifolia (L.)	34	42.5
Hypoestes forskaolii	31	38.75
Hagenia abyssinica	31	38.75

Prunus africana	27	33.75
Vernonia amygdalina Del.	26	32.5
Withania somnifera L	26	32.5
Lepidium sativum L.	25	31.25
Senna didymebotry	25	31.25
Solanum incanum L.	25	31.25
Zingiber officinale	23	28.75
Nigella sativa L	22	27.5
Ricinus communis L.	21	26.25
Vernonia thomsoniana	21	26.25
Olea europaea L. subsp. cuspidata	18	22.5
Foeniculum vulgare	17	21.25
Urtica simensis	14	17.5
Coffea arabica L.	11	13.75
Nicotiana tabacum L.	10	12.5
Artemisia afra Jacq. ex Willd	10	12.5
Aloe pubescens	10	12.5
Carica papaya L.	10	12.5

4.12.2 Preference ranking

Preference ranking was carried out on medicinal plants used to treat Anthrax. Among the five selected medicinal plants used to treat Anthrax, *Urtica simensis* Steudel stood first, followed by *Brassica carinata* A. Br, *Cymbopogon citratus* (DC.) Stapf, *Eucalyptus globulus* Labill, *Solanum giganteum* Jacq., *Lippia abyssinica* (Otto & A.Dietr.) Cufod and *Moringa stenopetala* (Bak f.) cuf. (Table 17).

Table 17 Preference ranking of medicinal plants used for treating Anthrax

List of medicinal plants for anthrax	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8	R 9	R_{10}	Total	rank
Brassica carinata A. Br	5	4	6	4	7	7	7	6	5	5	56	2
*Cymbopogon citratus (*DC.) Stapf	7	6	5	7	5	5	6	2	6	4	53	3
Eucalyptus globulus Labill	3	3	4	3	3	2	3	5	3	6	35	4
Lippia abyssinica (Otto & A.Dietr.) Cufod	4	1	2	2	4	1	2	3	2	2	23	6
Moringa stenopetala(Bak f.) cuf.	1	2	1	1	2	3	1	2	1	1	15	7
Solanum giganteum Jacq.	2	5	3	5	1	4	4	1	4	3	32	5
Urtica simensis Steudel	6	7	7	6	6	6	5	7	7	7	64	1

4.12.3 Direct matrix ranking

In the study area the majority of the community depends on plants for various purposes such as, firewood, medicinal, construction, fencing, food spices, and furniture. To assess the relative importance and to check the major impact on such plants direct matrix ranking was performed. Ten key informants selected and five plant species that had multiple uses to assess the relative importance of each plant. The five plant species have been selected based on their number of citation to treat anthrax. The result of the direct matrix ranking showed that *Eucalyptus globulus* stood first in being the most multipurpose medicinal plant followed by, *Olea europaea* subsp.

cuspidata, *Croton macrostachyus*, *Ensete ventricosum*, and *Ruta chalepensis*, was the least (Table 18).

Table 18 Average Direct matrix ranking score of ten key informants for five multipurpose medicinal species used in Kebena district

	Medicinal plants						
Use categories	***Eucalyptus globulus***	***Ensete ventricosum***	***Ruta chalepensis***	***Olea europaea***	***Croton macrostachyus***	**Total**	**Rank**
Fire wood	5	1	0	4	3	**13**	**2nd**
Construction	5	0	0	2	1	**8**	**5th**
Furniture	4	0	0	3	2	**10**	**3rd**
Food&spice	0	2	5	0	0	**7**	**6th**
Fencing	3	2	0	0	0	**5**	**7th**
Medicine	4	5	5	4	5	**23**	**1st**
Charcoal	4	0	0	2	3	**9**	**4th**
Total	25	11	10	15	14		
Rank	1st	4th	5th	2nd	3rd		

Based on use criteria (5= best; 4= very good; 3=good;2= less used; 1=least used and 0= no value

4.12.4 Paired comparison

For medicinal plants that were identified by the informants to be used for treating Stomach ache paired comparison was made among Five medicinal plants Ten informants participated in this activity. The response of the informants showed *Lepidium sativum* L.stood first followed by, *Ruta chalepensis* L, *Ocimum basilicum* L, *Vernonia thomsoniana* Oliv. & Hiern ex Oliv, and *Citrus aurantifolia* L (Table 19).

Table 19 Paired comparisons of five medicinal plant species used to treat stomach ache in Kebena district

Plant species	**R 1**	**R 2**	**R 3**	**R 4**	**R 5**	**R 6**	**R 7**	**R 8**	**R 9**	**R_{10}**	**Total**	**Rank**
Citrus aurantifolia (L.) Burm. f.	1	1	2	3	3	5	1	1	2	1	20	5th
Lepidium sativum L.	5	5	5	5	3	3	3	4	4	4	41	1st
Ocimum basilicum L	3	2	4	2	5	2	2	5	3	3	31	3rd
Ruta chalepensis L	4	3	1	4	4	4	5	2	5	2	34	2nd
Vernonia thomsoniana Oliv. & Hiern ex Oliv	2	4	3	1	2	1	3	3	1	5	25	4th

4.12.5 Informant consensus factor (ICF)

The diseases of the study area were grouped into different categories based on the site of incidence of the disease, condition of the disease as well as treatment resemblance of the disease to the local people. The informant consensus factors have been calculated for each category (Table 20). As the result indicates malaria had the highest ICF value (0.794) whereas; febrile illness (0.780) and leg swelling and wound (0.761) had the second and third highest ICF values. Excessive menstruation, nasal bleeding, Snake bite had the lowest (0.423).

Table 20 Informant consensus factor (ICF)

Category	Species	Use citation	ICF
Febrile illness	10	42	0.780
Malaria	9	40	0.794
Leg swelling and wound	6	22	0.761
Toothache	7	18	0.647
Evil eye	6	20	0.736
Gastritis, Stomachache, Loss of appetite, Rheumatism, Ascaries, Tape Worm, Diarrhea	22	63	0.661
Eye problem, Ear problem	3	5	0.5
Skin rash Ring worms, Tinea corporis, lice, vitligo, Dandruff , Hemorrhoids, Anthrax	16	32	0.51
Excessive menstruation Nasal bleeding, Snake bite	5	8	0.423
Hypertension, Headache, low blood pressure Diabetes, Epilepsy, Liver problem	16	37	0.581
Common cold, Cough, Asthma	15	45	0.681

4.12.6 Fidelity Level

Fidelity level was used to compare and determine relative healing potential of medicinal plants. The values of fidelity level were calculated for commonly used individual medicinal plants against the corresponding ailments: *Croton macrostachyus* (against Tinea corporis), *Ajuga remota* (against malaria), *Citrus aurantifolia* (L.) Burm. f. (against stomach ache), *Datura stramonium* L. (against tooth ache), *Ensete ventricosum* (Welw.) Cheesman (against broken bone), *Hypoestes forskaolii* (Vahl) R. Br (against excessive menstruation), *Solanum incanum* (against dandruff), *Senna didymebotry* Irwin and Barnely (against snake bite), and *Urtica simensis* Steudel (against anthrax). (Table 21) The result showed that *Ensete ventricosum* and *Senna didymobotrya* had the highest (100%) FL for the treatment of broken bone and snake bite respectively.

