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Medicinal plants used by the Ayehu-Woreda communities, Awi Zone, Amhara Regional State, Ethiopia: Threats and conservation methods.

By: Yohannes Menberu

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Addis Ababa University, Department of Zoological Sciences

Addis Ababa, Ethiopia

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A Thesis Submitted to the Department of Zoological Sciences in Partial Fulfillment of the Master of Science in Biology Requirements

Addis Ababa University, Department of Zoological Sciences

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GRADUATE PROGRAMMES

DECLARATION

This is to confirm that Yohannes Menberu Tsehaye's thesis, entitled: Medicinal plants used by the Ayehu- Woreda communities in the Awi Zone, Amhara Regional State, Ethiopia: Threats and conservation methods and submitted in fulfillment of the criteria for the Master of Science in Biology degree complies with University norms and fulfills recognized standards for originality and quality.

NAMES AND SIGNATURES OF THE EXAMINING BOARD:

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ABSTRACT

Medicinal plants used by the Ayehu- Woreda communities, Awi Zone, Amhara Regional State, Ethiopia: Threats and conservation methods.

Yohannes Menberu Tsehaye MSc Thesis

Addis Ababa University, September 2021

Ethiopia has a long history of employing traditional medicinal plants to treat a wide range of human and Livestock illnesses. The present study on medicinal plants was conducted to document local, plant-based medicinal knowledge of communities, conservation methods and the threats affecting these medicinal plants in Ayehu- Guagusa Woreda, Amhara Regional State Eastern Ethiopia. A total of 54 informants (aged between 20-80) were selected so as to provide information on medicinal plant use from 8 sampled kebeles. Of these, 6 male key informants were selected purposively based on recommendations obtained from elders and also younger members of the communities. Other informants (28 males and 20 females) were selected randomly by lottery method. Semi structured interviews, field observations, group discussions, and a guided field walk were used to collect data. Preference ranking, direct matrix ranking, and the informant consensus factor were utilized to analyze the data .Also, fidelity level calculations were run so as to assess the importance of a given medicinal plant for the intended Purpose. A total of 50 different medicinal plant species collected and identified.42 species (84%) were used to treat human illnesses, 5 species (10%) were used to cure livestock illnesses, and the remaining 3 species (6%) were used to treat both human and livestock diseases. From the total medicinal plant species, 16 ((34.04%), most of them 0f 6 (34.04%), were herbs, and least of them 2 ((29.79%were species of climbers. The most commonly used plant parts were 35 (33.98%) leaves followed by 30(29.13%) roots. The most commonly used method of preparation was crushing (50 %), squeezing (13.75%), and chewing (12.5%) of the different plant parts. Oral administration 60.6 % followed by dermal administration was the popular route of administration reported (22.7 %).most of the medicinal plants (46%) have been harvested from the wild, the effort of local people to conserve medicinal plants is limited. To relieve the rapid loss of medicinal plants, associated indigenous knowledge, we recommend that urgent measures be taken by the concerned government institutions. Strategic approach should include systematic awareness creation through schools, local institutions as well as through accepted leaders of the communities. Awareness creation should be supported by concrete conservation and development activities by way of technical support for selecting, domesticating, propagating and cultivating threatened medicinal plants.

Key words/Phrases: Ailments, Fidelity level, Indigenous knowledge, Informant consensus factor, Traditional medicinal plants.

