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Ethnobotanical Study of Medicinal Plants Used by the Local People of Akaki District, East Shewa Zone, Oromia Regional State, Ethiopia

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Abstract:

This study was conducted to document the indigenous medicinal plant-based knowledge of the people of Akaki District in South East of Addis Ababa from March, 2016 to December, 2016. A total of 40 informants (32 males and 8 females) above the ages of 18 were selected to collect information on medicinal plant identification from eight sampled kebeles. Out of these, 10 key informants were purposely selected based on the recommendations of elders and local authorities. Other 30 informants were selected randomly. Data were collected using semi-structured interviews and field observations. Informant consensus, preference ranking, paired comparison, informant consensus factor (ICF) and fidelity level were calculated. A total of 64 plant species distributed within 60 genera and 35 families were collected and identified. From these, 48 species were recorded for the treatment of human health problems and 16 species for the treatment of livestock health problems. From the total medicinal plant species, 26 were herbs followed by 23 species of shrubs, 12 species of trees and 3 species of climbers. The most frequently used plant parts were leaves (45.31%) followed by roots (28.12%). The most widely used method of preparation was crushing (35.95%) of the different plant parts followed by chewing (18.75%) and pounding (17.18%). The common route of administration recorded was oral (53.12%) followed by dermal (18.75%). The most commonly used application of medicinal plant was drinking (43.75%) followed by painting (17.18%) and putting on accounted for 4.68%. The medicinal plants such as Ocimum lamiifolium, Allium sativum and Indigofera tinctoria that were presumed to be effective in treating certain diseases have got high informant consensus. The disease categories such as external parasites, Ascaris and tape worm as well as the categories of retained urine and retained placenta have higher ICF values of 0.93, 0.92 and 0.90 respectively. Preference ranking showed that people of the area have preference for Ocimum lamiifolium for the treatment of febrile illness. Paired comparison of five species of plants that were used for the same disease showed that Ruta chalepensis was the most preferred species by traditional healers for the treatment of stomach ache. Agricultural encroachment, firewood collection, charcoal production, drought, plant use for house and fence construction, overgrazing, urbanization, construction of Addis Ababa-Adama high way and construction of Addis Ababa-Djibouti rail way were major threats to plants in general and medicinal plants in particular in the study area. Indigenous practices, cultural, spiritual, prime restrictions for collection and awareness rising have contributed to the conservation of medicinal plants.

Key words or phrases: medicinal plants, Indigenous knowledge, ethnomedicine, Akaki District and traditional healers.

1. Introduction

1.1. Background of the Study

Starting from ancient time, people have gathered plant and animal resources for their needs (Gidey Yirga, 2010). Examples include edible nuts, fruits, herbs, spices, gums, game, fodder and fibers used for construction of shelter and housing, clothing or utensils, and plant or animal products for medicinal, cosmetic or cultural uses. Many years later, several millions of people, mostly in developing countries, derive a significant part of their subsistence needs from gathered plant and animal products (Iqbal, 1993).Traditional medicine is used throughout the world as it is dependent on locally available plants, which are easily accessible, simple to use and affordable. These medical systems are heavily dependent on various plant species and plant based products. According to WHO (2001) report, traditional healers such as herbalists and spiritual healers constitute the main source of assistance with health problems for at least 80% of rural population in developing countries. This unquestionably shows that the populations of developing countries rely heavily on traditional medicine to cope with their health problems (Gidey Yirga, 2010).

About one fourth of identified higher plants in the world has at one time or other used by some cultures for medicinal purpose (Nair and Nathan, 1998). Some important activities of international organizations in the field of traditional medicine, like WHO in designating the world in six regional zones (African, American, South-east Asian, European, western Mediterranean and Western pacific), and providing a technical and financial supports, are the most encouraging system to collect, describe and investigate the medicinal plants at institutional level (Endale Amenu, 2007). Some recent reports have indicated that, 25% of the modern drugs are derived from the extract of medicinal plants (Maridass and John 2008). In the Industrialized countries people are seeking alternative herbal medicine because of the side effect from the strong modern drugs. According to WHO (2001), 70-90% of world population especially from developing countries, use plant remedies for their health care (Nair and Nathan, 1998). However, the effort to provide public acceptance and ascertain scientifically remained to minimum in developing countries (Behilu Etana, 2010). Moreover, the high cost of drugs and the inability of many developing countries to purchase modern drugs have prompted them to look for local products in the form of medicinal plants that

have proved to be effective, safe, inexpensive and culturally acceptable (Balcha Abera, 2003). Developing countries like India, Pakistan and China have identified potential usage of medicinal plants and integrated them in to their overall healthcare system (Balcha Abera, 2003). In Ethiopia the greater concentration of medicinal plants are found in the south and south western parts of the country following the concentration of biological and cultural diversity (Edwards, 2001). Medicinal plants and knowledge of their use provide vital contribution to human and livestock health care needs throughout Ethiopia. In Ethiopia, about 80% of human population and 90% of livestock rely on traditional medicine (Abbink, 1995). Ethiopian plants have shown very effective medicinal value for some ailments of humans and domestic animals. However, due to population pressure, accelerated urbanization, recurring drought, and deforestation, most of the medicinal plants are either destroyed or are on the verge of extinction (Maridass and John, 2008). Documentation of this indigenous knowledge of healing system still remains at minimum level (Nasir Tajure Wabe *et al.*, 2011). In certain parts of Ethiopia some investigations have indicated the rate of erosion of both indigenous knowledge and the herbs signals for the need of intervention.

In Ethiopia, ethnobotanical studies over the past decades haven't been emphasized on (Dawit Abebe, 2001; Mirutse Giday, 1999). The Institute of Biodiversity Conservation has pledged to do this in its long range strategic research plan. However, there exists an accelerated devastation of plant resources with loss of indigenous knowledge. The lack of conservation actions and activities is observed in Akaki District, which is similar to other areas of Ethiopia. The current plant use trend in the district shows that the environment is facing problems of plant resource depletion and loss of indigenous knowledge (ADAO, 2015). Thus, rigorous ethnobotanical research plays a vital role to draw information on plants and related indigenous knowledge; for identifying the medicinal plants and dealing on their conservation and sustainable utilization.

1.2. Statements of the problem

Traditional medicinal plant is used throughout the world as it is dependent on locally available plants which are easily accessible and capitalizes on traditional wisdom-repository of knowledge, simple to use and affordable. In developing countries like Ethiopia, the indigenous knowledge about traditional medicinal plants is transferred secretly from generation to generation through oral means. In addition, the indigenous knowledge on usage of medicinal plants as remedies are getting lost owing to migration from rural to urban areas, industrialization, expansion of modern education by making young generation refuting indigenous knowledge and failure of specialized healers to transfer their knowledge to next generation. In most parts of the country, the wild plants are almost totally lost by deforestation, agricultural expansion and over exploitation. Akaki District is one of the areas in Ethiopia with similar problems. So far, there has not been any research work on ethnobotany of medicinal plants and associate indigenous knowledge in Akaki District. Therefore, this study was designed to fill the knowledge gap on the ethnobotany of medicinal plants and associated knowledge in Akaki district.

1.3. Objectives of the study

1.3.1. General objective

The general objective of this study was to document medicinal plant species and the associated indigenous knowledge used to treat both human and livestock ailments in Akaki District

1.3.2. Specific objectives

The objectives of this study were to:

1. Collect, identify and document medicinal plant species and their growth form;
2. Document plant part(s) used, mode of preparation and route of administration for both human and livestock ailments treated by medicinal plants;
3. Identify threat factors and conservation methods to medicinal plants in the study area.

1.4. Significance of the study

The findings of this study is intended to have vital significances for researchers of traditional medicinal plants and traditional healers to identify traditional medicinal plant varieties, gathering them, documenting their use, management and the associated traditional ethnomedicinal knowledge in the study area. It also would help people of the study area to be awared of problems associated with medicinal plants and give attention to the threatened medicinal plants. In other words, the documentation of the indigenous knowledge of these medicinal plants could be part of the information source for those who want to conduct research in further ethnobotanical study and development of modern drug. Therefore, any concerned body and traditional healers could use the findings of this research in building the ethnobotanical database of Ethiopia in order to facilitate further actions in the collection, identification, documentation, management and utilization of medicinal plants.

2. Literature Review

2.1. Origin and progress of ethnobotanical study

Ethnobotanical work seems to have started with 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 from the new world documented food, medicine and other useful plants of the Aztec, Maya and Inca peoples (Martin, 1995). The term ethnobotany was for the first time mentioned orally by John Hershberger in 1895 during a public lecture (Balick, 1996 and Cotton, 1996; Hamilton *et al.,* 2003). In this day ethnobotany has become a more diversified and multidisciplinary subject that requires experts in various fields of academic study such as Botany, Anthropology, Agriculture, linguistics, Archeology and Economics (Martin, 1995; Alexiades, 1996; Balick, 1996). According to Cotton (1996), ethnobotany encompasses all studies that concern the mutual relationships between plants and people. Among the relationships of humans with plants, indigenous knowledge on traditional medicine is one. Thus, over many years, human beings have used plants for both preventive and curative traditional medicine preparations to cure human beings and livestock. 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 (Dery *et al.,* 1999). Considerable indigenous knowledge system, from the earliest times, is linked to the use of traditional medicine in different countries (Farnsworth, 1994). Evidence obtained from observations of animals shows that even chimpanzees use a number of plant species for their medicinal value (Huffman and Wrangham, 1994). The focus of ethnobotany is on how plants have been or are used, managed and perceived in human societies and includes plants used for food, medicinal, rituals, social life and others. The relationship between plants and human cultures is not limited to the use of plants for food, clothing and shelter but also includes their use for religious ceremonies, ornamentation and health care (Khan *et al*., 2007).

Ethnobotancal research documents the knowledge on cultural interaction of people with plants, and figure out how local people have traditionally used plants for various purposes and how they incorporate plants into their cultural tradition and religion (Balick and Cox, 1996). Traditional

people around the world possess unique knowledge of plant resources on which they depend for food, medicine and general utility including tremendous botanical expertise (Martin, 1995).

Nowadays ethnobotany has tended to become more analytical, quantitative, cross disciplinary multi institutional (Hamilton *et al*., 2003) and it is a rapidly growing science, attracting people with widely varying academic backgrounds and interests (MacDonald, 2009). One of the main motivating forces behind this expansion is the increasing awareness of the considerable practical and social value of traditional knowledge. Ethnobotany is also to define local community plant resources needs, utilization and management. Therefore, the conservation of ethnobotanical knowledge as part of living cultural knowledge and practices between communities and the environment is essential for biodiversity conservation (Martin, 1995; Balick and Cox, 1996; Cotton, 1996). Ethnobotany also helps to save foreign exchange. Moreover, the development of medicinal plants in primary health care not only save the foreign exchange but also helps in conserving our national heritage (Abiot Birhanu *et al*., 2006). Medicinal plants play a key role in the development and advancement of modern studies by serving as a starting point for the development of novelties in drug (Wright, 2005). According to Hamilton *et al*. (2003), application of ethnobotany can lead to a strengthening of cultural diversity conservation, greater sustainability in the exploitation of plant resources, and the development of new plant products. Application of ethnobotany can lead to rural developments by identifying and promoting useful plant resources for local use, natural resource managements and conservation. According to Martin (1995), ethnobotanists often have to work without the support of colleagues in order to establish close relationships with communities. However, in order to achieve more detailed and reliable results, ethnobotanical studies need participation of various disciplines such as plant taxonomy, anthropology, linguistics, economic botany and others. Ethnobotanists have the role of ‘’explorer’’ and they have a great responsibility to share the information they collect from the local people with the great collection of human knowledge (Arihan and Mahin, 2007). According to Cotton (1996) identification of new drugs based on traditional medicinal plants in the areas of pharmaceuticals is among the potential application of ethnobotanical inquiry in recent decade. Ethnobotanical studies are good sources of information for such investigations.

2.2. Indigenous knowledge

The accumulation of knowledge possessed by local people in a particular area is defined as indigenous knowledge (Quanash, 1998). The local people immediate dependency on natural resources resulted in the accumulation of indigenous knowledge that helped people to adapt to and survive in the environments in which they live. Traditional methods of healing have been beneficial in many countries with or without access to conventional allopathic medicine.

Most of the traditional knowledge on plant use has been passed orally from generation to generation (Nasir Tajure Wabe *et al.*, 2011). The traditional knowledge of plant utilization in Ethiopia has not been well documented. This knowledge, which is available in rural communities of Ethiopia, would probably be lost due to migration from rural areas to towns. Change in life style, rapid loss of natural habitats, drastic alteration of the local ecology could also affect the traditional knowledge of plant use. Human induced events could have major contributions to these changes (Dawit Abebe, 1986).