Table 21 Fidelity level values of medicinal plants commonly reported against selected ailments in Kebena district

No	Medicinal plant	Examples of ailment treated	Ip	Iu	FL%	Rank
1	*Croton macrostachyus*	Tinea corporis	20	44	68.18	6th
2	*Ajuga remota*	malaria	41	49	83.6	2nd
3	*Citrus aurantifolia* (L.)	stomach ache	33	42	78.57	3rd
4	*Datura stramonium* L.	tooth ache	21	29	72.41	5th
5	*Ensete ventricosum*	broken bone	45	45	100	1st
6	*Hypoestes forskaolii*	excessive menstruation	38	49	77.55	4th
7	*Solanum incanum*	dandruff	25	37	67.56	7th
8	*Senna didymobotrya*	snake bite	30	30	100	1st
9	*Urtica simensis*	anthrax	22	34	64.70	8th

5. Discussion Conclusion and Recommendations

5.1 Discussion

5.1.1 Comparison of Traditional Knowledge on Medicinal Plants

In most parts of Ethiopia, herbs are the predominant plants for traditional medicine (Tilahun Teklehaymanot and Mirutse Giday, 2007) and this is also the case in the study area. The findings of this study showed that among the collected medicinal plants the majority were herbs. This indicates that people in the study area are more dependent on herbs to prepare traditional medicine. This could be due to the presence of home gardens dominated by Ensete ventricosum (Welw.) Cheesman in almost every household in the study area, which include a large number of herbs (22 species), accounting for 51.1 % of all medicinal species in home gardens. This finding is in line with other medicinal plant studies in Ethiopia (Debela Hunde, 2001; Endalew Amenu, 2007) in which herbs were reported as the dominant growth forms of medicinal plants. This similarity may come from vegetation and traditional knowledge similarities among the investigated study areas and people.

Most of the medicinal plants (66.1%) utilized by the local people of the study area were collected from homegarden. This finding did not agree with the finding of Tizazu Gebre (2005) Netsanet Gonfa *et al*. (2007); in which most medicinal plants were collected from the wild. This difference may come from floristic composition and traditional knowledge difference of the investigated areas

In contrast to other studies by Gesseley *et al*., (1995) ; Tesfaye Seifu *et al*. (2006) no specific day was dedicated for medicinal plants collection in Kebena district. Informants reported

medicinal plants can be collected at any time as far as they exist. In addition, healers of the study area don't have a specific ritual before collection of medicinal plants in contrast to other study areas like Jabitehnan District in Gojam and Chifra District in Afar Tesfaye Seifu *et al*., (2006); Abiyot Berhanu *et al*. (2006).

The most frequent route of administration of remedies was oral followed by dermal administration. The dominance of oral and dermal routes of herbal drug application in the study area could be because of high prevalence of diseases such as Stomach ache, Febrile illness, Malaria, and Anthrax which are gastrointestinal and skin related problems in the area. In addition, the other reason for the dominance of these two application methods might be related to their permit for rapid physiological reactions of prepared medicines with the pathogens and a related increase in their curative power.

Regarding parts of the plant used for the preparation of traditional medicine, this study revealed that leaf is the most extensively used plant part followed by roots and seed. The extensive use of leaves in the study area for the preparation of medicinal plants could partly be related to the high availability of medicinal plants in the homegarden. Root was the second most frequently collected plant part by the local people at the study area. Unlike leaves, frequent harvesting of roots is disastrous to the survival of individual plants unless care is taken during the harvesting process (Mirutse Giday, 2007).

5.1.2 Solvents and Additives

Solvents and additives that were mentioned by informants like water butter, honey, milk, boiled coffee and tea have importance to ease pain, to get better taste and reduce adverse effects such as diarrhea and vomiting and enhance the efficacy and healing conditions as explained by

informants. For example, the leaf of *Ajuga remota* was pounded, then the powder was mixed with water and honey then it is drunk. The addition of water and honey was to dilute the mixture and to improve the taste as it was described by the informants

5.1.3 Dosage of medicinal plants

In the study area traditional medicinal plant preparations have no clearly standardized doses.The remedies were prescribed and given based on approximate dosages. People of the study area used various units of measurement and the duration of administration to determine the dosage. Local units such as finger length (e.g., for bark, root, stem), different measuring materials (e.g., spoon, coffee cup, tea cup and glass cups) and numbers (e.g., for leaves, seeds, fruits, bulbs, rhizomes, flowers and latex) were used to estimate and fix the amount of remedy. But, these measurements were not accurate enough to determine the precise amount of remedy. In addition these approximate dosages were reported to be determined based on age, gender, pregnancy status of patients This result agrees with the study reports of Getnet Chekole (2011) Ermial Lulekal (2014), and Mekonen Wolditsadik (2018).

5.1.4 Marketability

The results from the market survey of medicinal plants indicated that almost all medicinal plants were not marketed for their medicinal uses as the researcher observes and according to the informants with the exception of *Hagenia abyssinica* (Bruce) J.F. Gmel.

This might be due to preparation and home-based selling of TMPs by the healers rather than selling in the market. More over it was observed that healers and peoples with TMP knowledge prefer to give service freely in Kebena district. This result agrees with the study reports of Getnet Chekole (2011).

5.1.5 Informant consensus

The result of the study showed *Ocimum lamiifolium* Hochst. ex Benth is with the highest informant consensus This plant species was widely cited due to its existence in almost all home gardens in the study area and it used by the people in the study area to treat commonly occurring diseases like common cold and febrile illness. In addition, . *Allium sativum L, Ensete ventricosum* (Welw.) *Cheesman, Ruta chalepensis L., Ajuga remota,* have also highest informant consensus factor next to *Ocimum lamiifolium* Hochst. ex Benth. The popularity of the above mentioned plant species were also linked with the ease to find them in most homegardens and their utility to treat common diseases in the study area.

5.1.6 Preference ranking

Preference ranking was carried out on medicinal plants used to treat Anthrax due to it is widely existed in the district and it is also treated by several medicinal plants. Among the five selected medicinal plants used to treat anthrax, *Urtica simensis* Steudel stood first.

Since the knowledge on the use of remedies differ from healer to healer, the output of the comparison showed that there is variation among the ten key informants for anthrax treatment.

5.1.7 Direct matrix ranking

The result of the direct matrix ranking showed that *Eucalyptus globulus* stood first in being the most multipurpose medicinal plant followed by, *Olea europaea* subsp. cuspidata, *Croton macrostachyus* Del, *Ensete ventricosum* (Welw.) Cheesman, and *Ruta chalepensis*, was the least. These result showed that Medicinal plants like *Eucalyptus globulus* and *Olea europaea*

subsp. cuspidata were being highly used for non-medicinal purposes. These multipurpose medicinal plants were used for construction, firewood, furniture making.

5.1.8 Paired comparison

For medicinal plants that were identified by the informants to be used for treating Stomach ache. Stomach ache was selected for the paired comparison because it was the second most cited disease in the district and also it was treated by eleven different species. *Lepidium sativum* L was cited as the most effective species to treat stomach ache among the listed five species.

5.1.9 Informant consensus factor (ICF)

As the result indicates malaria had the highest ICF value (0.794) due to the high incidence of the disease in the area whereas; febrile illness (0.780) and leg swelling and wound (0.761) had the second and third highest ICF values. Excessive menstruation, nasal bleeding, Snake bite had the lowest (0.423). This might be because of the rare occurrence of these diseases.

5.1.10 Fidelity Level

Medicinal plants that were widely used by the local people to treat one or very few ailments had highest FL values than those that were randomly picked for any ailment (Tilahun Teklehaymanot and Mirutse Giday,2007). The result showed that *Ensete ventricosum* and *Senna didymobotrya* had the highest (100%) FL for the treatment of broken bone and snake bite respectively. Hence it can be considered as the most effective treatment species for broken bone and snake bite.