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LIST OF ACRONYMS

WHO=World Health Organization

AAU=Addis Abeba University

AGWAO=Ayehu-Guagusa Woreda Agricultural Office

AGWHO=Ayehu-Guagusa Woreda Health Office

AGWCO=Ayehu-Guagusa Woreda Communication Office

AGWAO=Ayehu-Guagusa Woreda Administrative Office

TMPs=Traditional Medicinal plants

IK=Indigenous Knowledge

ICF=Informant Consensus Factor

FL=Fidelity Level

1. INTRODUCTION

1.1. Background

A discussion of human life on this planet would not be complete without a look at the role of plants, because plants have been an integral part of human society since the start of civilization (Shah, 2005). The principal uses of plants include sources of food and fodder, construction of houses, clothes and musical instruments, medicine and cosmetics, textiles, rituals, as well as diverse ecological roles (Pie, 1999). Human beings have always been very dependent on plants. Many people around the world use traditional medicines for everyday healthcare, with as many as 80% relying on it in some countries (Hamilton, 2008). The geographical diversity of Ethiopia has favored different habitats and vegetation types, that medicinal plants are also a component of these ecosystems. This geographical diversity pairs with multiplicity of ethnic groups with complex cultural diversity make the country the home for high diversity of traditional knowledge, practice and uses of traditional medicine (ZemedeAsfaw, 200 1; Miruste Gidey, 2001). As a result, Ethiopia is thought to be home to roughly 6500 higher plant species, with about 12% of these being unique (UNEP, 1995).

Ethiopia has a long history of treating a wide range of diseases with traditional medicinal plants (Fasil Kibebew, 2001). The majority of Ethiopian people depend on indigenous remedies for a numerous socio-cultural and economic reasons (Slikkerveer, 1990; MesfinTaddesse et al., 2005). Culturally linked traditions, trust on traditional medicine, and relatively cheaper are the major reasons that in Ethiopia medicinal plants are demanded. Endashaw Bekele, 2007). Traditional medicinal practices are widespread in Ethiopia, where traditional medicine serves as the primary healthcare system for around 80% of the human population and 90% of cattle (DawitAbebe, 2001).Indigenous knowledge about traditional medicinal herbs is passed down orally from generation to generation in impoverished nations like Ethiopia. Because there is a discrepancy between the document and the country's medicinal plant records.Moreover, indigenous knowledge of the use of traditional medicinal plants as treatments is being lost as a result of migration from rural to urban regions, industrialization, and the expansion of modern education, and specialist healers failing to pass on their knowledge to the next generation.Furthermore, human impacts such as deforestation, agricultural expansion, overexploitation, and population growth have virtually eliminated wild flora and woodlands in most parts of the country, resulting in a clear loss of biodiversity (FentahunMengistu and Herbert, 2010).

Ethiopia is a country with a diverse range of climate and ecological conditions, as well as a large variety of wildlife and plants (Pankhurst 2001) .The country has a diverse spectrum of potentially beneficial medicinal plants, far more so than in many other parts of the world (DawitAbebe, 1986).

Traditional medicine continues to be used by the majority of Ethiopians. As the gap between supply and demand has continued to expand, the problem of guaranteeing the equitable distribution of contemporary healthcare has become increasingly critical (SebsebeDemissew and ErmiasDagne, 2001).There is widespread interest in utilizing traditional medicine's acquired knowledge, and as a result, research is being conducted in many nations with the goal of boosting traditional medicine's use for the benefit of the human population.In order to examine medicinal plants and traditional knowledge, the current study was started in Ayehu Guagusa Woreda, Awi zone, Amhara region, Ethiopia. According to Pankhurst (2001), detailed information on the medicinal plant can only be gathered when research is conducted in places where botanical exploration has been limited or non-existent. As a result, the goal of this study was to conduct botanical research on medicinal plants in the Ayehu-Guagusa Woreda of the Awi regional state.

1.2. Research questions

The primary goal of this study is to look at the traditional uses and medicines of several plants in Ayehu-Guagusa Woreda communities. The study's findings will attempt to respond to the following major study questions.

1. What are the most serious or prevalent human and livestock health issues in the study area?

2. In the study area, which medicinally important plant species are used by local people to cure their own health problems and livestock ailments?