Ethnoveterinary medicine in some previous few decades has been the target of numerous studies (McCorkle and Mathias, 1986). Many farmers rely on ethnoveterinary knowledge for the health care and treatment of their livestock ailments for several generations. Many plant species which have pharmacological activities were identified so far and the active ingredients have been extracted mainly from the root, stem, and leaf parts that processed to administer through appropriate routes (ITDG and IIRR, 1996). They traditionally learned to diagnose clinical features of endemic animal diseases by the use of traditional equipment like bamboo syringes, stone tourniquets, animal horn products, squashing with their hands, and wood forceps to determine dosage, and prepare remedies from local medicinal plants. Treatment by contemporary veterinary medicine has, in these days, been out of the reach of the ordinary farmers often due to high cost of drugs and none coverage (Muretse Giday and Gobana Ameni, 2003; Teshale Sori *et al.*, 2004). The farmers have subsequently explored many ethnobotanical products in treating livestock diseases (Fajmi and Taiwo, 2004). With a view of those traditional practices, the WHO declared the important roles of ethnobotanical products in veterinary and human medicines in the Alma-Ata proclamation in 1978.

Many studies assured that farmers and pastoralists in several countries such in West Java, Indonesia (Balakrishnan *et al*., 2009), Mexico, Nigeria (Shariazat, 2002), Ormaland, Kenya (Abubakar Swaleh, 1999), Zimbabwe (Tafara and Toana, 2004), South Africa (VanderMurewe *et al*., 2001),

China (Shen *et al*., 2010), Pakistan (Deeba *et al*., 2009) and India (Somvanshi, 2006) widely use medicinal plants in health care of livestock. Similarly, across all regions of Ethiopia, people have been using ethnoveterinary knowledge to treat livestock diseases for thousands of generations (Mirutse Giday and Gobana Ameni, 2003). It is estimated that up to 90% of current livestock diseases are managed through the use of traditional medicines (Endashaw Bekele, 2007). Few ethnoveterinary surveys have been conducted in Ethiopia, such as Borena pastoralists (Teshale Sori *et al*., 2004), Fentale, Eastern Shewa (Kebu Balemie *et al*., 2004), Boosat, Welenchetti (Debella Hunde *et al*., 2004), Bale Mountains National Park (Haile Yinegar *et al*., 2007), Gilgel Ghibe (Haile Yinegar *et al*., 2008), Goma district in Jimma zone (Etana Tolasa, 2007) to document ethnobotanical products used in animal health care practices.

The complex knowledge, beliefs and practices generally known as indigenous knowledge develops and changes with time and space. Indigenous knowledge is a body of knowledge built up by a group of people through generations of living in close contact with nature. It builds upon the historic experiences of people and adapts to social, economic, environmental, spiritual and political changes. It is local knowledge that is unique to a given culture or society and the base for agriculture, health care, food preparation, education, environmental conservation and a host of other activities (Thomas, 1995). Such knowledge includes time-tested practices that developed in the process of interaction of humans with their environment. Therefore, it is the result of many generations long year's experiences, careful observations and trial and error experiments (Martin, 1995).

Different community members according to their gender, age, social standing, profession and intellectual capabilities have traditional knowledge differs in both quality and quantity. For instance, societies concerned with biological diversity will be most interested in knowledge about the environment; this information must be understood in a manner, which encompasses knowledge about the cultural, economic, political and spiritual relationships with the land. It provides a distinctive worldview of which outsiders are rarely aware and at best can only incompletely grasp (Balick and Cox, 1996). Indigenous people of different localities have developed their own specific knowledge on plant resources, use, management and conservation (Cotton, 1996). Thus, systematic application of indigenous knowledge is important for sustainable use of resources and sustainable development (Thomas, 1995). One of the widely used indigenous knowledge system in many

countries is the knowledge and application of traditional medicine. Such knowledge, known as ethnomedicinal knowledge involves traditional diagnosis, collection of raw materials, preparation of remedies and its prescription to the patients (Farnsworth, 1994). Indigenous knowledge on remedies in many countries including Ethiopia, pass from generation to generation verbally with great secrecy (Fisseha Mesfin, 2007). Such secrete and crude transfer makes indigenous knowledge or ethnomedicinal knowledge vulnerable to distortion and in most cases, some of the lore is lost at each point of transfer (Eskedar Abebe, 2011), hence there is a need for systematic documentation of such useful knowledge through ethnobotanical research.

2.3. Ethnobotanical Studies of Medicinal Plants Researches in Ethiopia.

Ethnomedicinal uses of 230 plant species were documented from Mana Angetu District in Bale Zone by Ermias Lulekal *et al.,* (2008). Another similar study by Mirutse Gidey (2001) on Zay people indicated that most of the medicinal plants belong to herb habit group, followed by trees and shrubs. The study conducted by Debela Hunde *et al*., (2004) in Bosat stated that most of the medicinal plants were shrubs followed by herbs. In addition to the above points, ethnobotanical study of food and medicinal plants of Danio Gade (home gardens of Gamo people) by Belachew Wassihun *et al*., (2003) revealed that the majority of medicinal plants were herbs followed by shrubs. Moreover, the study explained that the most frequently utilized plant parts were the leaves followed by the roots. In terms of their growth location, the study showed that most of the medicinal plants were wild while the remaining were grown close to home. From this study, one can easily deduce that those grown close to homes provide good evidence for homegardens being useful as habitat for medicinal plants.

Ethnoveterinary service is among the uses of medicinal plants (Debela Hunde *et al.,* 2004). Some of the works that have been carried out includes: Eskedar Abebe, (2011); Fisseha Mesfin, (2007); Dawit Abebe (1986); Dawit Abebe and Ahadu Ayehu (1993); Mirutse Giday (1999); Kebu Balemi *et al.,* (2004); Debela Hunde *et al.,* (2004) and Ermias Lulekal (2005). Although, only small fractions of the world's plants have been investigated scientifically so far, human kind already reaped enormous benefits from them (Farnsworth *et al.,* 1985). More than ever, plant diversity remains vital for human well beings and still provides a significant number of remedies required in

health care. Therefore the crucial role played by plant derived products in human and livestock health, the need for systematic scientific investigation is unquestionable.

Several types of medicinal plant parts are being derived for medicine in order to cure human or livestock diseases in Ethiopia. However, roots and leaves are widely utilized plant parts. According to Tizazu Gebre (2005), roots are the most used plant parts followed by leaves .In addition to this, the study explained that most of the herbal remedies were applied orally followed by external application. People use medicinal plant parts to treat human or livestock ailments while they are fresh, dried or both. The study of Gidey Yirga (2010) on Central Tigray revealed that some of the remedy preparations were from fresh or dried state. As these plants are used in both forms, the chance of using the medicinal plants under different seasons of the year is increased and traditional healers preserve the plant that they could not find in dry season in different ways like pounding and hanging the plant material. Related studies by Kebu Balemie *et al.*, (2004) indicated those malaria, jaundice, cough and stomach aches are among the human ailments treated with medicinal plants. It was also pointed out that veterinary problems due to leech, tsetse, anthrax, tick and intestinal worms were among the diseases treated with medicinal plants recorded in the Fentalle study area, Eastern Shewa and upper Omo valley in southern Ethiopia. The study also underlined the indigenous knowledge of the Dawro people in herbal preparations that mostly involve concoction and infusion of leaves, fruits, seeds, stems and roots. Despite their diverse role in treating various diseases and ailments in both humans and animals, medicinal plants are facing an increasing pressure from both natural and anthropogenic factors as many of the literature sources indicated.

2.4. Medicinal plants and ethnomedicine in Ethiopia

2.4.1. Medicinal plants in public health care system

Starting from immemorial time, plants have been used as a source of traditional medicine in Ethiopia to combat different ailments and human sufferings (Asfaw Debela *et al.*, 1999). Due to its long period of practice and existence, traditional medicine has become an integral part of the culture of people in Ethiopia (Mirgissa Keba, 1998). According to Dawit Abebe (2001), there is a large magnitude of use and interest in medicinal plants in Ethiopia due to acceptability, accessibility and biomedical benefits. In this country, the long history of use of medicinal plants is reflected in various medico- religious manuscripts produced on parchments and believed to have originated

several centuries ago (Fassile Kibebew, 2001). Medical textbooks written in Geez or even Arabic in Ethiopia between the mid of 17th and 18th century imply that plants have been used as a source of traditional medicine in Ethiopian health care system. 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). The continued dependency on herbal medicine along with the side of modern medicine is largely conditioned by economic and cultural factors (Aketch, 1992). In addition to these factors, the fact that modern medical services are inaccessible to the vast majority of the populations due to their costs made herbal medicines more acceptable. The problem of ensuring equitable distribution of modern health care has become more serious, as the gap between supply and demand has continued to widen. Hence, in present day Africa including Ethiopia, the majority of people lack access to health care and where available the quality is largely below standard (Abbiw, 1996). This is why Archer (1990) and Nijiar (1996) stated that for most indigenous peoples and the local communities' reliance on plant resources accounts for anything up to 95% of their survival requirements. Therefore herbal remedies are the world's therapeutic means to act against diseases for a large proportion of people both rural and urban centers in developing countries like Ethiopia (Abbiw, 1996).

2.4.2. Plants in ethnoveterinary medicine

Animal disease in several developing countries, particularly in Sub-Saharan Africa, remains one of the principal causes of poor livestock performance leading to an ever-increasing gap between supply and demand for livestock and their products. In Africa the ever-declining provision of animal health services has resulted in the reappearance of a number of epizootic diseases reducing the economic efficiency of livestock production (Tafese Mesfin and Mekonen Lemma, 2001). Ethnoveterinary medicine which refers to traditional animal health care knowledge and practices comprising of traditional surgical and manipulative techniques, traditional immunization, magico-religious practices and beliefs, management practices and the use of herbal remedies to prevent and treat a range of disease problems encountered by livestock holders (Tafesse Mesfin and Mekonnen Lemma, 2001). Ethnoveterinary medicine provides traditional medicines, which are locally available and usually cheaper than standard treatments. Livestock holders can prepare and use

homemade remedies with minimum expense. So far, many livestock holders in rural areas where there are relatively few veterinarians and shortages of other facilities, traditional medicinal plants are the only choice to treat many ailments (McCorkle, 1995).

In our country, as in other developing countries, livestock production plays an important role in the livelihood and economy of majority of our population. Crop production is almost entirely dependent on traction power provided by animals. Livestock offers in many harsh environments the only way of survival and constitutes a driving force for food security and sustainable development in developing countries like Ethiopia. Although, the gain from livestock production is directly related with safeguarding animal health convention, veterinary medical system is among the smallest in Ethiopia. Techniques such as those to treat the more wide spread ailments are common knowledge among livestock holders (ITDG and IIRR, 1996). On the contrary, others are known only to a few indigenous professional healers who have over the year learned the practice. Stock raisers, both farmers and herders have developed their own ways of keeping their animal health and productivity (McCorkle and Mathias, 1986). They treat and prevent livestock diseases using sometimes age old homemade remedies, surgical and manipulative techniques. Taken together, these indigenous local animal health care beliefs and health care practices constitute an ethnoveterinary medicine. Like other kind of local technical knowledge, ethnoveterinary medicinal practice and skills are built up on over time empirical observation, mainly through trial and error and sometimes through deliberate or even desperate experimentation and innovation (McCorkle and Mathias, 1986). Ethnoveterinary medicine can be useful when ever and where ever stock raisers have no other animal health care options, whether in rural or peri-urban areas. In spite of its paramount importance as livestock health care system, the various traditional veterinary practices remained undocumented in Africa and Ethiopia (Dawit Abebe and Ahadu Ayehu, 1993). Thus, creation of awareness on ethnoveterinary medicine emphasizing on useful plants used for treatment of livestock has paramount importance to livestock management. In addition, proper documentation and understanding of farmers' knowledge, attitude and practices about the occurrence, cause, treatment, prevention and control of various ailments is important in designing and implementing successful livestock production (Tafese Mesfine and Mekonen Lemma, 2001).

2.4.3. Threat factors and conservation of traditional medicinal plants in Ethiopia

According to Zemede Asfaw (2001), throughout the world people use many wild species of plants for food, medicine, clothing, shelter, fuel, fiber, income generation and the fulfilling of cultural and spiritual needs. As elsewhere in Africa Ethiopia's traditional medicine is faced with problems of continuity and sustainability (Ensermu Kelbessa *et al.*, 1992). The primary causes of this problem are loss of taxa of medicinal plants, loss of habitats of medicinal plants and loss of indigenous knowledge. Some studies have shown that most of the medicinal plants utilized in Ethiopia are harvested from wild habitats (Mirutse Giday, 1999; Tesfaye Awas and Zemede Asfaw, 1999) and hence this aggravates the rate of loss of taxa with related indigenous knowledge and loss of widely occurring medicinal plant species. There are two sources of threats to medicinal plants, i.e. manmade and natural causes. Rapid increase in population, the need for fuel, urbanization, timber production, overharvesting, destructive harvesting, invasive species, commercialization, honey cut, degradation, agricultural expansion and habitat destruction are human caused threats to medicinal plants. Likewise, natural causes include recurrent drought, bush fire, disease and pest out breaks (Ensermu Kelbessa *et al.*, 1992). According to Mekonnen Abebe (2013), medicinal plants are considered to be at conservation risk due to over use and destructive harvesting (roots and barks collection). Dawit Abebe and Ahadu Ayehu (1993) found that many medicinal preparations use roots, stem and bark by effectively killing the plant in harvest.