5.1.11 Current status of medicinal plants and the indigenous knowledge of the people in the study area

Informants reported that there was a decline in the knowledge of traditional medicine due to the increasing mistrust of the community on medicinal plants. The informants mention the expansion of modern primary health care and the unknown dosage of medicinal plants in time of application as the reason for the increasing mistrust.

The death of traditional healers without sharing their knowledge to others was also mentioned as the other reason for the decline of knowledge of traditional medicine. Informants in the study area reported traditional healers die without transferring their knowledge to their children or any one due to secrecy and the growing disinterest of the society on their knowledge. According to Dagne Abebe and Belachew Garedew (2020) there is the issue of secrecy in other places like Abeshge district in Gurage zone like the study area.

5.1.12 Threats to medicinal plants in the study area

Many of the threats to medicinal plant species identified in the studied area were similar to those that put plant diversity in danger in general. Habitat loss, habitat degradation, and over-harvesting are the most significant threats (Hamilton, 2004).

In the study area the major threats were deforestation and urbanization. The study kebeles of the Kebena district are found around the zone capital Welkite,there are high amount of constructions which definitely have impacts on the areas. These constructions utilize wood as their main input often times *Eucaliptus globlus* wood. Other than that there were no other significant threats to other medicinal plants as their usage by the community was decreasing overtime.

The results of Endalew Amenu (2007), Eskedar Abera (2011), Kebu Balemi (2004), Mirutse Gidey (2001), showed that need for agricultural land and urbanization severely threatened plant species in general and medicinal plants in particular.

5.1.13 Conservation of medicinal plants in the study area

In the study area there was no specific conservation method implemented to conserve medicinal plants. The district's Natural resource protection office didn't give special attention to medicinal plants rather medicinal plants are protected as any other plant in the district.

The reason for the above situation was as mentioned by the district's Natural resource protection office staffs, the district don't encourage people to use traditional medicine or treatment, so they don't think it was necessary to give special attention for conservation of medicinal plants.

The other reason was that there are many medicinal plants that are found in the homegarden. Even though many of them are planted for their additional uses other than their medicinal use. Thus, peoples in the district believe there was no need of conservation of medicinal plants since they found it easily in their surrounding.

Yet, the researcher observed that the presence of medicinal plants in the homegardens isn't as abundant as the people of the district claim. For instance, the researcher spends half day to two days to find some homegarden medicinal plants like *Leonotis nepetifolia (L.)* R. Br, *Millettia ferruginea, Schinus molle* L, *Solanum giganteum* Jacq and others

In addition, even healers don't cultivate or protect medicinal plants other than the common medicinal plants like *Ocimum lamiifolium* Hochst. ex Benth and *Croton macrostachyus* Del. when healers asked why they don't cultivate medicinal plants in their homegarden extensively, they give answers like, peoples interest on medicinal plants is decreasing from time to time,

patients come to them rarely so cultivating and protecting medicinal plants extensively is waste full.

The same was true in sites like Wayu tuka district in East Wollega zone; in that healers don't conserve medicinal plants: instead it was reported that they prefer to collect medicinal plants from wild as reported by Moa Megersa (2010).

5.2 Conclusion

This research revealed that the people of Kebena district used traditional medicinal plants to treat themselves and their livestock. A total of 65 medicinal plant species were collected which have a great value to treat a wide spectrum of human and livestock diseases. These plants are distributed across 59 genera and 38 families growing over an extended area and used by the local traditional healers living in different kebeles of the study area. Out of the total collected plant species, 59 were used to treat human ailments, the rest 6 species was used to treat both human and livestock ailments. The medicinal plant species collected and identified from the wild vegetation were 22 species and those from homegardens were 43 species. In the study area, 43 ailments were reported which are being treated by traditional medicinal plants of the area. Herbs were highly utilized (43.07%) for medicinal purpose than trees and shrubs. Leaves (46.96%) were used for medicinal purpose more than other plant parts for preparation of human and livestock remedies. The remedies are taken with different additives and solvents and water (57.3%) was more frequently used for this purpose. Traditional medicine preparation in the study area often involves single plant and the mode of administration was mainly internal in which oral (58%) administration was the common route.

Ocimum lamiifolium Hochst. ex Benth was with the highest informant consensus value. *Urtica simensis* Steudel was the highest preferred plant species for the treatment of anthrax by the informants. In terms of use *Eucalyptus globulus* was used for different purposes in the district other than other plant species. Paired comparison was done for selected five species that were used to treat stomach ache. As a result *Lepidium sativum* L was cited as the most effective species to treat stomach ache among the listed five species. Malaria had the highest ICF value (0.794) due to the high incidence of the disease in the area. *Ensete ventricosum* and *Senna didymobotrya* had the highest (100%) FL for the treatment of broken bone and snake bite respectively.

The major threats to medicinal plants and the associated knowledge in the study area were deforestation and urbanization. On the other hand, threats that in danger indigenous knowledge arise from the unknown dosage of traditional medicine, secrecy, unwillingness of young generation to gain the knowledge, and influence of modern primary heath care were the major ones.

5.3 Recommendations

Based on the results of the study the following recommendations are forwarded:

- Government offices and NGOs should give attention to the usage of traditional medicine and indigenous knowledge of traditional practitioners.

This could be achieved through;

- ✓ Registering, licensing, training and supporting traditional healers and their association and indigenous skills to use this traditional practice properly to improve the traditional health care services for human and livestock diseases.

- Attention should be given to support the standardized practice of traditional medicine / indigenous medicine through documentation of the knowledge and training of traditional healers to make use of traditional medicine at primary healthcare level

- Government offices and NGOs should create awareness to local people of the study area to conserve medicinal plants in their homegarden.
- Adjusting conditions for close discussion and cooperation of traditional healers and modern health care system officials about the preparation and applications of remedies properly and effectively.
- *Olea europaea* L. subsp.cuspidata should be given prior conservation attention due to its multipurpose use and its medium existence in the district.

- Government offices and NGOs should have to participate in conservation of medicinal plants, and provide incentives to farmers for cultivation of medicinal plants in homegarden.

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Appendices

Appendix 1

The Most Frequent Human Diseases and Number of Plant Species used

Disease treated	Total Species	Percent
Common Cold	11	26.82
Stomach ache	10	24.39
Febrile illness	10	24.39
Malaria	8	19.51
Anthrax	8	19.51
Toothache	7	17.07
Evil eye	6	14.63
Sudden sickness	6	14.63
Gonorrhea	5	12.19
Dandruff	5	12.19
Headache	5	12.19
Wound	5	12.19
Rheumatism	5	12.19
Meat indigestion	5	12.19
Hyper tension	4	9.75
Snake bite	3	7.31
Ascariasis	3	7.31
Liver problems	3	7.31
Cattle ascariasis	3	7.31
Spider venom	3	7.31
Ear problem	2	4.87
Gastritis	2	4.87
Cough	2	4.87
Hemorrhoids	2	4.87
Loss of appetite	2	4.87
Diabetes	2	4.87
Asthma	2	4.87
Tinea corporis	1	2.43
Low blood pressure	1	2.43
Chigger	1	2.43
Eye problem	1	2.43
Vitiligo	1	2.43
Nasal bleeding	1	2.43
Epilepsy	1	2.43
Skin rash	1	2.43
Broken bone	1	2.43

Diarrhea	1	2.43
Ring worm	1	2.43
Tapeworm	1	2.43
Excessive menstruation	1	2.43
Leg swelling	1	2.43

Appendix 2

List of human and livestock diseases which are treated by medicinal plants in the study area