3. How are local medicinal herbs gathered, processed, and used?

4. What are the most often used plant parts? What form will it take and how will it be done?

5. How do communities ensure medicinal plants' long-term viability?

1.3. Statement of the problem

Due to a lack of adequate conservation and management, plant communities and natural vegetation are disappearing, creating detrimental effects on medicinal plants gathered from wild regions. This loss must be controlled. The richness of wild plant species and medicinal plant species is reduced when invasive plant species replace native vegetation.

Not only is it necessary to solve these difficulties, but it is also necessary to conduct scientific research and documentation on traditional plant species and associated indigenous knowledge about their use and management.

1.4. Objectives of the study

1.4. 1.General objective

The general objective of this study was to investigate and document the traditional medicinal plants used by the Ayehu-Guagusa Woreda communities and to evaluate the extent of the threats posed by over-exploitation.

1.4.2. Specific objectives

- To harvest, identify, and document traditional medicinal herbs used by the Ayehu-Guagusa Woreda indigenous people to treat human and cattle diseases;
- To assess the present status of medicinal plants and indigenous knowledge among the people in the study areas.
- To document medicinal plant parts, preparation methods, and administration methods, as well as to assess community knowledge regarding medicinal plant use, threats, and conservation.

2. LITERATURE REVIEW

2.1. Traditional medicinal plants

Traditional medicine (TMPs) is defined by the World Health Organization (WHO, 2008) as the sum total of all knowledge and practices, whether explicable or not, used in the diagnosis, prevention, and elimination of physical, mental, and social imbalances, based solely on practical experience and observation passed down from generation to generation, whether or not it is expressed vocally or in writing (Yilma et al., 1996) cited in (Fassil, 2001), folk medicine, ethno medicine, or indigenous medicine are all terms used to describe this type of health care.

According to Fassil Kibebew (2001), traditional medicines constitute the only source of health treatment for around 75-90 percent of the world's rural population (excluding western countries). This is due not only to poverty, traditional systems are more culturally acceptable and address psychological requirements in ways that contemporary medicine does not. According to the World Health Organization (WHO), working with medical practitioners is especially beneficial in developing and adopting relevant strategies into the planning and budgeting framework for health care provision in most developing countries and indigenous communities.

According to Jansen (1981), this situation will continue as long as modern medicine fails to meet the continent's health-care needs. The significance and importance of this health-care system will not diminish in the future since it is both culturally viable and likely to remain economical, whereas modern health-care services are both limited and costly (WHO, 1998). Indigenous traditional medicinal practices were largely based on private practice, i.e. private agreement between consenting parties, and traditional practice knowledge was passed down through oral folklore in most cases (AsfawDebela et al., 1999). Traditional healers' secrets of information are less vulnerable to tampering, but they are also less accessible to the general population (DawitAbebe, 1986). The knowledge, on the other hand, is dynamic, since practitioners strive to broaden their horizons by exchanging limited information with one another (DawitAbebe, 1986; Abbink, 1993).

Traditional medicine is preferred over contemporary medicine for a number of reasons, according to Konno (2004), including ease of access, efficacy of therapy, and low cost of health services. As several authors have pointed out, traditional medicine has drawbacks (Amare Getahun, 1976; Sofowora, 1982; DawitAbebe, 1986).The lack of precision and standardization is a disadvantage for the traditional health-care system's recognition. Another disadvantage of traditional medicine is the lack of precise dosage, which can lead to toxicity (DawitAbebe, 1986).The measurements used to estimate dosage are not standardized and are dependent on the patient's age and physical appearance, the sociocultural explanation for the sickness, the diagnosis, and the herbalist's experience (DawitAbebe and Ahdu Ayehu,1993; Pank, 1995).

2.2. Common Ethiopian medicinal herbs

Ethiopians have been using traditional medicine for a long time. Professional healers, knowledgeable elders, and/or ordinary people have passed down indigenous knowledge mostly in oral form from one generation to the next (Jansen, 1981). Around 80% of Ethiopians are still reliant on ethno medicine, which entails the use of herbs (DawitAbebe and EstifanosHagos, 1991).