Plant parts used to prepare remedies are different; however, root is the most widely used part. Such wide utilization of root part for human and livestock aliments with no replacement has severe effect on the future availability of the plant. Haile Yineger (2005) confirmed the fact that of the total plant parts to prepare remedies, roots are the most used plant part followed by leaves, which hence affects sustainable utilization. In a broad sense, conservation is achieved through in-situ and ex-situ means. Some medicinal plants have to be conserved in-situ due to difficulty for domestication and management (Endalew Amenu, 2007). Moreover, some plants fail to produce the desired amount and quantity of the active principles under cultivation out of their natural habitats. Medicinal plants can also be conserved by ensuring and encouraging their growth in special places, as they have been traditionally (Zemede Asfaw, 2001), this can be carried on in places of worship (churches, mosques, grave yards, etc.), scared grooves, farm margins, river banks, road sides, live fences of gardens and fields. Medicinal plants can be conserved using appropriate conservational methods in

gene banks and botanical gardens. This type of conservation of medicinal plants can also be possible in homegardens, as the homegarden is strategic and ideal farming system for the conservation, production and enhancement of medicinal plants.

3. Materials and methods

3.1. Description of the study area

3.1.1. Geographical location

Akaki district is located in Oromia region of Ethiopia, in Oromia special zone surrounding Finfine (Addis Ababa). It is bordered on the South west by Karsa Malima district , on the south by Liban district, on the west by Sebeta Hawas district, on the northwest by Addis Ababa, on the north by the Bereh district and on the East by Ada'a district. The administrative center of this district is Dukem town located at a distance of 37 km from Addis Ababa. Its location is 8°45'25"-8°50'30" north latitude and 38°51'55"-8°56'5" East longitude. The altitude of this district ranges from 1500-2300 meters above sea level. Mountain Yerer on the border with Ada'a Chukala, is the highest peak in Akaki District. Rivers include Akaki, Dukem and Hawas. About 72% of the land is arable, 7.6% pasture and the remaining is considered swampy, degraded or otherwise unusable. Lentils, chickpeas and fenugreek are important cash crops of the area (ADAO, 2015).

Industry in the district includes 3 licensed miners, 11 small industries employing 71 people and 694 registered businesses including 44 wholesalers, 139 retailers and 115 service providers. The district has 85 kilometers of dry-weather and 35 all-weather road, for an average of road density of 210 kilometer per 1000 square kilometers. About 16% of the rural, 100% of the urban and 23% of the total population has access to clean drinking water (ADHO, 2015).

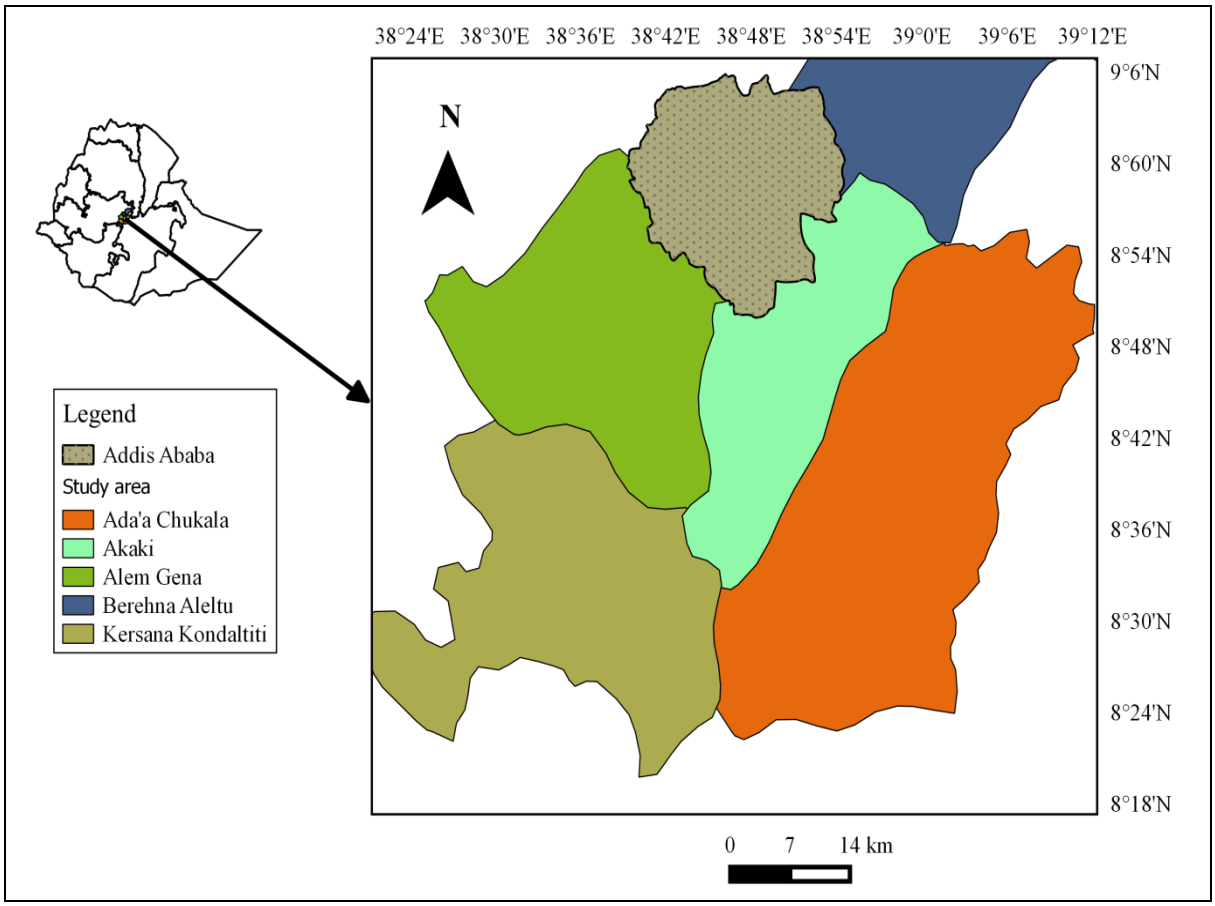

Figure 1: Location map of Akaki district (by Dereje Denu)

3.1.2. Climate

The District falls within agro climatic conditions of middle-land (98%) and high land (2%), with annual rain fall of 800-1800 mm and annual temperature of 15°c-27°c (ADAO, 2015). The rainfall pattern of the study area is bimodal i.e. have two distinct rainy seasons. The District receives high rainfall between July and September as well as relatively good amount of rain fall from March to April. The dry season extends from December to February and to some extent from May to June.

3.1.3. Population and medical services

The 2007 national census reported a total population of 77,836 for this district (40,241 male and 37,595 female) (CSA, 2008). Of the total population, 6,670 or 8.57% were urban dwellers while the

rest are living in the rural area (CSA, 2008). The majority of the populations are followers of Orthodox Christianity (85.86%), while 7.01% practice Traditional beliefs, 3.52% Protestant, and 3.34% Muslim religion. The largest ethnic group in Akaki District is the Oromo (81.24%) followed by Amhara (17.1%) and Werji (0.81%). All other ethnic groups account for 0.85% of the population. Afan Oromo is spoken as a first language by 81.42% and 18.14% speak Amharic; the remaining 0.44% speaks all other primary languages.

The district has three health centers, twenty eight health posts and one central veterinary clinic. According to (ADHO, 2015), the first ten major diseases in the area are: acute febrile illness, diarrhoea (non-blood), acute upper respiratory infections, pneumonia, trauma (injury), helminthiasis, diarrhea with blood (dysentery), diarrhea with dehydration, dyspepsia and urinary tract infection. These diseases mostly affect people living in the rural areas where the health services are at most in shortage and do not cater their needs as well they are unable to afford the high cost of modern drugs. These conditions and others force people to be served by traditional health practitioners and traditional means of treatment.

3.1.4. Livestock

The numbers of livestock in Akaki district include: cattle (128,758); sheep (19,486); goats (14,420); poultry (60,975); mules (3,715); horses (9,973) and donkeys (26,775). Even though livestock population is promising in the district, their productivity is very low as in most places in the country. The livestock resources of Akaki district have not yet been exploited. Their performance (milk, meat, egg) and contribution to the regional and national economy is very low mainly due to poor management, low genetic potential due to inbreeding, inadequate and low quality feed supply, and the prevalence of various animal diseases (ADAO, 2015).

In the District, livestock make a substantial contribution to the rural economy. Most rural farming, transport and source of income do directly or indirectly link with them. The most important animal diseases in the District include: bacterial infections (anthrax, black leg, pastureolosis, mastitis, actinobacillosis and actinomycosis), coccidiosis, internal parasites, ticks, mangemites, sheep pox, goat pox, newcastle and rabies (ADAO, 2015).

3.2. Reconnaissance survey

A reconnaissance survey of the study area was conducted before the actual data collection to get sufficient information about the study sites and population.

3.3. Selection of study sites and Informants

Eight kebeles were selected out of twenty eight total kebeles of the district using random sampling technique for the study. In general, 40 informants (32 males and 8 females) ≥18 age were selected depending on their volunterness as most people are working in different factories. Out of these, 10 key informants (all males) were selected using purposive sampling based on the recommendations of local authorities, knowledgeable elders and developmental agents as locally females rarely have position in traditional healing. The other 30 informants (22 males and 8 females) were selected randomly from the local people of the study area to save time for collecting data and specimens.

3.4. Data collection

The most vital tools used in this investigation were resource persons such as known herbalists, aged men, women and other individuals who have the knowledge of medicinal plants and the efficacy. Some visits were also made to the field with these resource persons who assisted me in identifying the medicinal plants in their local names and their medicinal uses. Ethnobotanical data were collected in April and May 2016 on the study sites on four field trips based on methods given by Hedberg (1993), Martin (1995) and Cotton (1996). Accordingly, semi-structured interviewees, observations and guide field walks with informants were employed to obtain indigenous knowledge about the medicinal plants of a local community twice.

3.5. Specimen collection and identification

Based on ethnobotanical information provided by informants medicinal plants were collected from wild and cultivated areas like homegardens. The local names, habits, habitats and associated indigenous plants knowledge were recorded. The collected specimens were numbered, pressed, and

dried for identification. The collected voucher specimens were taken to the National Herbarium (Addis Ababa University). The identification of samples was done from June 1 – November 30/ 2016 by comparison with illustrations and taxonomic keys and with the assistance of experts at National Herbarium. The identification was based on referring the works of different authors in various volumes of the flora of Ethiopia and Eritrea; Sebsebe Demissew (2003), Friis (1995), Tewolde Birhan Gebregiziabeher and Edwards (1997), Friis and White (2003) and Gilbert (1995).

3.6. Ethical Considerations

Data collection was performed after permission obtained from Akaki District administrative offices and the informants who were targeted for the research.

3.7. Data analysis

3.7.1. Descriptive statistics

Descriptive statistical methods, percentage and frequency were employed to analyze and summarize the data on medicinal plants and associated knowledge. The most useful information gathered on medicinal plants reported by local people: medicinal value, application, methods of preparation, route of application, ailment treated, part and habit used were analyzed through descriptive statistical analysis. Facilities in MS Excel spread sheet were utilized to make simple calculations, determine proportions and draw bar graphs.

3.7.2. Informant consensus

In order to evaluate the reliability of information during the interview, informants were contacted at least 2 times for the same ideas and the validity of the information was proved and recorded. Consequently, as the idea of the informant deviated from the original information, it was rejected from informant consensus factor since it considered as unreliable. Only the relevant ones were taken into account and statistically analyzed. The method was adopted from Alexiades (1996). Similarly, informant consensus factor was analyzed for one of plant attributes reported by informants and calculated as follows:

$$\mathrm{ICF} = \frac{\mathrm{Nur} - \mathrm{Nt}}{\mathrm{Nur} - 1}$$

Where: ICF = Informant Consensus Factor,

N_{ur} = number of use citation and

N_t = number of species used.

3.7.3. Preference ranking

Preference ranking was computed following Martin (1995) for six most important medicinal plants used in treating febrile illness. Eight key informants were selected to assess the degree of effectiveness of these six medicinal plants against the disease. The medicinal plant believed to be most effective to treat the illness has got the highest value (6), and the one with the least effective got the lowest value (1). The value of each species was summed up and the rank for each species was determined based on the total score. This helped to indicate the most effective medicinal plants used by the community to treat the disease.

3.7.4. Paired comparison

This analytical tool can be used for evaluating the degree of preferences or levels of importance of certain selected plants/parts of plants (Nemarundwe and Richards, 2002). Paired comparisons to indicate the efficacy and popularity of five medicinal plant species used to treat stomach ache were employed as described by Martin (1995). In such a way that seven key informants were randomly selected by flipping coins and allowed to show their responses independently for pairs of five traditional medicinal plants that are noted for treating the stomach. A list of the pairs of selected items with all possible combinations was made and sequence of the pairs and the order within each pair was randomized before every pair is presented to selected informants and their responses recorded, total value summarized and rank made based on the report of the informants.