No.	Local Name	English Name
1.	Mujele	Chigger
2.	Weba	Malaria
3.	Chebte	Gonorrhea
4.	Yesewnet ebtet	Body swelling
5.	Yehode kurtet	Stomach ache
6.	Yejero besheta	Ear problem
7.	Aynebesheta	Eye problem
8.	Yetres himem	Toothache
9.	Yeayin beshta	Eye disease
10.	Forefor	Dandruff
11.	Neser	Nasal bleeding
12.	Cheguara	Gastritis
13.	Yemitel beshta(Azurit)	Epilepsy
14.	Yebabe nekesha	Snake bite
15.	Sibirat	Broken bone
16.	Buda	Evil eye
17.	Tekimate	Diarrhea
18.	Kintarote	Hemorrhoids
19.	Kosso	Tapeworm
20.	Wosfat	Ascariasis
21.	Kusel	Wound
22.	Miche	Febrile illness
23.	Yerase mitate	Headache
24.	Sale	Cough
25.	Yemigeb filagot matat	Loss of appetite
26.	Gubet	Liver problems
27.	Gunfane	Common Cold
28.	Wugat	Stabbing pain
29.	Chifee	Skin rash
30.	Yedem gefite	Hyper tension
31.	Chirt	Tinea corporis
32.	Yehode menifat	Blotting
33.	Yekebt wosfat	Cattle ascariasis
34.	Yekunicha niksha	Lice
35.	Yekulalit beshta	Kidney disease
36.	Wayamo(Aba senga)	Cattle Anthrax
37.	Lemte	Vitiligo
38.	Assem	Asthma

39.	Sheme tere	Anthrax
40.	Kurtmat	Rheumatism
41.	Yekebt tigegna til	Cattle tape worm
42.	Yesiga metalat	Meat indigestion
43.	Dingetegna	Sudden sickness
44.	Kuakucha	Ring worm
45.	Leshererit	Spider venom
46.	Yesikuar beshta	Diabetes
47.	Yewer abeba mezabat	Excessive menstruation
48.	Yeeger ebtet	Leg swelling
49.	Yedem manes	Low blood pressure

Appendix 3

Number of Medicinal Plant Species in each Family

Family	Number of genera	Percent	Number of species	Percent
Lamiaceae	4	6.77	6	9.23
Asteraceae	3	5.08	6	9.23
Fabaceae	5	8.47	5	7.69
Solanaceae	4	6.77	5	7.69
Euphorbiaceae	4	6.77	4	6.15
Cucurbitaceae	3	5.08	3	4.61
Brassicaceae	2	3.38	2	3.07
Rutaceae	2	3.38	2	3.07
Rosaceae	2	3.38	2	3.07
Acanthaceae	2	3.38	2	3.07
Verbenaceae	2	3.38	3	4.61
Alliaceae	1	1.69	2	3.07
Aloaceae	1	1.69	1	1.53
Melianthaceae	1	1.69	1	1.53
Apocynaceae	1	1.69	1	1.53
Celastraceae	1	1.69	1	1.53
Rubiaceae	1	1.69	1	1.53
Araceae	1	1.69	1	1.53
Poaceae	1	1.69	1	1.53
Boraginaceae	1	1.69	1	1.53
Sapidiaceae	1	1.69	1	1.53
Flacourtiaceae	1	1.69	1	1.53
Musaceae	1	1.69	1	1.53
Myrtaceae	1	1.69	1	1.53
Myrsinaceae	1	1.69	1	1.53
Apiaceae	1	1.69	1	1.53
Moraaceae	1	1.69	1	1.53
Moringaceae	1	1.69	1	1.53
Ranunculaceae	1	1.69	1	1.53
Oleaceae	1	1.69	1	1.53
Oxalidaceae	1	1.69	1	1.53
Lauraceae	1	1.69	1	1.53
Piperaceae	1	1.69	1	1.53
Phytolacaceae	1	1.69	1	1.53
Rhamnaceae	1	1.69	1	1.53
Urticaceae	1	1.69	1	1.53
Zingiberaceae	1	1.69	1	1.53

Appendix 4

Scientific Name, Family, Local Name, Growth form, Source, Geographical Location, (Altitude, Longitude and Latitude) Status (common, Medium, Rare) and Collection Number

Scientific Name	**Family**	**Local Name**	**Growth form**	**Source**	**Geographical Location**		**Altitude**	**Status**	**Collection no.**
					Longitude (N)	***Latitude (E)***			
Ajuga remota	Lamiaceae	Anamurcho (harmagussa)	Herb	Home gardens	3777421	830708	1880	Medium	MT /12
Acacia abyssinica Hochst. Ex Benth.	Fabaceae	Nech girar	Tree	Wild	3779293	833400	1776	Medium	MT 23
Allium sativum L.	Alliaceae	Tuma (Nech shenkurt)	Herb	Home gardens	3777421	830708	1880	Medium	MT 4
Allium cepa L.	Alliaceae	Key shenkrt	Herb	Home garden	3777421	830708	1880	Medium	MT/46
Aloe pubescens Reynolds.	Aloaceae	fuga Gedel (Ret)	Herb	Wild	3777431	830720	1880	Medium	MT /67
Artemisia afra Jacq. ex Willd.	Asteraceae	Natrar (Ariti)	Herb	Home garden	3777891	830686	1869	Common	MT /12

Brassica carinata A. Br	Brassicaceae	Gomen zer	Herb	Home garden	3777421	883078	1880	Common	MT /42
Bridelia micrantha (Hochst.) Baill.	Euphorbiaceae	Anenebu	Herb	Home garden	3777322	829995	1840	Common	MT /9
Bersama abyssinica Fresen	Melianthaceae	Bitensa	Tree	Home garden	3779293	833400	1776	Common	MT /22
Calpurina aurea alt benth	Fabaceae	Chiche haqa	Tree	Home garden	3777421	883078	1880	Common	MT /9
Carica papaya L.	Cucurbitaceae	Papaya	Tree	Home gardens	3777421	883078	1880	Common	MT /12
Carissa spinarum L.	Apocynaceae	Agam	Shrub	Wild	3779293	833400	1776	Common	MT /12
Catha edulis	Celastraceae	Chat	Tree	Home gardens	3777322	829995	1840	Common	MT 32
Citrus aurantifolia (L.) Burm. f.	Rutaceae	Lomi	Shrub	Home gardens	3777421	883078	1880	Rare	MT /54
Coffea arabica L.	Rubiaceae	Buna	Shrub	Homegarden	3777464	829968	1886	Medium	MT63
Colocasia esculenta (L.) Schott	Araceae	Godere	Herb	Home gardens	3778177	829156	1906		AM1
Croton macrostachyus Del.	Euphorbiaceae	Mesena (Bisana)	Tree	Home gardens	3777421	883078	1880	common	MT /26
Cucumis ficifolius A. Rich.	Cucurbitaceae	Adene Deba qula (Yemider embuay)	Herb	Wild	3778903	833253	1762	Rare	MT /92
Cymbopogon citratus (DC.) Stapf	Poaceae	Hitcho, ,(Moseret)	Herb	Home gardens	3777421	830708	1880	Common	MT /12