It's impossible to say when medicine originally arrived in Ethiopia, but the development of healing techniques follows the path of illness.Traditional medicine practitioners frequently treat illness with herbs, spiritual healing, bone-setting, and minor surgical operations. Ethiopian traditional medicine is advanced and diverse, with considerable ethnic diversity.In Ethiopia, most traditional medical methods rely on a disease explanation that includes both "mystical and natural" causes of illness, as well as a holistic approach to therapy (BishawMengistu, 1991).With the opening of Menelik II Hospital in Addis Ababa in 1906, the first government-run modern health care was established. However, Ethiopia's overall growth and development of modern health care has been hindered, with coverage of less than 50% of the population to date (SeifuTesfaye, 2004). As a result, traditional medicine and its practitioners continue to be used by the vast majority of rural inhabitants.

Despite the fact that Western medicine is becoming more widely used in Ethiopia, Ethiopians still prefer traditional medicine. Traditional medical services are concentrated in metropolitan regions and have failed to keep up with population growth, leaving health care out of reach for the majority of Ethiopians living in the country. Traditional medicine is used as a primary source of health care by up to 80% of the Ethiopian population because it is culturally embedded, accessible, and economical (Pankhurst, 1990; Kebede Deribe et al., 2006) .Furthermore, Western medicine has shifted its focus to

preventative measures, while people seeking curative procedures continue to turn to indigenous medicine as their major source of health care (Pankhurst, 1990).Traditional medicine has an impact on Ethiopian migrant populations, as well. Traditional herbs, medical equipment, and practitioners are widely available in nations with significant Ethiopian immigrant populations (Papadopoulos, 2002). Traditional medicine is still widely practiced in Ethiopia, and its acceptance, accessibility, and popularity are unquestionable, with about 90% of the population relying on it for health care.Medicinal plants is used by up to 80% of people in Africa to meet their health-care needs (WHO, 2000). Ethiopia is a complex country with many different languages, customs, and beliefs, all of which have contributed to the people's traditional knowledge and practices, which include, among other things, the usage of medicinal herbs (MirutseGiday and Gobana Amani, 2003).Plants have long been used in Ethiopia as a source of medicine to cure a variety of diseases.

According to a research published in 1993, 80 % of Ethiopians still rely on traditional medicine for their health treatment (SeifuTesfaye, 2004).In Ethiopia, medicinal plants play an important role in the country's basic healthcare system (Shimelis et al., 2012). In Ethiopia, plant origin is stated in over 95% of traditional medicinal formulations (Sebsebe Demissew and Ermias Dagne, 1998).

People in the country are familiar with the therapeutic characteristics of numerous plants that are used to treat human and cattle problems because of the country's deep-rooted medicinal plant culture (Wabe et al., 2011).Despite the existence of an old medico-religious pharmacopeia of Ethiopian medicinal plants inscribed on parchments in the ancient Geez language (now the working language only in the Ethiopian Orthodox Tewahdo Church) have documented some of the indigenous knowledge on medicinal plant use, but the most of the documentation have been lost owing to damage, theft, and illicit sale to foreign plant collectors (Fassil Kibebew, 2001).

2.3. Human and livestock healthcare with medicinal plants

In Ethiopia, traditional medicines are used by around 80% of the human population and 90% of the cattle population (Ermias et al., 2008) ; (Haile et al., 2008); (Fisseha et al., 2009); (Gidey, 2010).Ethiopia has vast but largely untapped livestock potential; it is thought to have Africa's largest livestock population. According to the findings of the livestock survey, there are approximately 47.57 million cattle, 26.12 million sheep, 21.71 million goats, 1.78 million horses, 5.57 million donkeys, 0.38 million mules, and one million camels, as well as 39.6 million poultry (CSA, 2007) In Ethiopia, livestock production serves as a source of meat, milk, and eggs, as well as a source of draft power and

manure to support crop production in pastoral systems and as a major form of engagement in highland crop livestock production systems. It also serves multiple functions as a source of meat, milk, and eggs, as well as a source of draft power and manure to support crop production in highland crop livestock production systems. In Ethiopia, animal disease is still a major cause of poor livestock performance, resulting in a growing gap between supply and demand for livestock products (Teshale Sori et al., 2004). For generations, Ethiopians have treated livestock ailments with traditional veterinary techniques.