3.7.5. Fidelity level

The fidelity level was calculated for those frequently reported diseases by informants in order to identify the most important medicinal plant species used to treat. It was calculated by using the formula: $FL = (N_i/N) \times 100$ where, N_i is the number of informants that claim use of a plant species to treat a particular disease and N is the number of informants that use the plant as a medicine to treat any given disease. It was designed to quantify the importance of the species for a particular given purpose (Alexiades, 1996).

4. Results and Discussion

4.1. Indigenous knowledge of local people on health concept

In the study area, health (“Fayyaa" in Afaan Oromoo) is perceived as special asset provided by God ("Waaqayyo"). The local people believe or understand as health problems are the cause for health upset caused either with organisms “ilbiisotaa” or can be sent from God as punishment “dheekkamsa Waaqayyoo” for wrong doings. They can also classify health problems, as those that can be treated and that cannot. From discussion made with elders, the community expressed the value of their health by using different proverbs. To cite few of these:

- “Dhibbi abbaan hin beekne fayyaadha” to indicate that a great wealth and gift is health.
- ‘‘Fayyaa fi farsootu fira qabaa.’’ meaning a healthy person and the common local drink ‘farsoo’ would have friends.
- “Fayyaan muka nyaata” to show that healthy man does everything, can even devour any available food.
- ‘‘Fayyaan culullee dha.’’ meaning a healthy person is like a kite. This is to say that a healthy person can do things he wants to do.

From these local sayings, it is clear that health is considered as a great asset, and a life engine for any aspect of life activities in the area.

4.2. Indigenous Beliefs on Medicinal Plants

The local people of Akaki district use their shared knowledge in order to manage health problems at home by using different medicinal plants found around them before looking for other options such as modern health services. For example, diseases such as: evil eye, evil spirit and febrile illness believed to be cured by treating with medicinal plants. Some healers connect the knowledge with spiritualism. One traditional healer among the informants believes that “the medicine works for him/her if and only if a patient pays him certain amount of money”. Then he will ask his spirit to make the medicine effective against that particular disease and only after that he will collect and give the medicine for the patient in need. This might indicate the secrecy of traditional medicinal

knowledge, not to let others know about its efficacy. Another healer expressed it as follows ‘‘if I collect the medicine myself it will serve as medicine; if another person harvests the parts on my behalf the medicine does not work as I share whatever I will get with my God”. This type of beliefs might probably help to restrict others not to join in this kind of business.

According to the traditional healers, extensive indigenous plant use knowledge was retained and transferred orally to selected young family members. Most of the traditional healers (80%) reported that the expansion of modern health institutions, schools, some environmental and cultural modifications had effects on the transfer of the indigenous knowledge to the next generations. As the discussions made with some selected healers, there were both healers transferring their knowledge and those didn’t do. This reveals that some of the traditional healers might have given much attention to the indigenous knowledge transfer while others kept the knowledge with them for the sake of secrecy.

4.3. Medicinal Plants of the Study Area

Despite the large scale environmental degradation and recurrent droughts, the study area still could maintain a good number (64) of medicinal plants and there are people who have the indigenous medicinal knowledge of the plants. In this study the 64 plant species distributed in 60 genera and 35 families were recorded to have medicinal values for 42 different health problems (Table 1).

Table 1: Distribution of collected species of plants in different families

Family	Number of species	Percent
Lamiaceae	8	12.50
Fabaceae	5	7.81
Poaceae	5	7.81
Solanaceae	4	6.25
Asteraceae	3	4.68
Rutaceae	3	4.68
Euphorbiaceae	3	4.68
Melianthaceae	2	3.12
Cucurbitaceae	2	3.12
Myrsinaceae	2	3.12
Malvaceae	2	3.12
Polygonaceae	2	3.12
The remaining 23 families	1	35.93

These plant species were used to treat human and livestock ailments, 48 (75%) for human and 16 (25%) for livestock were reported respectively (Appendices 4 and 5). Among them, 46 (71.8%) species were collected from wild vegetation, 13(20.3%) species from homegardens and five (7.8%) species from cultivated fields. This finding is a good indicator for the presence of more considerable diversity of plant species in the wild than in the homegardens of the study area. The majority of medicinal plant species were obtained from wild and homegardens. The dominance of herbs is due to active ingredients availability to local people and their abundance in the area. This finding is in line with Endalew Amenu (2007) and Ermias Lulekal (2005) in which herbs were the dominant growth form of medicinal plants.

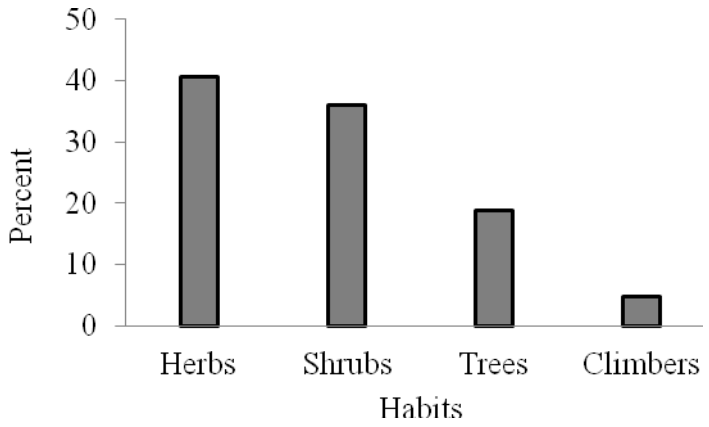

Figure 2: Habits of medicinal plants collected from Akaki District

Some of the medicinal plant species collected and identified in this study were also medicinally used in other parts of Ethiopia. For example, of the 48 medicinal plants collected from Akaki district, 26 of them were reported by Mekonnen Abebe (2013) from Gololcha district, Bale Zone, 20 by Behilu Etana (2010) from Goma district, Jimma Zone and 23 by Etana Tolasa (2007) from Gimbi district, Western Wellega as medicinally important to cure human and livestock ailments. Such widespread report on the use of these plants by different groups of societies in different areas could be attributed to different cultural groups which could validate the medicinal properties of these species. Of the 64 medicinal plants studied, 46 (71.8%) species were gathered from the wild and 13 (20.3%) species were collected from homegardens. This result indicates that the local communities mostly depend on medicinal plants collected from the wild than those from the homegardens. The number of medicinal plants obtained in homegardens is also promising. This finding agrees with Haile Yineger and Delenasaw Yewhalaw (2008); Endalew Amenu (2007); Etana Tolasa (2007).

4.3.1. Medicinal plants used to treat human ailments

The numbers of ethnomedicinally important plant species used to treat human ailments recorded in eight kebeles of Akaki District were 48. These plants belong to 44 genera and 24 families. Family Lamiaceae contributed eight species, Poaceae five, Asteraceae, Euphorbiaceae, Fabaceae, Rutaceae and Solanaceae comprised three species each, Myrsinaceae and Polygonaceae comprised two species each and the rest 15 families comprised one species each. Some of the medicinal plants

recorded are also used as remedies in other parts of Ethiopia. For example, Mekonnen Abebe (2013) has reported 23 of these plant species.

4.3.1.1. Sources of medicinal plants used to treat human ailments

From the medicinal plants that are used for human ailments, 33 species were collected from the wild vegetation, 11 species from homegardens and four species from cultivated areas. This indicated that the local people obtain medicinal plant species from wild vegetation than homegardens. This result agrees with Endalew Amenu (2007) and Ermias Lulekal (2005).

4.3.1.2. Habits of medicinal plants used to treat human ailments

This study revealed that medicinal plants used to treat human ailments constitute habits indicated in (Figure 3). This finding showed that the most represented growth forms of medicinal plants in the study area were herbs followed by shrubs. This could be due to the fact that naturally there are more herbs than woody plants and woody plants are overused because of their diverse use values. The analysis of the data also showed that the majority of medicinal plants in the homegardens were herbs. It might also indicate that the threats exist on other growth form particularly trees and shrubs. Similar findings were also reported in earlier works in Ethiopia in which herbs were the dominant growth form for human health care (Endalew Amenu, 2007).

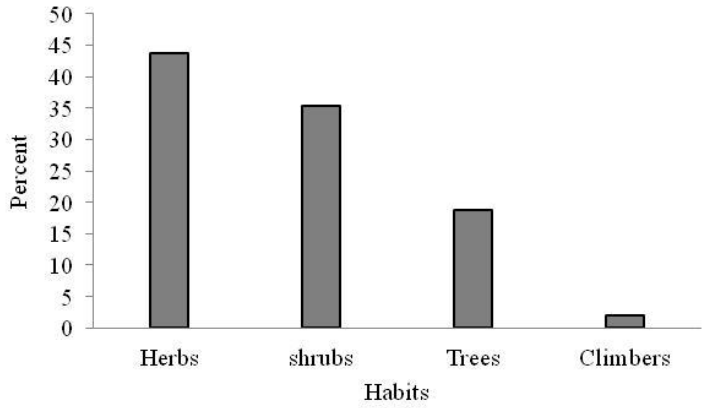

Figure 3: Habits of medicinal plants used for treatment of human ailment in Akaki District

4.3.1.3. Parts of medicinal plants used to treat human ailments

Leaves were the most reported plant parts in the preparation of remedies. The preference of leaves to other plant parts could be due to ease of preparation and the chemical constituents of leaf for the treatment of diseases. Remedy preparation that involves roots, bulbs, barks or stems have effects that pose a lasting danger to the continuity of an individual plant compared to leaves. In this study area, the fear of high threat of medicinal plants due to plant parts used for the purpose of medicine is minimal as leaves were the most harvested plant parts used in the area which has little effect on the survival of mother plant. This finding is in line with the results of other ethnomedicinal studies made by Endalew Amenu (2007); Etana Tolasa (2007); Haile Yineger and Delenasaw Yewhalaw (2007) who reported that leaves were the most cited plant parts used in remedy preparations.

Table 2: Plant parts used to treat human ailment in Akaki District

Parts used	Number of species	Percent
Leaves	26	54.16
Roots	9	18.75
Seeds	7	14.58
Fruits	2	4.16
Bulbs	2	4.16
Stems	1	2.08
Flowers	1	2.08

4.3.1.4 Methods of preparation of medicinal plants used to treat human ailments

Concerning the preparation of medicine for treatment of human ailments, the local community employs various methods of preparation of traditional medicines (Table 3). The preparations vary based on the type of disease treated and the actual site of the ailment.

Table 3: Ways of remedy preparation for human ailments

Preparation	Percentage
Crushing	31.25
Chewing	20.83
Squeezing	20.83
Pounding	12.50
Boiling	6.25
Cooking	2.08
Grinding	2.08
Splitting	2.08
Warming	2.08

4.3.1.5. Routes of administration of medicinal plants used to treat human ailments

Medicinal plants are applied through different routes of administration internally or externally. Internal applications include through mouth, eyes, nasal or through the ear canal. External applications involve dermal treatments. In the study area oral administration was the dominant route with 28 (58.33%) of the cases followed by dermal 10 (20.83%) and nasal five (10.41%) and others accounted the remaining percent (Figure 4). Similar results were obtained by Endalew Amenu (2007), Etana Tolasa (2007), Haile Yineger and Delenasaw Yewhalaw (2007) and Ermias Lulekal (2005).

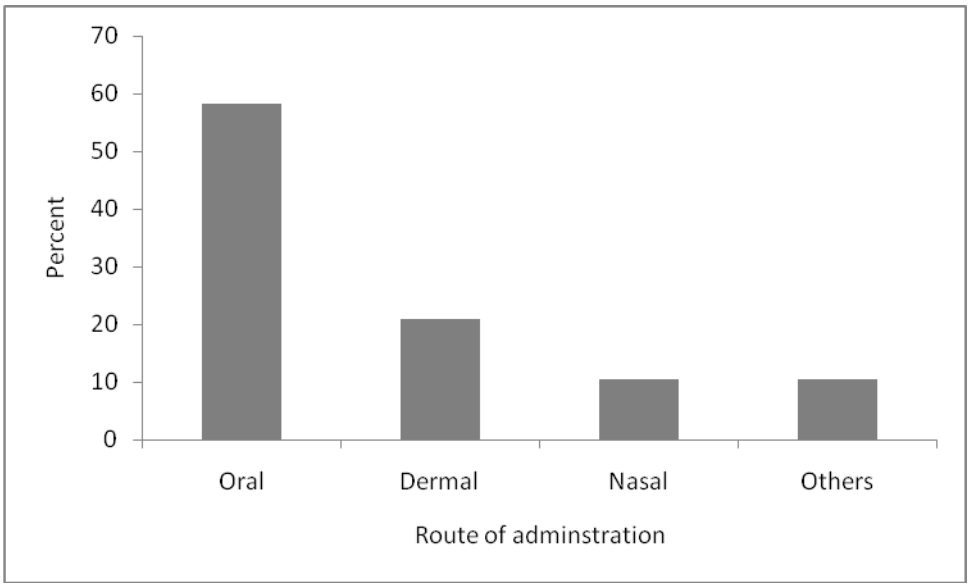

Figure 4: Route of administration of medicinal plants that used for human ailments in Akaki District

4.3.1.6. Dosage of medicinal plants used to treat human ailments

People of the study area used various units of measurements and the duration of administration to determine the dosage. Local units such as finger length (e.g., for bark, root, stem, pinch (e.g., for pounded plant medicine) and numbers (e.g., for leaves, seeds, fruits, bulbs and flowers) were used to estimate and fix the amount of medicine. Recovery from the disease, disappearance of the symptoms of the diseases, fading out of the disease sign and judgment of the healer to stop the treatment were some of the criteria used in determining duration in the administration of the dosage.