		(tej sar)							
Cynoglossum coeruleum Hochst. ex A.DC.	Boraginaceae	Bertetusa	Herb	Home gardens	3777421	830708	1882	Rare	AM/2
Datura stramonium L.	Solanaceae	Ashkakula	Herb	Wild	3779293	833400	1880	Medium	MT /26
Dodonaea angustifolia L. f	Sapidaceae	Kitkita	Tree	Wild	3779293	833400	1776	Rare	MT /26
Dovyalis abyssinica (A. Rich.) Warb.	Flacourtiaceae	Koshim	Shrub	Home gardens	3777322	829995	1840	Rare	MT /25
Echinops kebericho Mesfin.	Asteraceae	chossa (Kebericho)	Herb	Wild	3779293	833400	1776	Rare	MT /56
Ensete ventricosum (Welw.) Cheesman	Musaceae	Enset	Shrub	Homegarden	3777421	830708	1880	Common	MT /22
Eucalyptus globulus Labill.	Myrtaceae	Nech bahir zaf	Tree	Home garden	3777421	830708	1880	Common	MT /17
Euphrobia Tirucalli	Euphorbiaceae	Kinchib	Tree	Home garden	3777421	830708	1880	Common	MT /9
Foeniculum vulgare Mill.	Apiaceae	Enshilale	Herb	Home gardens	3777421	830708	1880	Common	MT /33
Ficus sur Forssk.	Moraceae	Shola	Tree	Wild	3777421	830708	1880	Medium	MT /42
Hagenia abyssinica (Bruce) J.F. Gmel.	Rosaceae	Kosso	Tree	Home garden	3777322	829995	1840	Rare	MT /26
Hypoestes forskaolii (Vahl) R. Br.	Acanthacea	Etebader	Herb	Home garden	3777421	830708	1880	Medium	MT /20

Justicia schimperiana Hochst. ex A. (Nees) T. Anders	Acanthaceae	Sensel	Shrub	Wild	3777464	829968	1886	Common	MT /21
Lagenaria siceraria (Molina) Standi.	Cucurbitaceae	Qulechu (qil)	Herb	Home garden	3774799	827150	1845	Medium	MT /45
Leonotis nepetifolia(L.) R. Br.	Lamiaceae	Menti arebe	Herb	Wild	3777421	830708	1880	Medium	KT/1
Lepidium sativum L.	Brassicaceae	Shinfa (Feto)	Herb	Wild	3777421	830708	1880	Rare	MT /16
Lippia abyssinica (Otto & A.Dietr.) Cufod	Verbenaceae	Koseret	Shrub	Home garden	3777421	830708	1880	Common	MT /37
Millettia ferruginea	Fabaceae	Birbira	Tree	wild	3779293	833400	1776	rare	MT /28
Maesa lanceolata Forssk.	Myrsinaceae	Gewado	Tree	wild	3779293	833400	1776	Medium	MT /37
Moringa stenopetala (Bak. f.) Cuf.	Moringaceae	Shiferaw	Tree	Home garden	3774794	827147	1845	Rare	MT /13
Nicotiana tabacum L.	Solanaceae	Timbaho	Herb	wild	3777421	830708	1880	Rare	MT /13
Nigella sativa L.	Ranunculaceae	Gmebel menzuta (Tiqur Azmud)	Herb	Wild	3777421	830708	1880	Rare	MT /27

Ocimum basilicum L.	Lamiaceae	Beqeret	Herb	Home gardens	3777421	830708	1880	Common	MT /35
Ocimum lamiifolium Hochst. ex Benth.	Lamiaceae	Damakessi	Shrub	Home gardens	3779293	833400	1776	Medium	MT /24
Ocimum urticifolium Roth	Lamiaceae	leliBeqeret	Shrub	Home gardens	3774799	827150	1845	Common	MT /16
Olea europaea L. subsp. cuspidata (Wall. ex G.Don	Oleaceae	Wetechu (Weyera)	Tree	Home gardens	3774799	827150	1845	Medium	MT /18
Oxalis corniculata L.	*Oxalidaceae*	Yeqola qusel medhanit	Herb	Home gardens	3777421	830708	1880	rare	MT /17
Persea americana.	Lauraceae	Abocado	Tree	Home gardens	3777421	830708	1880	Common	MT /33
Phytolacca dodecandra L. Herit	Phytolacaceae	Endode	Shrub	Wild	3774293	833400	1880	Common	MT /23
*Prunus africana (*Hook. f.) Kalms	Rosaceae	(Gembel haqa) Tiqur Enchet	Tree	Wild	3779293	833400	1776	Medium	MT /1
Rhamnus prinoides L.Herit	. Rhamnaceae	Gesho	Shrub	Home garden	3801679	835934	1945	Medium	MT /6
Ricinus communis L.	Euphorbiaceae	Qoboo	Tree	Wild	3801679	835934	1945	Common	MT /3
Ruta chalepensis L.	Rutaceae	Chrakot (Tene adam)	Herb	Home gardens	3777684	830686	1869	Common	MT /11
Schinus molle L.	Anacerdiaceae	Kundo	Tree	Home	3779293	833400	1776	medium	MT /29

		Berbere		garden					
Senna didymebotry Irwin and Barnely	Fabaceae	Senemeki	Tree	Wild	3777421	830708	1880	Rare	MT /13
Solanum incanum L.	Solanaceae	Embuay	Shrub	Home garden	3777421	830708	1880	Medium	MT /15
Solanum giganteum Jacq.	Solanaceae	Niza	Shrub	wild	3777421	830708	1880	Medium	
Thymus schimperi Ron.	*Lamiaceae*	Tosign	Herb	Wild	3777421	830708	1880	Rare	MT /17
Urtica simensis Steudel	Urticaceae	Dobe (Sama)	Herb	Wild	3778903	833253	1869	Common	MT /32
Verbena officinalis L.	Verbenaceae	Qisqisa	Herb	Home gardens	3777421	830708	1880		MT /28
Vernonia amygdalina Del.	Asteraceae	Heba (Girawa)	Shrub	Home gardens	3779293	833400	1880	Common	MT /22
Vernonia myriantha Hook. f.	Asteraceae	Reji	Shrub	Home garden	3801679	835934	1945	Medium	MT /17
Vernonia thomsoniana Oliv. & Hiern ex Oliv.	Asteraceae	Agunba	Shrub	Home gardens	3777421	830708	1880	Common	MT /35
Vicia faba	Fabaceae	Baqela	Herb	Home garden	3777421	830708	1880	Common	MT /26
Withania somnifera L Dunal	Solanaceae	Gizaawwaa	Shrub	Homegarden	3774794	827147	1845	Common	MT /25
Zingiber officinale	Zingibiraceae	Janjibil	Herb	Homegarden	3801679	835934	1945	Rare	MT /14

APPENDIX 5

List of medicinal plants used for treating in the study area; with scientific name, family, local name, Parts used(L=Leaf, S=Stem, R=Root, Se= Seed, Ba= Bark, Bu= Bulb, Co= Corm), Disease Treated, Mode of preparation and route of administration

No.		**Local Name**	**Parts Used**	**Disease Treated**	**Mode of Preparation**	**Root of Administration**
1	*Ajuga remota* Lamiaceae	Anamurcho (Harmagusa)	L	Malaria, common cold, Head ache, Rheumatism, Gonorrhea, Ascarisis and Diabetes	The leaf of *Ajuga remota* is pounded, then the powder is mixed with water and honey then it is drunk.	O

2.	*Acacia abyssinica Hochst. Ex Benth.* Fabaceae	Nech girar	Ba	Stomach ache	The bark of Acacia *abyssinica Hochst. ex* *Benth* is crushed and the powder is mixed with water then drunk	O
3.	*Allium sativum* L. Alliaceae	Tuma (nech shinkurt)	bu	Common cold, malaria, stomach ache and cough.	The bulb of *Allium sativum* L. is crushed and mixed with honey then is is eaten.	O
				Asthma and rheumatism	The bulb of *Allium sativum* L. is crushed and mixed with butter then is is eaten	O
				Hypertension	The bulb of *Allium sativum* L. is crushed and mixed with lemon juice then drunk	O
				Tooth ache	The bulb of *Allium sativum* L. will be put on the diseased tooth.	Too