Plants make up the majority of the many medicinal ingredients used in traditional cattle treatment techniques. This is owing to a lack of veterinarian drugs and the high expense of the majority of drugs, which puts them out of reach for Ethiopian farmers and pastoralists (Mirutse Gidayand Gobana Amani, 2003).As a result of this and other comparable causes, Ethiopian livestock farmers have developed their own methods for keeping their animals healthy and productive by utilizing locally accessible materials, primarily plants.

2.4. Indigenous medicinal plant knowledge

Indigenous knowledge, according to Quanah (1998), is the accumulation of knowledge, rules, norms, abilities, and mental sets owned by local people in a certain location. Indigenous peoples all throughout the world have a unique understanding of the plant resources they rely on for food, medicine, and general usefulness, as well as significant botanical expertise (Martin, 1995). Aboriginal people from many locations have acquired their own unique understanding of plant resource usage, management, and conservation through millennia (Cotton, 1996). It is the culmination of many generations' worth of experiences, meticulous observations, and trial and error experimentation (Martin, 1995).

Indigenous knowledge (IK) on plant utilization is the result of many years of man's interaction with and selection of the most desired, vigorous, and successful plant available in the immediate area at the time. The necessity for a society's well-being is the ultimate motivator of millennia-old interactions and selection of the most successful medicinal plants, as well as the development of indigenous knowledge linked with their use.Traditional plant knowledge will be lost if there is no continuous cultural interaction, according to winter and McClatchey (2008). Traditional knowledge is influenced by the demographic, economic, sociopolitical, ecological, religious, and cultural factors that present in a society (Cetinkaya, 2009). The Ethiopian indigenous knowledge of traditional medicinal herbs,

which has been passed down for millennia, is now threatened by extinction, as it has been primarily kept in the memory of elderly people and passed down by word of mouth for consecutive generations (MirutseGiday and Tilahun Teklehymanot, 2013).

2.5. Threats to medicinal plants and how they can be conserved

2.5.1. Threats to traditional medicinal plants

Traditional medicine in Africa, especially Ethiopia, has experienced sustainability challenges (Ensermu Kelbessa, et al., 1992). The loss of medicinal plant species, ecosystems, and indigenous knowledge are the fundamental drivers of this problem. According to some studies (Mirutse Giday, 1999, Tesfaye Awas and Zemede Asfaw, 1999), the majority of medicinal plants used by Ethiopians are harvested from wild habitats, implying that the rate of loss of taxa with related indigenous knowledge and loss of widely occurring medicinal plant species is high. Throughout the world, people use various wild plant species for food, medicine, clothing, shelter, fuel, fiber, in come generation, and the fulfillment of cultural and spiritual requirements (ZemedeAsfaw, 2001).The principal causes of this problem are the extinction of medicinal plant species, the destruction of medicinal plant ecosystems, and the loss of indigenous knowledge.

According to certain surveys, the majority of Ethiopians' medicinal herbs are gathered from untamed areas (Mirutse Giday, 1999; Tesfaye Awas and Zemede Asfaw, 1999). As a result, the rate of loss of taxa with relevant indigenous knowledge and loss of widely distributed medicinal plant species has increased. Man-made and natural factors are both sources of dangers to medicinal plants. Population growth, energy consumption, urbanization, timber production, over harvesting, destructive harvesting, invasive species, commercialization, honey harvesting, degradation, agricultural development, and habitat devastation are all human-caused threats to medicinal plants. Natural disasters include droughts, bushfires, diseases, and insect outbreaks (Ensermu Kelbessa et al., 1992). As a result of the reasons described above, the problem manifests itself in Ayehu- Woreda, as it does elsewhere in Ethiopia.