However, from the interview made during the study, it was found that there was disagreement among the healers concerning the dosage. For example, some informants suggested that three or four leaves of *Rhamnus prinoides* was used to treat tonsillitis, while some suggested that two or three leaves enough for the same problem. Still some others suggested that they applied the leaves number up to seven randomly without such measuring system. Although the full dose determination is varying from healer to healer, the dose given depends on age, physical strength and health conditions. The healers never administer treatments that are taken internally to pregnant women. This finding indicates us that there is lack of precision in the determination of doses in the area. According to Dawit Abebe and Ahadu Ayehu (1993), the real drawback in traditional medicine mostly arises from lack of precision in dosage.

4.3.1.7. Applications of medicinal plants used to treat human ailments

The prepared traditional medicines were applied in a number of methods as indicated in (Figure 5). Internal ailments were commonly treated by making the patient drink herbal preparations; tooth infections were treated by warming and put on the remedial plant part on the tooth surface; skin infections such as ringworm were treated by painting herbal preparations on an infected skin. Some plants do have different applications for different disease types. This preparation is used for different diseases by diverse application techniques. For instance, drinking squeezed leaves of *Ocimum lamiifolium* was used to treat cough while sniffing it used to treat febrile illness.

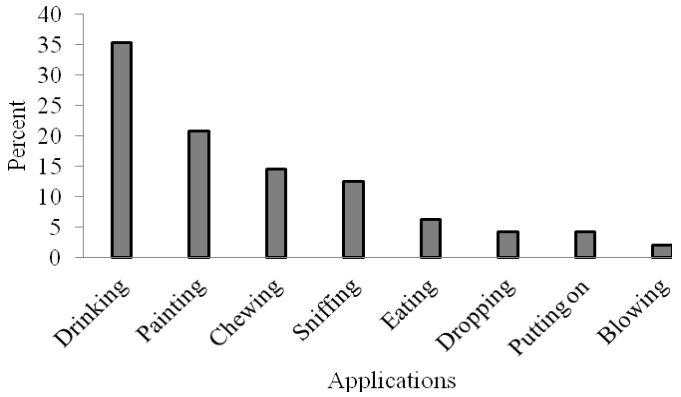

Figure 5: Graph showing ways of application of plant remedies in the treatment of human ailment treatment in the study area

4.3.1.8. Major human ailments and plant species used by local people

Though more than 33 different diseases of humans were recorded as human health problems that are treated by 52 plant species (Table 4), one species can treat a single disease or a number of diseases. The practitioners of the area commonly diagnose each health problem by an interview and visual inspection of the patient. This shows that certain diseases have got solution by traditional medicine in the study area compared to different investigations in Ethiopia. For example, Endalew Amenu (2007) reported 47 human diseases treated by 48 plant species and Etana Tolasa (2007) reported 77 plant species used to treat 49 diseases of humans. According to the informants the

largest number of species was used to treat febrile illness (15.38%) species, followed by stomach ache (9.61%) and tonsillitis (7.69%).

Table 4: Human diseases and number of plant species used

Disease treated	Total Species	Percent
Febrile illness	8	15.38
Stomach ache	5	9.61
Tonsillitis	4	7.69
Malaria	3	5.76
Cough	2	3.84
Rabies	2	3.84
Skin rash	2	3.84
Sudden sickness	2	3.84
Asthma	1	1.92
Ascaris	1	1.92
Wound	1	1.92
Broken bone	1	1.92
Common cold	1	1.92
Tenia pedis	1	1.92
Tooth ache	1	1.92
Diarrhoea	1	1.92
Ear disease	1	1.92
Tape worm	1	1.92
Scabies	1	1.92
Swelling part of body	1	1.92
Influenza	1	1.92
Cold	1	1.92
Heart problem	1	1.92
Hepatitis	1	1.92
Head ache	1	1.92
Skin cut	1	1.92
Snake bite	1	1.92
Ring worm	1	1.92
Evil eye	1	1.92

Disease treated	Total Species	Percent
Snake sight	1	1.92
Spider urine	1	1.92
Dandruff	1	1.92

4.3.2. Medicinal plants used to treat livestock health problems

From the medicinal plants collected from the study area, 16 species were used for the treatment of livestock ailments. They were grouped under16 genera and 15 families. Family Fabaceae comprised two species and the remaining 14 families comprised one species each (Appendix 6). Regarding their habitats; 12 (75%) species were collected from the wild, three (18.75%) species from homegardens and one (6.25%) species was collected from cultivated field. More species for livestock treatment were collected from the wild. This shows that there is less practice of planting livestock remedies in the homegardens by the local community. As most informants agree, even though the area has high number of livestock population, the local people do not have enough knowledge about ethnoveterinary medicinal plants compared to those used for treatment of human ailments. Mostly they use modern medicine from the veterinary clinics for the treatment of their livestock.

4.3.2.1. Habits, parts used, method of preparations, routes of administration and application of livestock medicinal plants

4.3.2.1.1. Habits of medicinal plants used to treat livestock ailments

The distribution of ethnoveterinary medicinal plants in different habit groups is comprising as indicated in (Figure 6). In this study shrubs like *Calpurnia aurea, Carissa spinarum, Dodonaea angustifolia, Gossypium barbadense, Osyris quadripartita* and *Rhus retinorrhoea;* herbs like *Aloe pubescens, Foeniculum vulgare, Linum usitatissimum, Nicotiana tabacum* and *Verbascum sinaiticum;* trees like *Acacia albida, Bersama abyssinica* and *Ficus vasta;* climber species like *Cucumis ficifolius* and *Stephania abyssinica* were used for the treatment of only livestock ailments

in the study area. This finding agrees with the work of Endalew Amenu (2007) in which shrubs were the dominant habits for the treatment of livestock ailments.

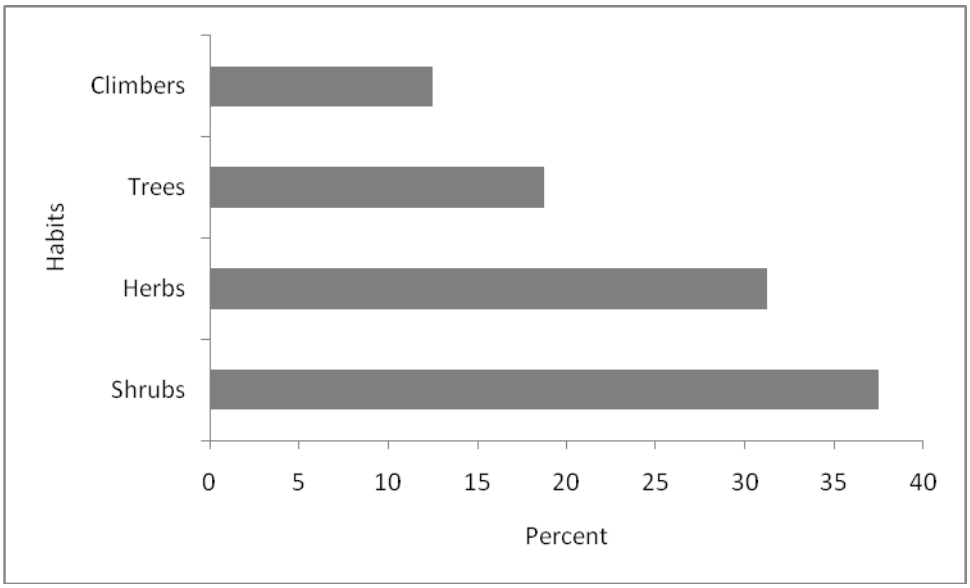

Figure 6: Distribution of habits of medicinal plants used for livestock disease treatment in Akaki

4.3.2.1.2. Plant parts of medicinal plants used to treat livestock ailments

The plant parts used for treatment of livestock ailments in the area were as indicated in (figure 7). Unlike that of human medicine, roots were the most harvested plant part of remedy preparation for livestock ailments. This agree with the report of Endalew Amenu (2007) in which roots were the major plant part used for livestock remedy preparation followed by leaf.

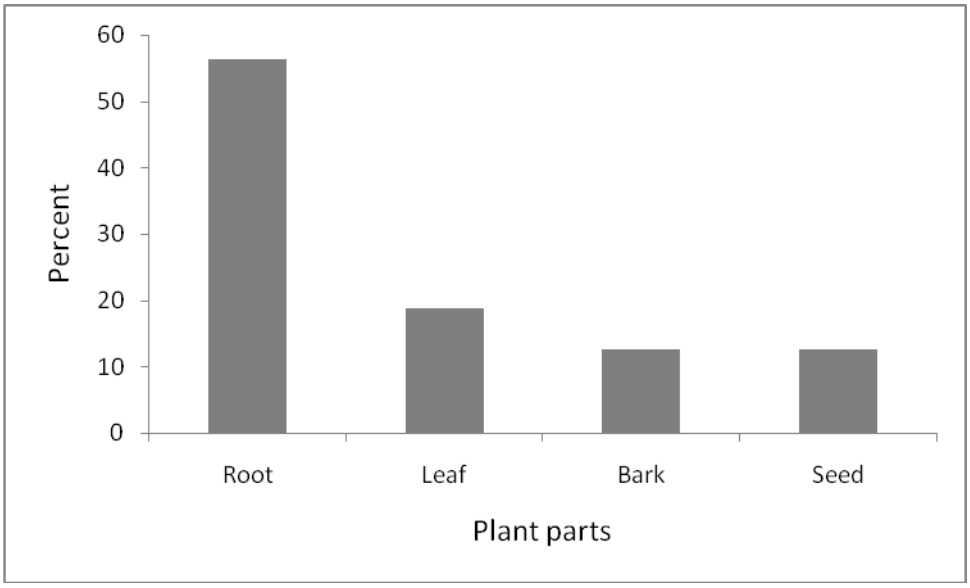

Figure 7: Percentage of medicinal plant parts used for livestock diseases treatment in the study area

4.3.2.1.3. Methods of preparations and routes of administration of medicinal plants used to treat livestock ailments

The local people used different forms of remedy preparations and applications to treat livestock diseases. The technique of preparations used involved crushing, pounding, chewing and warming. For instance, the roots of *Foeniculum vulgare* was crushed, mixed with little water and then added through the mouth by using bottle. This remedy was used to treat the common disease in the area known as retained urine. Harvested and crushed dried leaves of *Nicotiana tabacum* was used to treat cattle from leech disease by ejecting the leech from under side of tongue. Based on the nature of the ailment the remedies were applied through different routes as indicated in (Figure 8). This finding agrees with the work of Endalew Amenu (2007) and Teshale Sori *et al*., (2004).

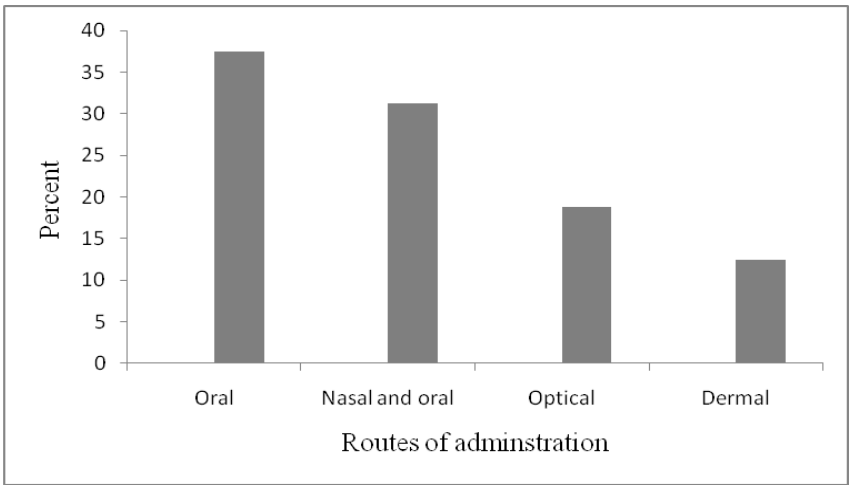

Figure 8: Percentage of route of medicinal plants administration for livestock ailments in the study area

4.3.2.1.4. Application of medicinal plants used to treat livestock ailments

Application of ethnoveternary medicinal plants is as indicated in (Figure 9). For example, if roots of *Dodonaea angustifolia* pounded and mixed with one litter of water given orally to cattle it can cure the animal from the Anthrax. Crushing and adding the leaves of *Calpurnia aurea* to the skin of cattle killed external parasites that are found on the body skin of the animal.