4.	*Allium cepa* L. Alliaceae	Qey Shinkurt	bu	Ear disease	The bulb of *Allium cepa* L. is pounded and use the juice as an ear drop for the affected ear.	Ea
				Liver Disease	The bulb of *Allium cepa* L. is chopped and mixed with butter then eaten.	O
5.	*Aloe pubescens Reyonolds.* Aloaceae	Fuga Gedel (Ret)	L	Leg swelling	The leaf of *Aloe pubescens Reyonolds.* is put on fire then the leaf is tied over the wounded part.	D

				Hyper tension	The leaf of *Aloe pubescens Reyonolds.* is peeled and the jelly part of the leaf is boiled with water then drunk three tea cup	O
				Rheumatism	The raw leaf of *Aloe pubescens Reyonolds.* is eaten.	O
				Epilepsy	The root of *Aloe pubescens Reyonolds.* is pounded and boiled with water, then it will be drunk.	O

			L and R	Toothache	The root and leaf of *Aloe pubescens Reyonolds.* is pounded, then the juice will be applied on the infected tooth, then it will be spitted	D
			L and R	Cattle ascariasis	The root and leaf of *Aloe pubescens Reyonolds.* will be pounded and boil ed in water. Then the juice will be given to the cattle.	O
6.	*Artemisia afra Jacq. ex Willd.* Asteraceae	Natrar (Ariti)	Wh	Headache	The whole plant should be diluted with butter and the resulting aroma should be sniffed through the nose.	Na

7	*Bersama abyssinica* Fresen Melianthaceae	Bitensa	L	Evil eye	The leaf of *Brucea antidysenterica* is pounded and applied on the face of the patient	D
8	*Brassica carinata* A. Br (Brassicaceae)	Gomen zer	Sd	Toothache	The seed of *Brassicacarinata* A. Br is crushed and powdered. Then the powder is put on affected teeth.	D
				Anthrax and asthma	The seed of *Brassicacarinata* A. Br is roasted, crushed, powdered and mixed with egg. And it is to be drunk. The seed of gomen zer is crushed then the powder is mixed with milk and drunk.	O

9	*Bridelia micrantha* (Hochst.)Baill Euphorbiaceae.	Anenebo	L	Liver disease	The leaf of *Bridelia micrantha* (Hochst.)Baill Is pounded and squeezed together and diluted with half cup of water and then it will be drunk.	O
			Ba	Meat indigestion	The bark of Anenebo is pealed and pounded then mixed with water. Then it will be filtered and the filtered liquid is drunk.	O

10.	*Calpurina aurea* alt benth Fabaceae	Chichehaqa	L	Toothache	The leaf of *Calpurina aurea* alt benth will be squeezed and put on the affected teeth.	D
				Wound	The leaf of *Calpurina aurea* alt benth along with the leaf of gembel leqa is squeezed and the juice will be applied on the wound.	D
11.	*Carica papaya* L. Cucurbitaceae	Papaya	L and R	Malaria	The leaf if *Carica papaya L.* is pounded and the juice is drunk.	O

					The root of *Carica papaya L.* is pounded and the juice is drunk.	O
			Sd	Gastritis	The seed of *Carica papaya L.* is dried then crushed and powdered to be mixed drunk with tea.	O
12.	*Carissa spinarum L* Apocynaceae.	Agam	R	Evil Eye	Crushing the root and smoking	Sm
13.	*Catha edulis* Celastraceae	Chat	L	Common cold	The dry leaf of *Catha edulis* is crashed and mixed with coffee or tea then drunk	O
14.	*Citrus aurantifolia* (L.) Burm. f. Rutaceae	Lomi	Fr	Febrile illness	The leaf and fruit of *Citrus aurantifllia* (L.) Burm. f. and *Croton macrostachyus* Del. respectively, are squeezed and it will be sniffed through the nose.	Na.
				Stomach ache	The fruit of *Citrus aurantifolia* (L.) Burm. f. is squeezed and the juice is drunk.	O

				Spider venom	The fruit of *Citrus aurantifolia* (L.) Burm. f. is squeezed and the juice is drunk, and also the juice will be applied on the infected part	O and D
15	*Coffea arabica* L. Rubiaceae	Buna	La	wound	The latex of *Coffea arabica* L. leaf will be applied on the wound.	D
16.	*Colocasia esculenta* (L.) Schott Araceae	Godere	L	Snake bite	The leaf of *Colocasia esculenta* (L.) Schott is rubbed on the snake bitten area.	D
				wound	The leaf of *Colocasia esculenta* (L.) Schott should be pounded and mixed with water. And it will be given to the cattle to drink.	O

17	*Croton macrostachyus* Del. Euphorbiaceae	Mesena (Bisana)	La			
				Wound	The petiole of *Croton macrostachyus* Del leaf is broken and then the latex of the petiole will be applied on the affected area gently.	D
				Tinea corporis	The petiole of *Croton macrostachyus* Del leaf is broken and then the latex of the petiole will be applied on the affected area gently.	D
			L	Common cold	The diseased person wash hi/her body by the leaf of *Croton macrostachyus* Del.	D

			Ba L			
				Ear disease	The petiole of *Croton macrostachyus* Del leaf is broken and then the latex of the petiole is dropped in to the ear.	Ea
				Dandruff	The petiole of *Croton macrostachyus* Del leaf is broken and then the latex of the petiole is applied on the infected part.	D O O

				Meat indigestion	The bark of *Croton macrostachyus* Del is pounded and mixed with water. Then it will be filtered. At last drunk	
				loss of appetite	The leaf of *Croton macrostachyus* Del, *Ocimum basilicum* L. is pounded and mixed with water then the cattle drunk	
18	*Cucumis ficifolius* A. Rich. Cucurbitaceae	Adene Deba qula (Yemider embuay)	R	Stomach ache and sudden sickness	The root of *Cucumis ficifolius* A. Rich. is dried, crushed and mixed with water to be drunk.	O
			R	Sudden sickness	The root of *Cucumis ficifolius* A. Rich. is pounded and mixed with water then the cattle drunk.	O
19	*Cymbopogon citratus (*DC.) Stapf poaceae	Hitcho (Moseret)	L	Anthrax	The leaves are boiled and the soup is drunk.	O

20	*Cynoglossum coeruleum** Hochst. ex A.DC. Boraginaceae	Bertetusa	L	Headache	The leaf of *Cynoglossum coeruleum** Hochst. ex A.DC. is squeezed and put into the left nostril and the left ear.	N and Ea
				Febrile illness	The leaf of *Cynoglossum coeruleum** Hochst. ex A.DC. and Ocimum basilicum L. is squeezed, then the juice will be drunk and applied on the body.	O and D
21	*Datura stramonium* L. Solanaceae	Ashkakula	L	Hemorrhoids	The leaves of *Urtica simensis* Steudel and *Datura stramonium* L. are pounded together and mixed with water and finally it will be drunk.	O
			Sd	Toothache	The seed of *Datura stramonium* L. is put on heated iron then the smoke will be directed through bamboo towards the affected tooth.	Too

				Head ache	The seed of *Datura stramonium* L. is crushed and the powder will be mixed with butted the it is applied on the for head and head.	D
22.	*Dodonaea angustifolia* L. f Sapidaceae	Kitkita	L	Ascariasis	The leaf of *Dodonaea angustifolia* L. f is pounded and mixed with some water and drunk by the cattle.	O
			L	Cattle ascariasis	The leaf of *Dodonaea angustifolia* L. f is pounded and mixed with water then the cattle drunk.	O
23	*Dovyalis abyssinica* (A. Rich.) Warb. Flacourtiaceae	Koshim	Ba	Meat indigestion	The bark is boiled and salt will be added then it shall be drank.	O
24	*Echinops kebericho* Mesfin. Asteraceae	Chosa (Kebericho)	R	Stomachache and Meat indigestion	The root of *Echinops kebericho* Mesfin. is pounded, mixed with water, tea, coffee and drunk.	O