2.5.2. Conservation of traditional medicinal plants

According to Dawit Abebe and Ahadu Ayehu, many curative cures incorporate roots, stems, and bark by effectively killing the plant during harvest (1993). To produce medicines, several plant parts are used; however, the root is the most usually used part.With no substitute, the plant's future supply is endangered due to widespread use of the root component for human and livestock feeding. According to Haile Yineger (2005), of the total plant components used to make medicines, root is the most widely used, accounting for 64 species (35.5%), followed by leaf, accounting for 47 species (25.97%), which has an impact on long-term utilization. In a broad sense, both in-situ and ex-situ procedures can be used for conservation. In-situ conservation refers to the preservation of species in their natural habitat. Several traditional medicinal plants must be kept in their natural habitat due to the difficulty of domestication and maintenance (ZemedeAsfaw, 2001). Furthermore, certain plants do not produce the appropriate number and quantity of active components in their natural habitats. Medicinal plants can also be preserved by ensuring and fostering their growth in designated areas, as has been done in the past (ZemedeAsfaw, 2001). This can be done in places of worship (churches, mosques, graveyards, etc.), scared grooves, farm margins, river banks, road sides, live fences of gardens and fields, According to ZemedeAsfaw, medicinal plants can be saved utilizing appropriate conservational processes in gene banks and botanical gardens (2001).

3. MATERIALS AND METHODS

3.1. The study area description

The research was conducted in Amhara Regional State of Ethiopia, in Awi zone, Ayehu-Guagusa Worda. Ayehu-Woreda belongs to the 12 Woredas of Awi zone Amhara Regional State. Azena is the administrative capital of Ayehu. Ayehu is bounded in east by Wenbeerma (West Gojam), in west Zigem, in south Assosa (Benshangule-Gumuze) in north Ankesha Woreda. The Woreda is located 138 km south from the capital of the Amhara Regional state, Bahir Dar and 27 km from the administrative zone. It is 468 km North of Addis Ababa, the capital city of Ethiopia. Its total area is about 60151 hectares and its elevation ranges from 1500-2800 meter. Topographically, Ayehu- Woreda is 70.8% plateau, 26% mountainous 2.2 % valleys, 0.1% swampy and 0.9 %