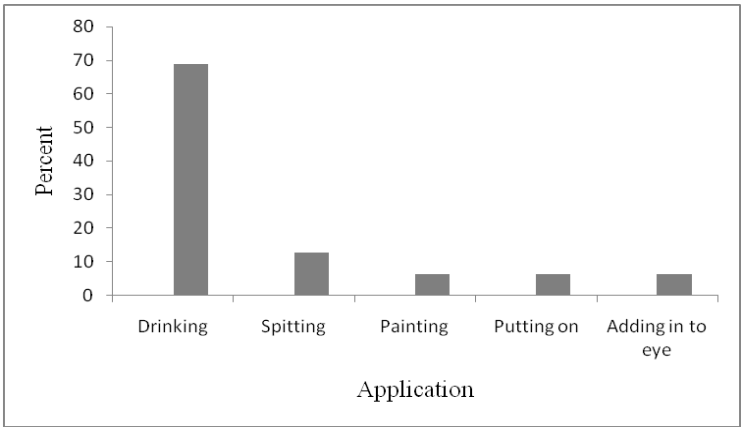

Figure 9: Application of livestock medicinal plants in the study area

4.3.2.1.5. Major livestock diseases and number of plant species used by local people

In comparison to human diseases livestock diseases were treated with a few number of plant species in the study area. A total of 12 livestock ailments were identified that treated by medicinal plants in the area. Common diseases affecting livestock health in the study area were indicated in (Table 5). This finding agrees with the work of Endalew Amenu (2007) that reported 34 livestock problems treated by 60 plant species.

Table 5: Common diseases of livestock and number of species used

Disease treated	Total species	Percent
Anthrax	6	31.57
Eye disease	3	15.78
Ecto-parasite	1	5.26
Leech	1	5.26
Wound	1	5.26
Retained urine	1	5.26
Retained placenta	1	5.26
Pasturolosis	1	5.26
Scabies	1	5.26
Diarrhoea	1	5.26
Stomach ache	1	5.26
Swollen neck	1	5.26

4.4. Informant consensus

The results of the study showed that some medicinal plants were popular than the others, in view of that, *Ocimum lamiifolium* took the lead where it was cited by 28 (70%) informants for its medicinal value for treating febrile illness. The popularity of this medicinal plant was due to the preference of the species for treating febrile illness in the community rather than going to modern medication for the disease and its easy access in the homegardens of many people. *Allium sativum, Indigofera tinctoria, Eucalyptus globules* and *Ocimum gratissimum were* cited as indicated in (Table 6), informants ranking 2nd, 3rd, 4th and 5th respectively. The latter four species were used for treating a

series of different health problems like asthma or malaria, sudden sickness, influenza and febrile illness respectively. Popularity of these medicinal plants was due to their easy access. As a result everybody should have got a chance to see the treatment and as a result the secrecy becomes low.

Table 6: List of Medicinal plants and the corresponding informants from 40 ones (Percentage ≥ 20)

Scientific name	Total informants	% total
Ocimum lamiifolium	28	70
Allium sativum	25	62.5
Indigofera tinctoria	24	60
Eucalyptus globules	22	55
Ocimum gratissimum	21	52.5
Croton macrostachyus	20	50
Lepidium sativum	20	50
Ruta chalepensis	20	50
Leonotis ocymifolia	18	45
Vernonia amygdalina	18	45
Acmella caulirhiza	17	42.5
Calpurnia aurea	16	40
Linum usitatissimum	16	40
Rhamnus prinoides	16	40
Foeniculum vulgare	15	37.5
Justicia schimperiana	8	20

4.5. Informant consensus factor (ICF)

In this study, all cited human and livestock diseases were grouped into 14 categories based on the site of occurrence 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 7). The informant consensus of medicinal plant usage resulted in ICF ranging from 0.58 to 0.93 per illness category. The factor provides a range of 0 to 1, where a high value acts as a good

indicator for a high rate of informant consensus. Those disease categories having high ICF value (e.g., > 0.67) may be the ones that commonly occur in the study area so that more number of people communicates on their remedy. According to Tilahun Teklehaymanot and Mirutse Giday (2007), medicinal plants that are presumed to be effective in treating a certain disease have higher ICF values. A high ICF value (value close to 1) indicates that the informants rely most on the same taxa to manage specific disease conditions, while a low value (close to 0) indicates that the informants disagree on the taxa to be used in the treatment of a given ailments.

Table 7: Informant consensus factor (ICF)

Category	Species	Use citation	ICF
External parasites	2	16	0.93
Ascaris and tape worm	2	14	0.92
Retained urine and retained placenta	2	12	0.90
Heart problem and hepatitis	2	10	0.88
Rabies and snake bite	3	15	0.85
Tooth ache and tonsillitis	4	19	0.83
Eye disease and ear disease	5	24	0.82
Asthma, common cold, cough and influenza	6	29	0.82
Malaria and leech	4	18	0.82
Swollen part of body and wound	4	16	0.80
Skin rash, *Tenia pedis*, scabies and ring worm	6	27	0.80
Febrile illness, sudden sickness and head ache	11	32	0.67
Broken bones	2	8	0.66
Stomach ache, diarrhea and anthrax	14	32	0.58

4.6. Preference ranking

When there are different species prescribed for the same health problem, people show preference of one over the others. Preference ranking of six medicinal plants that were reported for treating febrile illness was conducted after selecting eight key informants. The informants were asked to compare the given medicinal plants based on their efficacy and to give the highest number (6) for the medicinal plant which they thought most effective in treating febrile illness and the lowest

number (1) for the least effective plant in treating it. *Ocimum lamiifolium* scored 42, ranked first indicating that it is the most effective in treating febrile illness followed by *Ocimum gratissimum* and the least effective was *Leonotis ocymifolia* (Table 8).

Table 8: Preference ranking of medicinal plants used for treating febrile illness

Medicinal plants	Informants R_1—R_8								Total	Rank
	R1	R2	R3	R4	R5	R6	R7	R8		
Eucalyptus globules	3	4	2	1	2	3	2	3	20	3rd
Ocimum gratissimum	6	3	2	6	6	5	3	2	33	2nd
Ocimum lamiifolium	6	6	5	5	4	5	6	5	42	1st
Leonotis ocymifolia	2	1	1	2	1	2	1	3	13	6th
Lepidium sativum	1	2	4	3	3	1	1	1	16	5th
Echinops kebericho	4	1	4	2	2	1	2	2	18	4th

4.7. Paired comparison

A paired comparison made to determine the most preferred medicinal plants among the five species that were used to treat stomach ache in the study area, the responses of seven informants, showed that *Ruta chalepensis* ranked first followed by *Rumex nepalensis* **(** Table 9). Therefore, this result indicated that *Ruta chalepensis* was the most preferred while *Carica papaya* was the least favored over the other plant species cited in treating the disease.

Table 9: Paired comparisons of five medicinal plants used to treat stomach ache

Medicinal plants	Informants R_1- R_7							Total	Rank
	R_1	R_2	R_3	R_4	R_5	R_6	R_7		
Ruta chalepensis	2	2	4	4	4	3	3	22	1st
Ajuga integrifolia	1	1	0	0	1	2	3	8	4th
Cymbopogon citratus	3	2	4	3	3	1	2	18	3rd
Rumex nepalensis	4	3	3	2	4	2	3	21	2nd
Carica papaya	2	0	2	0	1	2	0	7	5th

4.8. Fidelity level index (Fl)

Fidelity level (FL) values were calculated for some commonly used medicinal plants against some commonly reported ailments: *Ocimum lamiifolium* (against febrile illness), *Allium sativum* (*against* cough), *Ruta chalepensis* (against stomach ache), *Croton macrostachyus* (against ring worm), *Vernonia amygdalina* (against malaria), *Acmella caulirhiza* (against tonsillitis) and *Justicia schimperiana* (against rabies) (Table 10). The medicinal plants that were widely used by the local people to treat one or very few ailments would have higher FL values than those that were less popular (Tilahun Teklehaymanot and Mirutse Giday, 2007). For example, *Ocimum lamiifolium* and *Allium sativum* were reported by many informants to treat febrile illness and cough and hence had 94.44% and 93.75% FL respectively. High FLs could also be indicator of efficacy of the reported plants to cure specific ailments.

Table 10: Fidelity index of some medicinal plants in Akaki District

Medicinal Plants	ailments treated	N_i	N	FL	FL%
Ocimum lamiifolium	Febrile illness	17	18	0.94	94.44
Allium sativum	Cough	15	16	0.93	93.75
Ruta chalepensis	Stomach ache	14	16	0.87	87.50
Croton macrostachyus	Ring worm	12	15	0.80	80.00
Vernonia amygdalina	Malaria	11	14	0.78	78.57
Acmella caulirhiza	Tonsillitis	10	13	0.76	76.92
Justicia schimperiana	Rabies	10	14	0.71	71.42

5. Threats to medicinal plants and conservation practices in the study area

The indigenous people of the study area need plants for their daily life activities. From the interview with informants various factors such as agricultural encroachment, firewood collection, charcoal production, drought, plant use for house and fence construction, overgrazing, urbanization, construction of Addis Ababa-Adama high way and construction of Addis Ababa-Djibouti rail way were recorded as the main threats to medicinal plants in Akaki district. Similar study by Fisseha Mesfin (2007) in Wonago District showed that there were different threats in medicinal plants such as agricultural expansion (24.4%), fire wood collection (18.8%) and others. Furthermore, the negative impact of deforestation on medicinal plants was also reported by Mirutse Giday (1999). The threat factors mentioned above in Akaki district were reported to be factors for the dwindling of natural vegetation in general and medicinal plants in particular. According to the traditional healers, nowadays searching of medicinal plants require long time and moving long distances even going to neighboring districts to collect the plants. Even some healers have started to grow some medicinal plants in their homegardens as a result of scarcity of plants in the wild. Generally, in connection to population growth the demand for wood material, agricultural expansion and urbanization are increased and thus have effects in threatening the medicinal plants and associated indigenous knowledge of the study area. The threats on the medicinal plants are among the major causes for the loss of the medicinal plants and ethnomedicinal knowledge. The other reasons for the loss of the knowledge on medicinal plants were modernization and refusal to practice or inherit the knowledge by new generation. As reported by the informants, the expansion of modern health institutions, schools, some environmental and cultural modifications were among the reasons for the loss of the knowledge on medicinal plants of the area. The study showed that Akaki District is relatively rich in medicinal plant diversity and associated indigenous knowledge. However, anthropogenic factors coupled with acculturation and very poor conservation efforts threaten medicinal plant survival in the area.

Moreover, depending on the age of the healers passing the knowledge of numerous species of ethnomedicinal plants use, management and ways of preparation are threatened. From discussion with informants, it was observed that the forefathers tell information only to one or few family members to use in secrecy. As a result, these old aged healers provide the knowledge with doubtful

accuracy to the learners. Many researches done in some parts of Ethiopia also revealed that many of the traditional healers reported to transfer their knowledge and use of ethnomedicinal plants orally to their favorite family members. Such transfer of indigenous knowledge is liable to erosion as it could vanish when knowledgeable elders die before the knowledge is transferred.

Even though there are many problems facing medicinal plants, the local people of the study area know the importance of conserving the plants under both ex-situ and in-situ conservation methods, though the actual effort on the ground is minimal. For instance, some people and the District Agriculture Office have started conserving the plants by in-situ method (in their natural habitat), live fences, road sides, different places of worship (churches and mosques), in their farm fields or farm margins. Some local people are also conserving medicinal plants by ex-situ method by planting them in their homegardens. In the study area some cultural believes and traditional practices that associated with traditional medicines are found to contribute much to the conservation of medicinal plants in their natural habitat.

6. Conclusion

Despite the environmental degradation and recurrent drought, medicinal plants are still playing significant role in the management of various human and livestock diseases in Akaki District and the District is relatively rich in medicinal plant diversity. Sixty four medicinal plants were recorded. Of these, 48 and 16 species were noted to treat human and livestock ailments respectively. The medicinal plant species collected and identified were largely from the wild (46 species were from the wild vegetation), 13 species from homegardens and five species from cultivated field areas. There are locally preferable treatments by traditional healers for some diseases in the area like febrile illness, cough, ringworm and tonsillitis. Overall, 42 ailments of human and livestock were reported to be treated by medicinal plants of the area. Herbs constituted the main source of traditional remedies followed by shrubs and tree species. Leaves were also found to be the most frequently used plant parts followed by roots for preparation of human and livestock remedies. Traditional medicine preparation mostly involved single plant and mainly by crushing the part used. Route of administration was mainly internal in which oral administration was the common route followed by dermal (external application).