				Evil Eye	The root of *Echinops kebericho* Mesfin. is dried then smoke in the house.	N
25	*Ensete ventricosum (Welw.) Cheesman* Musaceae	Ense t	Astara Enset	Co and pseudo S	To repair & soften the Broken bone ,	The corm sliced and boiled and the amicho and starchy powder bulla are eaten with milk	O
			guariye	Co	To strengthen broken bone	The corm boiled and eaten with milk	O
			Kibinar	Co	Used to join the broken	The corm boiled and eaten with milk	O
26	*Eucalyptus globulus* Labill. Myrtacea	Nech bahir zaf		L	Cough and common cold	The leaf of *Eucalyptus globulus* Labill.is chopped and boiled with water and the vapour inhaled repeatedly, while boiling steam bath is taken by humans with the doors and windows closed.	D

				Anthrax	The leaf of *Eucalyptus globulus* Labill.is pounded and the juice will be mixed with coffee then drunk.	O
				Sudden sickness	The leaf of *Eucalyptus globulus* Labill.is pounded and mixed with water then drunk.	O
			.	. malaria and febrile illness	The leaves of *Croton macrostachyus* Del. , *Calpurina aurea* alt benth, *Prunus africana (*Hook. f.) Kalms, and *Eucalyptus globulus Labill.* are mixed and boiled together and the affected person will bath with that	D

					water thrice a week	
27	*Euphrobia Tirucalli* Euphorbiaceae	Cheda (Kinchib)	La	Hemorrhoid	The latex of *Euphrobia Trucali* leaf is applied on the infected part	D
28	*Ficus sur Forssk.* Moraceae	Shola	Ba	Stomach ache	The bark is boiled and salt will be added then it shall be drank.	O
29	*Foeniculum vulgare* Mill. Apiaceae	Golota (Enshilale)	L	Malaria and Evil eye	The leaf of *Foeniculum vulgare* Mill. is crushed powdered and mixed with water then drunk by a tea cup.	O

				Febrile illness	The leaf of *Foeniculum vulgare* Mill. is put on fire and then it will be sniffed by nose	Na
30	*Hagenia abyssinica (*Bruce) J.F. Gmel. Rosaceae	Kosso	Sd	Tape worm	The seed of *Hagenia abyssinica (*Bruce) J.F. Gmel. is powdered and mixed with water to be drunk.	O
31	*Hypoestes forskaolii* (Vahl) R. Br. Acanthaceae	Etebader	L	Diarrhoea, Excessive bleeding during menstruation, low blood pressure	The leaf of *Hypoestes forskaolii* (Vahl) R. Br. is boiled with water and the water is drunk.	O
				Cattle ascariasis	The leaf of *Hypoestes forskaolii* (Vahl) R. Br. is pounded and mixed with water then the cattle drunk	O
				Gonorrhea	The leaf of *Hypoestes forskaolii* (Vahl) R. Br. is dried then crushed. Then the powder is boiled with bula then eaten	O

32	*Justicia schimperiana Hochst. ex A.* (Nees) T. Anders Acanthaceae	Sensel	R	Evil eye	The root of *Justicia schimperiana Hochst. ex A.* (Nees) T. Anders is pounded and squeezed then mixed with water then drunk.	O
33	*Lagenaria siceraria* (Molina) Standi. Cucurbitaceae	Qulechu (Qil)	R and Fr L	Tooth ache and dandruff	The root of *Lagenaria siceraria* (Molina) Standi. is pounded and squeezed then drunk The root of *Lagenaria siceraria* (Molina) Standi. is pounded and put on the affected tooth.. The fruit of *Lagenaria siceraria* (Molina) Standi. is pounded and mixed with water. Then the dandruff affected area is washed with the solution.	O and D Too D

				Ring worm	The leaf of *Lagenaria siceraria* (Molina) Standi. is pounded and mixed with water. Then it will be applied on the infected part	D
34	*Leonotis nepetifolia(L.)* R. Br. Lamiaceae	Menti arebe(yeset milas)	R	Sudden sickness	The root is dried, powdered and mixed with water to be drunk.	O
35	*Lepidium sativum L.* Brassicaceae	Shifa (Feto)	Sd	Gonorrhea	The seed of *Lepidium sativum L.* is crushed and mixed with milk, water or coffee and it is drunk.	D and O
				Stomach ache and Malaria	The seed of *Lepidium sativum L.* is crushed and mixed with water then drunk The seed of *Lepidium sativum L.* is mixed with coffee or milk then drunk.	O

36	*Lippia abyssinica* (Otto & A.Dietr.) Cufod. Verbenaceae	Koseret	L	Anthrax	The leaf of *Lippia abyssinica* (Otto & A.Dietr.) Cufod. and the root of *Urtica simensis* Steudel are mixed and powdered. Then it will be added in to chicken soup and drunk.	O
37	*Maesa lanceolata* Forssk	Gewado	L	lice	The leaf of *Maesa lanceolata* Forsskis pounded and squeezed then it will be drunk with tea or coffee.	O
38	*Millettia ferruginea* *Fabaceae*	Birbira	Fr	Chigger	The fruit of *Millettia ferruginea* is crushed and the powder is mixed with butter and applied on the infected area	D

			L	lice	The leaf of *Millettia ferruginea* is mixed with water and the cattle will be bathed by it.	Dermal
39	*Moringa stenopetala*(Bak f.) cuf. Moringaceae	Shiferaw	L L	Anthrax Diabetes, hyper tension and gastritis	The leaves are boiled and the soup is drunk. The leaf of *Moringa stenopetala*(Bak f.) cuf. is dried, pounded and the powder is mixed with coffee then drunk.	O. O
40	*Nicotiana tabacum L.* Solanaceae	Timbaho	L	Snake bite	The leaf of *Nicotiana tabacum L.* is squeezed, mixed with little water and drunk. The leaf of *Nicotiana tabacum L* is rubbed on the snake bitten body part.	O and D
41	*Nigella sativa L.* Ranunculaceae	Gembelmenzuta (Tiqur azmud)	Sd	Common cold	The seed of *Nigella sativa L.* is grounded and the powder will be sniffed through the nose.	N

				Vitligo	The seed of *Nigella sativa L* is crushed and powdered. Then it will be mixed with S*obr (Arabic)* and oil. It will be applied to the affected portion of the body.	D
				Nose bleeding	The seed is crushed, powdered and mixed with the bark of a bullhorn and it will be sniffed through the nose.	Na
				Head ache	The seed of *Nigella sativa L* is crushed and the powder will be mixed with water then mixed	O

42	*Ocimum urticifolium Roth** Lamiaceae	Leli beqeret	L	Head ache and febrile illness	The leaf of *Ocimum urticifolium Roth* is squeezed and mixed with water then drunk and applied on the body.	D And O
43	*Ocimum basilicum L.* Lamiaceae	Beqeret (Beso bila)	L	Stomach ache, Rheumatism, and febrile illness.	The leaf of *Ocimum basilicum L.* is chewed then swallowed.	O
44	*Ocimum lamiifolium* Hochst. ex Benth. Lamiaceae	Dama (Dama kese)	L	Common cold and febrile illness	The fresh leaf of *Ocimum lamiifolium* Hochst. ex Benth. is squeezed and added in tea or coffee and drunk.	O
				Hyper tension	The leaf of *Ocimum lamiifolium* Hochst. ex Benth. is boiled with water then the water will be filtered and the filtered water is drunk	O
45	*Olea europaea L. subsp. cuspidata (Wall. ex G.Don* Oleaceae	Wetechu (weyra)	L	Dandruff	The leaf of *Olea europaea L. subsp. cuspidata (Wall. ex G.Don* is pounded and the juice is applied on the affected area.	D