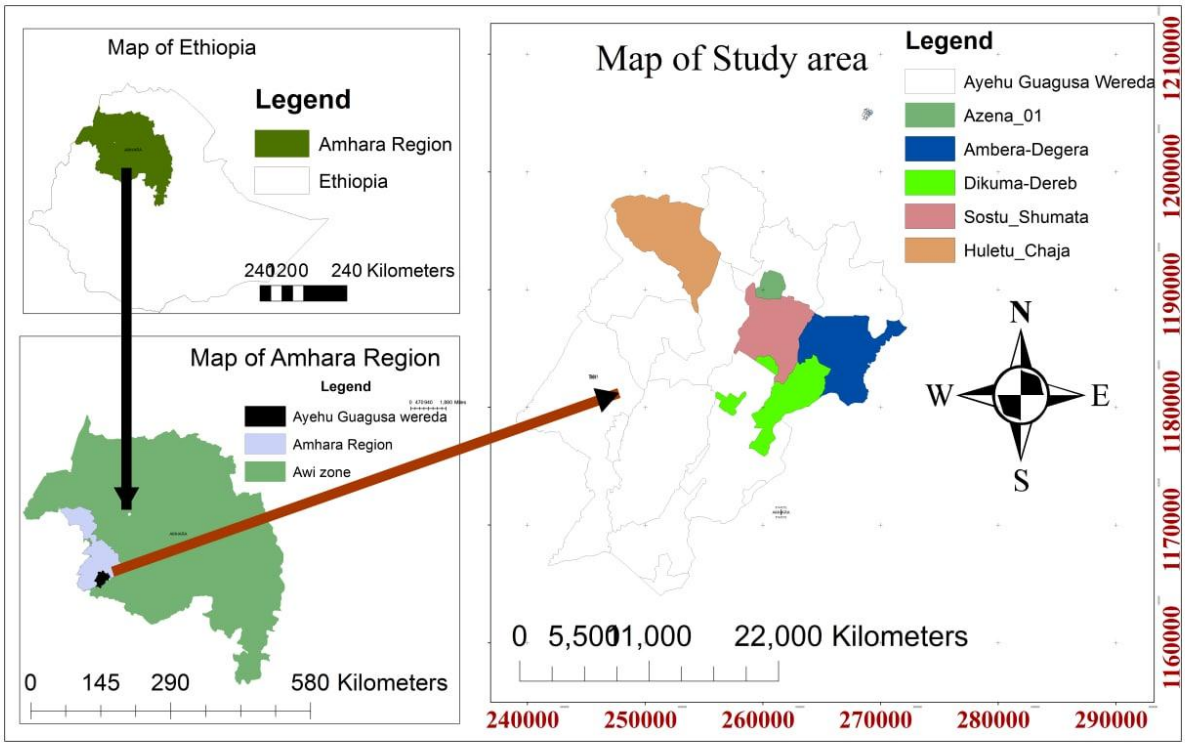

Figure 1. Map of Ethiopia, showing Amhara Region and the study district (Source: ArcGIS Arc Map)

As the Woreda Government Communication Affairs Bureau of 2011E.C (AWCO,2019) the land utilization availability is: 37200hectares for farming, 1591hectare covered by natural vegetation, 7388.55 hectares for irrigation, 13960hectares for grazing, 520 hectare covered by water bodies and 160 hectares swampy. The meteorological data taken from the district Communication Office (AWCO, 2019) indicates that the major

rainy seasons in the district include spring (May), summer (June-August) and autumn (September-October).The average annual rainfall of the district 1000-2000 mm, while the average annual temperature is about 15-200C. Ayehu-Guagusa Woreda has three major climatic zones. These are, WoinaDega 80%, Dega 10%, and kola 10% (AWAO 2019). Different species of plants are grown in these three different climatic zones.

3.2. Population

According to CSA 2007 E.C the total population number of the Woreda was 133783 .Out of this 64849 were males and 68934were female .From these 4547 male and 5873 female were living in the town. The remaining 60302male and 63061 female were living in the rural areas. The major ethnic compositions of the population found in the Woreda are 80%, Amhara 19.5% and 0.5% Gumiz. Awigna is the official language of both the District and the Administrative Zone. About 98% of the population is Orthodox Christians and the rest are Protestants and Muslims.

3.3. Agriculture

About 85% of the population is engaged in agriculture. In kola climatic zones most people depended on harvesting pepper but in Dega climatic zone the recent fashion is planting the invasive plant species such as, Acacia decurrens, and extracting charcoal (AGWAO, 2019).

3.4. Major farmed crops and vegetation

The vegetation of the study field consists of various trees, shrub and herbaceous species. Some of the common plant species include *Acacia abyssinica*, , *Juniperusprocera*, , *Acacia decurrens* . The shrub layer includes J*usticiaschimperiana*, *Olea europeae*, *Carissa spinarum, Calpurnia aurea, Vernonia* sp. etc. Most of the plants are found in and around protected areas, Church compounds and Grave yards. The other areas are highly degraded due to agricultural activities, overgrazing, and high demand of wood for construction, firewood and charcoal. Especially *Juniperusprocera, Cordia africana and Acacia pilispina* are cut and highly used for construction and other purposes. The common crops cultivated in the study filed include *Zea mays* (Maize), *Eragrostistef* (Teff), *Hordeum vulgare* (Barley), T*riticumaestivum* (Wheat*), Pisumsativum* (Field peas), *Sorghum spp*. *Guizotiaabyssinic*a (Nug), Brassica carinata (Gomenzer),re among the commonly cultivated crops in the study filed (AGWAO, 2019).