The main threats to medicinal plants in the study area include: agricultural expansion, fire wood, charcoal production, drought, environmental degradation and construction. Threat to medicinal plants due to the utilization of these plants for medicinal purpose is negligible. Whereas threats that erode indigenous knowledge emanate from secrecy, oral based knowledge transfer, reluctance of young generation to learn the knowledge, unavailability of the species, influence of modern education and awareness factors are the major ones. Therefore, awareness rising should be made to enable the healers so as to avoid erosion of the indigenous knowledge and to ensure its sustainable use. Further biological studies should also be conducted on the reported medicinal plant species of the study area so as to utilize them in drug development.

7. Recommendations

Based on the results of the study, the following recommendations were forwarded.

- Identifying effective medicinal plants and encouraging the local people to grow them in homegardens, mixing with crops in farm lands and as live fences of their residential areas is crucial.
- Medicinal plants are central to the indigenous cultures and material needs. Therefore, formal and non-formal education systems should be designed to create positive attitude among the young by integrating in to the curricula about the traditional use of plants in general and medicinal plants in particular.
- Since some of the traditional healers might have given much attention to the indigenous knowledge transfer while others have little concern regarding the value of indigenous knowledge, some governmental and nongovernmental organizations should participate in awareness rising for healers to minimize the loss of indigenous knowledge.
- Recognitions and intellectual property rights should be given to traditional healers, either through certification or through organizing them at community or district level, which popularizes their indigenous knowledge and medicinal plants value.
- Attention should be given to standardization of measurement and hygiene of the traditional medicines made from plants by training both the healers and other members of the local community.
- The overall analysis reveals that major uses of medicinal plants for treatment of different diseases range from simple to fatal diseases. These traditional remedies indeed, need to be confirmed through scientific investigations to identify those that may provide alternatives for modern drugs.

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9. Appendices

Appendix 1. Medicinal plants used for human and livestock diseases, scientific name; family ; local name; habit; habitat; use; part used; mode of preparation; route of administration and disease treated.

Key: Habit (Ha); Habitat (Hab); Use (U); Part used (Pu); Tree (T); Herb (H); Shrub (Sh); Climber (Cl); Wild (W); Home garden (Hg); Cultivated (Cu); Human (Hu); Livestock (Li); Bark (Ba); Flower (F); Leaf (L); Bulb (Bu); Root (R); Seed (S) and Fruit (Fr) .

Scientific name	Family	Local name	Ha	Hab	U	Pu	Mode of preparation	Route of administration	Disease treated
Acacia albida Del.	Fabaceae	Garbii	T	W	Li	Ba	Chewing bark and spit in eye	Optical	Eye disease
Acmella caulirhiza Del.	Asteraceae	Gutichaa	H	W	Hu	F	Chew flower and hold on tonsil with tongue	Oral	Tonsillitis
Ajuga integrifolia Buch,Ham.	Lamiaceae	Harma guusa	H	W	Hu	L	Boil and drink half tea cup	Oral	Stomach ache
Allium sativum L.	Alliaceae	Qullubbi adii	H	Hg	Hu	Bu	Crush and soak to eat	Oral	Asthma and malaria
Aloe pubescens Reynolds.	Aloaceae	Hargiisa	H	W	Li	L	Warm and put on Swollen ox neck or donkey wound	Dermal	Swollen neck,wound
Bersama abyssinica Fresen.	Melianthaceae	Lolchiisaa	T	W	Li	R	Pound and spray into eyes	Optical	Eye problem
Calpurnia aurea (Ait.)Benth.	Fabaceae	Ceekaa	Sh	W	Li	L	Crush and scratch on skin.	Dermal	External parasite,Scabies

Capparis tomentosa Lam.	Capparidaceae	Harangamaa	Sh	W	Hu	R	Dry and Pound	Oral	Ascarisis,evil eye
Carica papaya L.	Caricaceae	Paappaayaa	T	Hg	Hu	L	Crush leaf and mix with water to drink before food	Oral	Stomach ache
Carissa spinarum L.	Apocynaceae	Hagamsa	Sh	W	Li	R	Crush	Oral and nasal	Anthrax
Citrus limon L.	Rutaceae	Loomii	Sh	Hg	Hu	Fr	Squeeze	Oral	Common cold
Clausena anisata (Willd.)Benth.	Rutaceae	Ulumaayii	Sh	W	Hu	L	Crush	Dermal	Skin rash
Crinum abyssinicum L.	Amaryllidaceae	Shunkurtii waraabechaa	H	W	Hu	Bu	Crush	Dermal	Scabies
Croton macrostachyus Del.	Euphorbiaceae	Bakkannisa	T	W	Hu	L	Squeeze and rub	Dermal	Ring worm, Dandruff
Cucumis ficifolius A.Rich.	Cucurbitaceae	Hiddii hoolootoo	Cl	W	Li	R	Crush with root of *Foniculum Vulgare*	Oral	Anthrax
Cymbopogon citratus L.	Poaceae	Xajjisaara	H	Hg	Hu	L	Squeeze and drink with *Ruta chalepensis*	Oral	Stomach ache
Cynodon dactylon (L.) Prers	Poaceae	Coqorsa	H	W	Hu	L	Chew and spit on swollen part	Dermal	Swelling body (snake sight)
Dodonaea angustifolia L.f	Sapindaceae	Eticha	Sh	W	Li	R	Dry and pound	Oral and nasal	Anthrax
Echinops kebericho Mesfin	Asteraceae	Qarabichoo	H	W	Hu	R	Crush and smoke	Nasal	Febrile Illness
Embelia schimperi Vatke	Myrsinaceae	Haanquu	Sh	W	Hu	S	Dry and crush	Oral	Tape worm

Eucalyptus globules Labill.	Myrtaceae	Barzaafii adii	T	Cu	Hu	L	Boil	Nasal	Febrile Illness and Influenza
Euphorbia lathyris L.	Euphorbiaceae	Hadaamii	T	W	Hu	Fr	Chew	Oral	Heart problem
Euphorbia tirucalli L.	Euphorbiaceae	Qincibii	Sh	W	Hu	L	Split	Dermal	Skin disease
Ficus vasta Forssk.	Moraceae	Qilxuu	T	W	Li	Ba	Crush and add to boiled water	Oral	Diarrhea
Foeniculum vulgare Mill.	Apiaceae	Insilaalee	H	Hg	Li	R	Crush	Oral	Retained urine
Gossypium barbadense L.	Malvaceae	Jirbii	Sh	Hg	Li	S	Chew and spit into eye	Optical	Eye disease
Hordeum vulgare L.	*Poaceae*	Garbuu	H	Cu	Hu	S	Crush and eat its porridge	Oral	Broken bones
Indigofera tinctoria L.	Fabaceae	Dingetagna	H	W	Hu	R	Chew	Oral	Sudden sickness
Juniperus procera L.	Cuppressaceae	Gattiraa	T	W	Hu	S	3-4 solution drops of pounded dry seed is added into ear.	Auditorial	Ear disease
Justicia schimperiana (Hochst.ex.Nees) T. Andres	Acanthaceae	Dhummuugaa	Sh	W	Hu	R	Pound	Oral	Rabies
Lagenaria siceraria (Mol.) Standl.	Cucurbitaceae	Araddoo(Buqqee)	Cl	W	Hu	L	Squeeze	Oral	Malaria
Leonotis ocymifolia (Burm.f.) Iwarsson	Lamiaceae	Bokkolluu	Sh	W	Hu	L	Squeeze	Nasal	Febrile Illness
Lepidium sativum L.	Brassicaceae	Feecoo	H	W	Hu	S	Grind	Oral and nasal	Febrile Illness

Linum usitatissimum L	Lineaceae	Talbaa	H	Cu	Li	S	Pound	Oral	Retained placenta
Lycopersicon esculentum Mill.	Solanaceae	Timaatimii	H	Hg	Hu	L	Crush and rub against the skin	Dermal	Skin rash
Maesa lanceolata Forssk.	Myrsinaceae	Abayi	Sh	W	Hu	L	Crush and squeeze to drink	Oral	Rabies
Melia azedarach L.	Meliaceae	Nim	T	Hg	Hu	S	Pound	Oral	Malaria
Nicotiana tabacum L.	Solanaceae	Tamboo	H	Hg	Li	L	Crush	Oral and nasal	Leech
Ocimum basilicum L.	Lamiaceae	Bassobilaa	H	Hg	Hu	L	Chewing and swallowing fresh leaf during feeling pain	Oral	Sudden sickness
Ocimum gratissimum L.	Lamiaceae	Baalcabbii	Sh	W	Hu	L	Crush and Squeeze	Oral dermal and nasal	Febrile Illness
Ocimum lamiifolium Hochst.Ex. Benth.	Lamiaceae	Damakase	Sh	Hg	Hu	L	Squeeze	Oral and nasal	Febrileillnes s and cough
Olea europaea L. ssp. *cuspidata (*Wall. ex G.Don*)*	Oleaceae	Ejersa	T	W	Hu	St	Warm and hold on teeth	Oral	Tooth ache
Osyris quadripartita Decn.	Santalaceae	Waatoo	Sh	W	Li	R	Dry and pound	Oral and nasal	Anthrax, Pasturolosis
Otostegia integrifolia Decn.	Lamiaceae	Xunjitii	Sh	W	Hu	L	Chew	Oral	Tonsillitis
Pavonia urens Cav.	Malvaceae	Maxxannee	H	W	Hu	L	Squeeze	Nasal and dermal	Febrile Illness
Phytolacca dodecandra L'Herit	Phytolaccaceae	Handoodee	Sh	W	Hu	R	Crush	Oral	Hepatitis

Plantago lanceolata L.	Plantaginaceae	Qorxobbii	H	W	Hu	L	Squeeze	Dermal	Skin cut
Plectranthus punctatus L.	Lamiaceae	Adha dabbasee	H	W	Hu	L	Crushed and sniffed	Nasal	Head ache
Rhamnus prinoides L 'Herit.	Rhamnaceae	Geshoo	Sh	Hg	Hu	L	Chew and spit into mouth of children	Oral	Tonsillitis
Rhus retinorrhoea Krauss	Ancardaceae	Dabaluuccaa	Sh	W	Li	R	Dry and pound	Oral and nasal	Anthrax, Pasturolosis
Rumex nepalensis Spreng.	Polygonaceae	Shuultii	H	W	Hu	R	Chew	Oral	Stomach ache
Rumex nervosus Vahl	Polygonaceae	Dhangaggoo	Sh	W	Hu	R	Pound	Oral	Snake bite
Ruta chalepensis L.	Rutaceae	Xeenaaddami	H	Hg	Hu	L	Squeeze and drink with *Cymbopogon Citratus*	Oral	Stomach ache
Satureja abyssinica (Benth.) Briq	Lamiaceae	Xoosanyii	H	W	Hu	L	Boil and drink its hot decoction	Oral	Cough
Schinus molle L.	Anacardiaceae	Qundoo Barbaree	T	W	Hu	L	chewing and swallowing the leaves.	Oral	Tonsillitis
Snowdenia polystachya (Fresen.) Pilg.	Poaceae	Manjii	H	W	Hu	L	Crush and squeeze	Dermal	Tenia Pedis
Solanum dasyphyllum Schumach.	Solanaceae	Hiddi Hongorcaa	Sh.	W	Hu	R	Crush	Oral	Diarrhea
Stephania abyssinica (Dillon.and A.Rich.)Walp.	Menispermaceae	Kalaalaa(bala anddoo)	Cl	W	Li	R	Crush and boil	Oral	Anthrax
Tamarindus indica L.	Fabaceae	Erbaa (misrichii)	T	W	Hu	L	Squeeze	Dermal	Wound

Triticum aestivum L.	Poaceae	Qamadii	H	Cu	Hu	S	Chew and put the bolus on swollen part	Dermal	Swelling, spider urine
Verbascum sinaiticum Benth	Scrophulariaceae	Gurra harree	H	W	Li	R	Crush	Oral	Stomach ache
Vernonia amygdalina Del.	Asteraceae	Eebicha	Sh	W	Hu	L	Crush	Oral	Malaria
Vicia faba L.	Fabaceae	Baqela	H	Cu	Hu	S	Cook and blow in its hot vapour	Oral	Cough
Withania somnifera (L.) Dunal in DC.	Solanaceae	Wahallee	Sh	W	Hu	R	Pound and dry to burn	Nasal	Febrile Illness and cold

Appendix 2: List of human diseases treated by medicinal plants in the study area

No	Local name (Afaan Oromoo)	English name
1	Arsassee	Tonsillitis
2	Asimii	Asthma
3	Bowwoo	Head ache
4	Budaa	Evil eye
5	Busaa	Malaria
6	Buutii	Snake sight
7	Cabiinsa lafee	Broken bone
8	Ciniinnaa garaa	Stomach ache
9	Cittoo	Scabies
10	Dhiitaha	Swelling
11	Dhibee gurraa	Ear disease
12	Dhibee ilkaanii	Tooth ache
13	Dhibee laphee	Heart disease
14	Dhukkuba saree	Rabies
15	Dhukkuba sinbiraa	Hepatitis
16	Dingatanyaa	Sudden sickness
17	Fincaan sharariitii	Spider urine
18	Baarolee	Dandruff
19	Baarolee	Tenia pedis
20	Garaa kaasaa	Diarrhoea
21	Hidaa bofaa	Snake bite
22	Koosoo	Tape worm
23	Maagaa	Ascaris
24	Madaa	Wound
25	Madaa mataa	Head sore(skin disease)
26	Muraa gogaa	Skin cut