46	*Oxalis corniculata L.* *Oxalidaceae*	*Yeqola qusel medhanit*	L	Skin rash	The leaf of *Oxalis corniculata L.* is pounded then it will be covered by leaf and warmed on fire and it will be tied around the wound by using plastic or garment.	D
47	*Persea americana*. Lauraceae	Avocado	Fr	Dandruff	The fruit of *Persea americana*.is creamed on the dandruff affected parts of the body.	D
48	*Piper nigrum* Piperaceae	Kundo berbere	Sd	Common cold	The seed of *Piper nigrum is crushed and chewed.*	O
49	*Phytolacca dodecandra* L. Herit Phytolaccaceae	Endode	R	Liver disease	The root of *Phytolacca dodecandra* L. Herit is pounded and mixed with water then the filtered solution will be drunk.	O

50	*Prunus africana* (Hook. f.) Kalms Rosaceae	Gembel haqa (Tiqur Enchet)	L	Sudden sickness, malaria and febrile illness.	The leaves of *Croton macrostachyus* Del. ,*Calpurina aurea* alt benth, *Prunus africana (*Hook. f.) Kalms, and *Eucalyptus globulus Labill.* are mixed and boiled together and the affected person will bath with that water thrice a week	D
				Wound	The leaf of *Prunus africana* (Hook. f.) Kalms along with the leaf of *Calpurina aurea* alt benth is squeezed and the juice will be applied on the wound.	D
51	*Rhamnus prinoides* L.Herit Rhamnaceae	. Gesho	L	Spider venom	The leaf of *Rhamnus prinoides* L.Herit is squeezed and then applied on the infected body pare	D
52	*Ricinus communis L.* Euphorbiaceae	Qoboo	L	Febrile illness	The root of *Ricinus communis L.* is pounded and mixed with water then drunk.	O

53	*Ruta chalepensis L.* Rutaceae	Chrakot (Tene adam)	L and Sd	Common cold, loss of appetite ,Stomach ache, gonorrhea, Febrile illness and malaria.	The leaf and seed of *Ruta chalepensis L.*is squeezed and mixed with water, coffee or tea and is drunk.	O
			Sd and L	Gonorrhoea	The leaf of *Ruta chalepensis L.*should be pounded and mixed with the seed of *Lepidium sativum L.* and pounded *Allium sativum* L. then it will be mixed with milk and drunk.	O
54	*Senna didymebotrya Irwin and Barnely* Fabaceae	Senemeki	L	Snake bite	The snake beaten area is slightly cut by razor then the leaf of *Senna didymebotry Irwin and Barnely* will be squeezed by hand and it will be applied in the infected area.	D
55	*Solanum giganteum* Jacq. Solanaceae	Niza	L	Anthrax	The leaf of *Solanum giganteum* Jacq. Is pounded and applied on the infected area	D

56	*Solanum incanum L.* Solanaceae	Embuay	Fr	Dandruff	The fruit of *Solanum incanum* L is crushed and mixed with water then it will be on the head.	D
57	*Thymus schimperi* Ron. Lamiaceae	Tosign	L	Common cold	The leaf of *Thymus schimperi* Ron is boiled with tea then drunk	O
58	*Urtica simensis* Steudel Urticaceae	Dobe (Sama)	R	Headache, sudden sickness, Anthrax and malaria.	The root of *Urtica simensis* Steudel is boiled with water and it is drunk.	O
			R	Anthrax	The leaf of *Lippia abyssinica* (Otto & A.Dietr.) Cufod and the root of *Urtica simensis* Steudel are mixed and powdered. Then it will be added in to chicken soup and drunk.	O

59	*Verbena officinalis* L. Verbenaceae	Qisqisa	L	Meat indigestion	The leaf will be pounded, mixed with water and then filtered. Then the resulting solution will be drunk.	O
60	*Vernonia amygdalina Del.* Asteraceae	Heba (Girawa)	L	Ascariasis	The leaf of *Vernonia amygdalina Del.* is pounded and mixed with water and boiled then drunk	O
61	*Vernonia myriantha* Hook. f. Asteraceae	Reji	L	Eye disease	The leaf of *Vernonia myriantha* Hook. f. is squeezed and the juice is dropped in to the eye.	O

62	*Vernonia thomsoniana* Oliv. & Hiern ex Oliv. Asteraceae	Agumba	L	Stomach ache and meat indigestion	The leaf of *Vernonia thomsoniana* Oliv. & Hiern ex Oliv. is pounded with salt and qebercho then mixed with water to be drunk.	O
				Rheumatism	The leaf of *Vernonia thomsoniana* Oliv. & Hiern ex Oliv. will be squeezed hand and three tea spoon of the squeezed juice will be dropped in to tea or coffee then drunk	O
			S	Toothache	The stem of *Vernonia thomsoniana* Oliv. & Hiern ex Oliv. is used to brush the teeth.	Too
63	*Vicia faba* Fabaceae	Baqela	Sd	Spider venom	The patient will hold the seed of *Vicia faba* in his/her mouth for a moment and then he/she will spit or apply on the affected area.	D

64	*Withania somnifera* (L.) Dunal Solanaceae	Gizawa	R	evil eye	The roots of *Withania somnifera* L *Dunal* should be boiled or and the soup shall be drunk.	O
65	*Zingiber officinale* Roscoe Zingibiraceae	Janjibil	Rh	Stomach ache, Toothache, Common cold	The rhizome of *Zingiber officinale* Roscoe is pounded and mixed with tea then drunk	O

Appendix 6

Semi Structured Interview Questions.

I. General information

1. Information on respondents:

Date of interview_____ Kebele _____ Name of interviewer_____

Name of respondent_____

Gender: M _____ F_____ Age _____Ethnicity _____

Religion: Orthodox _____ Muslim_____ Protestant_____ other_____

Educational level_____

Marital status _____ for how long have you lived in the area? _____

Ethnobotanical Data

1. What are the most common diseases of humans in your area?

2. What are the most common diseases of animals in your area?

3. List plant species used to treat a given disease in your area?

4. List traditional way of classifying vegetation, soil types and landscapes in your area?

1. Vegetation_____2. Soil types _____3. Landscapes_____

5. Are there members of the community who frequently use the traditional medicinal plant as compared to modern medicine? Why?

6. How is the knowledge of traditional medicine passed to a family member/younger generation?

7. Are there restrictions /taboos in collecting medicinal plants? Are there taboos in the utilization of some medicinal plants in the locality?

8. Is there any modernization interference with traditional medicine application and use?

9. Are medicinal plants marketable?

10. Which Seasons are preferred for collection of medicinal plants in your area?

Wet season_____, Dry season_____, All-the-year round _____

11. Where do the medicinal plants grow? (Place of collection?)

In home gardens _____, Follow land _____, Arable land_____, In the forest _____.

12. Availability of medicinal plants as compared to the past:

More_____, Same_____, and Less_____

13. What are threatening factors of medicinal plants in your area?

14. What other uses does the medicinal plant you are using has in your village?

For medicinal _____, Food_____, Firewood_____, Charcoal_____, Fence_____, Construction_____, Furniture_____, Edible fruit_____

15. Which medicinal plants species is commonly threatened in the study area? _____

16. How do the local people manage and conserve these medicinal plant species through their traditional indigenous knowledge?

17. Is the medicinal plant X marketable?

18. What is the market price of the medicinal plant?