No	Local name (Afaan Oromoo)	English name
27	Qorra	Cold
28	Qufaa	Influenza
29	Qufaa	Common cold
30	Robbii	Ring worm
31	Rukuttaa	Fibril illness
32	Shiffee	Skin rash
33	Ukaa	Cough

Appendix 3: List of livestock diseases treated by medicinal plants in the study area

No	Local name(Afaan Oromoo)	English name
1	Abbaa sangaa	Anthrax
2	Cinii	Ecto-parasite
3	Ciniinnaa garaa	Stomach ache
4	Cittoo	Scabies
5	Dhiitaha gateettii qotiyyoo	Shoulder swelling
6	Dhukkuba ijaa	Eye disease
7	Dhunaandhula	Leech
8	Fincaan dhoowwaa	Urine retaintion
9	Garaa kaasaa	Diarrhoea
10	Gororsaa	Pasturolosis
11	Hafiinsa dil'uu	Retained placenta
12	Madaa harree	Donkey wound

Appendix 4: List of medicinal plants used for treating only human ailments in the study area; with scientific name, family, local name, ailment treated and collection no

Scientific name	Family	Local name	Ailment treated	Coll no.
Acmella caulirhiza Del.	Asteraceae	Gutichaa	Tonsillitis	KT 23
Ajuga integrifolia Buch-Ham.	Lamiaceae	Harma guusa	Stomach ache	KT 51
Allium sativum L.	Alliaceae	Qullubbi adii	Asthma and malaria	KT 22
Capparis tomentosa Lam.	Capparidaceae	Harangamaa	Ascarisis,evil eye	KT 72
Carica papaya L.	Caricaceae	Paappaayaa	Stomach ache	KT 65
Citrus limon L.	Rutaceae	Loomii	Common cold	KT 66
Clausena anisata (Willd.) Benth.	Rutaceae	Ulumaayii	Skin rash	KT 57
Crinum abyssinicum L.	Amaryllidaceae	Shunkurtii waraabechaa	Scabies	KT 39
Croton macrostachyus Del.	Euphorbiaceae	Bakkannisa	Ring worm, Dandruff	KT 18
Cymbopogon citratus L.	Poaceae	Xajjisaara	Stomach ache	KT 50
Cynodon dactylon (L.) Prers	Poaceae	Coqorsa	snake sight	KT 31
Echinops kebericho Mesfin	Asteraceae	Qarabichoo	Febrile Illness	KT 25
Embelia schimperi Vatke	Myrsinaceae	Haanquu	Tape worm	KT 58
Eucalyptus globules Labill.	Myrtaceae	Barzaafii adii	Febrile illness and Influenza	KT 30
Euphorbia lathryis L.	Euphorbiaceae	Hadaamii	Heart problem	KT 32
Euphorbia tirucalli L.	Euphorbiaceae	Qincibii	Skin disease	KT 64
Hordeum vulgare L.	Poaceae	Garbuu	Broken bones	KT 67
Indigofera tinctoria L.	Fabaceae	Dingetagna	Sudden sickness	KT 52
Juniperus procera L.	Cuppressaceae	Gattiraa	Ear disease	KT 68
Justicia schimperiana (Hochst.ex.Nees) T. Andres	Acanthaceae	Dhummuugaa	Rabies	KT 11
Lagenaria siceraria (Mol.) Standl.	Cucurbitaceae	Buqqee	Malaria	KT 12
Leonotis ocymifolia (Burm.f.) Iwarsson	Lamiaceae	Bokkolluu	Febrile Illness	KT 16
Lepidium sativum L.	Brassicaceae	Feecoo	Febrile Illness	KT 46

Scientific name	Family	Local name	Ailment treated	Coll no.
Lycopersicon esculentum Mill.	Solanaceae	Timaatimii	Skin rash	KT 69
Maesa lanceolata Forssk.	Myrsinaceae	Abbayyii	Rabies	KT 63
Melia azedarach L.	Meliaceae	Nim	Malaria	KT 49
Ocimum basilicum L.	Lamiaceae	Bassobilaa	Sudden sickness	KT 70
Ocimum gratissimum L.	Lamiaceae	Baalcabbii	Febrile Illness	KT 24
Ocimum lamiifolium Hochst.ex. Benth.	Lamiaceae	Damaakasee	Febrile Illness and cough	KT 15
Olea europaea L. ssp. *Cuspidate (*Wall. ex.Don*)*	Oleaceae	Ejersa	Tooth ache	KT 40
Otostegia integrifolia Benth.	Lamiaceae	Xunjitii	Tonsillitis	KT 36
Pavonia urens Cav.	Malvaceae	Maxxannee	Febrile Illness	KT 45
Phytolacca dodecandra L'Herit.	Phytolaccaceae	Handoodee	Hepatitis	KT 48
Plantago lanceolata L.	Plantaginaceae	Qorxobbii	Skin cut	KT 61
Plectranthus punctatus L.	Lamiaceae	Adha dabbasee	Head ache	KT 55
Rhamnus prinoides L.Herit.	Rhamnaceae	Geshoo	Tonsillitis	KT 35
Rumex nepalensis Spreng.	Polygonaceae	Shuultii	Stomach ache	KT 34
Rumex nervosus Vahl	Polygonaceae	Dhangaggoo	Snake bite	KT 53
Ruta chalepensis L.	Rutaceae	Xeenaaddami	Stomach ache	KT 73
Satureja abyssinica (Benth.) Briq	Lamiaceae	Xoosanyii	Cough	KT 27
Schinus molle L.	Anacardiaceae	Qundoo barbaree	Tonsillitis	KT 62
Snowdenia polystachya (Fresen.) Pilg.	Poaceae	Manjii	Tenia pedis	KT 13
Solanum dasyphyllum Schumach.	Solanaceae	Hiddi hongorcaa	Diarrhea	KT 54
Tamarindus indica L.	Fabaceae	misrichii	Wound	KT 26
Triticum aestivum L.	Poaceae	Qamadii	Swelling,spider urine	KT 38
Vernonia amygdalina Del.	Asteraceae	Eebicha	Malaria	KT 10
Vicia faba L.	Fabaceae	Baqelaa	Cough	KT 37
Withania somnifera (L.) Dunal.	Solanaceae	Wahallee	Febrile Illness and cold	KT 17

Appendix 5: List of medicinal plants used for treating only livestock ailments in the study area; with scientific name, family, local name, ailment treated and collection no

Scientific name	Family	Local name	Ailment treated	Coll no.
Acacia albida Del.	Fabaceae	Garbii	Eye disease	KT 19
Aloe pubescens Reynolds.	Aloaceae	Hargiisa	Swollen neck, wound	KT 71
Bersama abyssinica Fresen.	Melianthaceae	Lolchiisaa	Eye problem	KT 56
Calpurnia aurea (Ait.) Benth.	Fabaceae	Ceekaa	External parasite, Scabies	KT 14
Carissa spinarum L.	Apocynaceae	Hagamsa	Anthrax	KT 44
Cucumis ficifolius A.Rich.	Cucurbitaceae	Hiddii hoolootoo	Anthrax	KT 28
Dodonaea angustifolia L.f	Sapindaceae	Eticha	Anthrax	KT 41
Ficus vasta Forssk.	Moraceae	Qilxuu	Diarrhea	KT 33
Foeniculum vulgare Mill.	Apiaceae	Insilaalee	Retained urine	KT 47
Gossypium barbadense L.	Malvaceae	Jirbii	Eye disease	KT 20
Linum usitatissimum L	Lineaceae	Talbaa	Retained placenta	KT 59
Nicotiana tabacum L.	Solanaceae	Tamboo	Leech	KT 60
Osyris quadripartita Decn.	Santalaceae	Waatoo	Anthrax, Pasturolosis	KT 42
Rhus retinorrhoea Oliv.	Ancardaceae	Dabaluuccaa	Anthrax, Pasturolosis	KT 43
Stephania abyssinica (Dillon.and A.Rich.)Walp.	Menispermaceae	Kalaalaa	Anthrax	KT 29
Verbascum sinaiticum Benth.	Scrophulariaceae	Gurra harree	Stomach ache	KT 21

Appendix 6.Checklist of Questions or Items used as a Basis for semi-structured Interviews for collecting ethnomedicinal information

1. Name of the respondent----------sex M--------, F-------
   Kebele----------occupation----------age----------
2. What are the main human diseases in your Kebele?
3. What are the main livestock diseases?
4. How do you control these diseases?
5. How do you treat human health problems?
6. How do you treat live stock problems?
7. Which plants do you use for treating those particular diseases?
8. Local name(s) of the plants?
9. Plant parts used: Root/stem/root bark/leaves/flowers/ fruit/seed/whole plant. Others----------
10. Used alone or mixed with other materials----------
11. Preparation for medicinal use: pounded/crushed/crushed and powdered/ extract with
    Cold water /boiled/juice: other----------
12. Doses?
13. Does the dose differ among males, females, children, elders?
14. How do you preserve traditional medicines?
15. Are there restrictions /taboos in collecting medicinal plants?
16. Are there threats to those medicinal plants?
17. How do you conserve traditional medicinal plants?
18. How is the knowledge of traditional medicine passed to younger generation?
19. How dose modernizations interfere with traditional medicine application and use?

----------Thank you----------

Appendix7: List of informants contacted in the ethnobotanical study (Keys; with* are key Informants and with $^{+}$ are traditional healers)

S. no	Name	Sex	Age	Kebele	Occupation
1	Abebe Fikadu	M	30	Abbeyi Sllto	Forester
2	Abebe Mulatu	M	40	Yerer Necho	Farmer
3	Abebech Gemechu	F	40	Kombolcha	House wife
4	Abera Hordofa	M	75	Koftu	Farmer
5	Alemu Hailu	M	54	Kombolcha	Farmer
6	Bekele Bedada	M	51	Gale Koticha	Farmer
7	Birbirsa Dabi*$^{+}$	M	70	Abbeyi Silto	Farmer
8	Biru Bedane	M	55	Yerer Necho	Farmer
9	Bogale Alemu*$^{+}$	M	63	Gimashe	Farmer
10	Dinku Debele*$^{+}$	M	50	Oda Nabe	Carpenter
11	Fayisa Urgecha	M	70	Koftu	Farmer
12	Fikire Hailemariam	M	75	Kombolcha	Farmer
13	Geletu Tola*$^{+}$	M	77	Yere Necho	Farmer
14	Gemechu Fayisa	M	70	Oda Nabe	Farmer
15	Gemechu Yadesa	M	42	Gale Koticha	Farmer
16	Getachew Belayneh	M	70	Insilale Fincha	Farmer
17	Gosa Bira	M	45	Abbeyi Silto	Forest guard
18	Hailu Gurara*$^{+}$	M	65	Insilale Fincha	Farmer
19	Hayele Dabi	M	50	Gimashe	Merchant
20	Iftu Abdi	F	66	Yerer Necho	House wife
21	Jemberu Bedane	M	60	Oda Nabe	Farmer
22	Kajela Adare*$^{+}$	M	72	Yerer Necho	Farmer
23	Kore Tullu	F	48	Insilale Fincha	House wife

S. no	Name	Sex	Age	Kebele	Occupation
24	Korme Dadi*+	M	50	Yerer Necho	Farmer
25	Kuba Regasa	F	40	Gale Koticha	House wife
26	Lali Lema	M	50	Gale Koticha	Farmer
27	Leta Simimu	F	49	Yerer Necho	House wife
28	Masresha Legese	M	51	Gimashe	Merchant
29	Meti Eda'e	F	62	Kombolcha	House wife
30	Mulatu Jima*+	M	80	Gimashe	Farmer
31	Sharo Senbetu*+	M	64	Gale Koticha	Farmer
32	Sisay Kebede	M	37	Oda Nebe	Farmer
33	Teshome Mekonnin	M	50	Oda Nebe	Farmer
34	Tullu Midakso	M	65	Koftu	Farmer
35	Wondifra Mulugeta*+	M	35	Oda Nebe	Farmer
36	Wondimu Alemu	M	49	Insilale Fincha	Farmer
37	Workinesh Sharo	F	50	Yerer Necho	House wife
38	Worku Gobana	M	50	Insilale Fincha	Forest guard
39	Yirdachew Eda'e	M	49	Gimashe	School worker
40	Zebenay Gebre	F	60	Gale Koticha	House wife

Declaration

I, the undersigned, declare that this thesis is my original work and has not been presented for a degree in any other universities.

Name: Kebede Tirfesa

Signature_____

Date _____

This thesis has been submitted for examination with my approval as a University advisor:

Dr. Dereje Denu

Signature_____

Date _____

Mr.Tamene Belude

Signature_____

Date _____