3.5. Soil

The three different dominant soil types such as red, dark brown and black were favored to grow various types of plants. The soil of the study area is dominated by dark brown soil which covers-53% and red and black soil cover 30% and 17% respectively (AGWAO, 2019).

3.6. Livestock

The number of livestock in the Woreda includes: cattle 40,156; sheep 9,521; goat 5,859; horse 3,193; donkey 3,552 and mules 504 .The Woredas cattle resources have yet to be fully utilized. Milk, beef, eggs, honey, and other goods are among their offerings .Milk, beef, eggs, honey, and other goods are among their offerings. Due to poor management, insufficient and low-quality feed supply, and the prevalence of various animal diseases, the contribution to the regional and national economies is minimal (AGWAO, 2019).

3.7. Human health

The numbers of health stations in the Woreda are; health centers 4, health extensions 20 and the total civil servants employed in these stations are male 125, female 165, and total 290. Sanitation, inadequate diet, lack of drinkable water, and poor physical condition of the houses are all linked to health concerns in Ayehu District, either directly or indirectly. Data obtained from Health Office of Ayehu District (2019) show the three common health problems in the District based on the number of local people who have visited health services are febrile, Acute upper respiratory and infections, Helminthiasis in 2018/19; Acute upper respiratory infections, diarrhea (Source; AGWHO, 2019).

3.8. Reconnaissance survey and selection of the study sites

Ayehu Woreda has total of 20 kebeles, reconnaissance survey was conducted from September to October 2019. Selection of informants was performed following Martin (1995) who indicated that when recording indigenous knowledge held by knowledgably traditional healers or by certain social groups the choice of key informant is crucial. A total of 54 informants (34 male and 20 female) were randomly selected by tossing of coin. From 5 site of Kebeles, 11 individual informants were selected from Dekuna-Derb, Azena 01, Huletu-Chaja, Ambera-Degera and 10 individuals from Sositu-Shomata, kebeles. Six key informants (males), were preferentially selected with the help of local administers, elders and other community members. Other 48 informants were selected randomly by lottery method from the local people of the study area. Age group of the informants consists of young (20-39), middle (40-49) and elders (50-80).

3.9. Data collection technique

3.9.1. Semi structured interview

Semi- structured interviews were prepared and used as guide (Appendix 1) following Martin (1995); Cotton (1996). Semi structured interview allowed the investigator to provide supplementary question when needed. The items in the questionnaire were first prepared in English based on review of related literature. Then they had been translated into local language. Most of the questions were focused on the availability, distribution and threats of medicinal plants in Ayehu-Guagusa Woreda. 54 respondents were selected for this interview since these could gave significant information for the investigator about the conservation, distribution threats of medicinal plants and information flow from elders to Youngers. Individual key informants were initially contacted (Appendix 2) to learn about the sorts of human and livestock ailments studied, the local names of the plants they use to cure diseases, diseases treated, part(s) of plants utilized, methods of gathering, and techniques of remedy production, path of administration of remedies, application of the remedies, dosage, side effects of the treatment, use of the plants other than medicine, types of threat and conservation problems.

3.9. 2. Group discussion

Intuition and experience, according to Martin (1995), are the best guides to informal ways of acquiring knowledge with the most knowledgeable ones who were suggested by respective kebele elders and administrators about the status of the distribution, threats and conservation attempt of traditional medicinal plants. The number of participants in group discussion in Dekuna-Derb 6 male informants were selected randomly by lottery method. They interacted face to face and actively discussed on the distribution, threats and conservation in order to share information about a topic.

3.9 .3. Field observation

Field observation was performed with the help of local guides and interviewed informants in the study area. Full notes on facts and information about the respondents, history of the traditional healers, history of the medicinal plants and other essential information based on the questions were recorded on site.

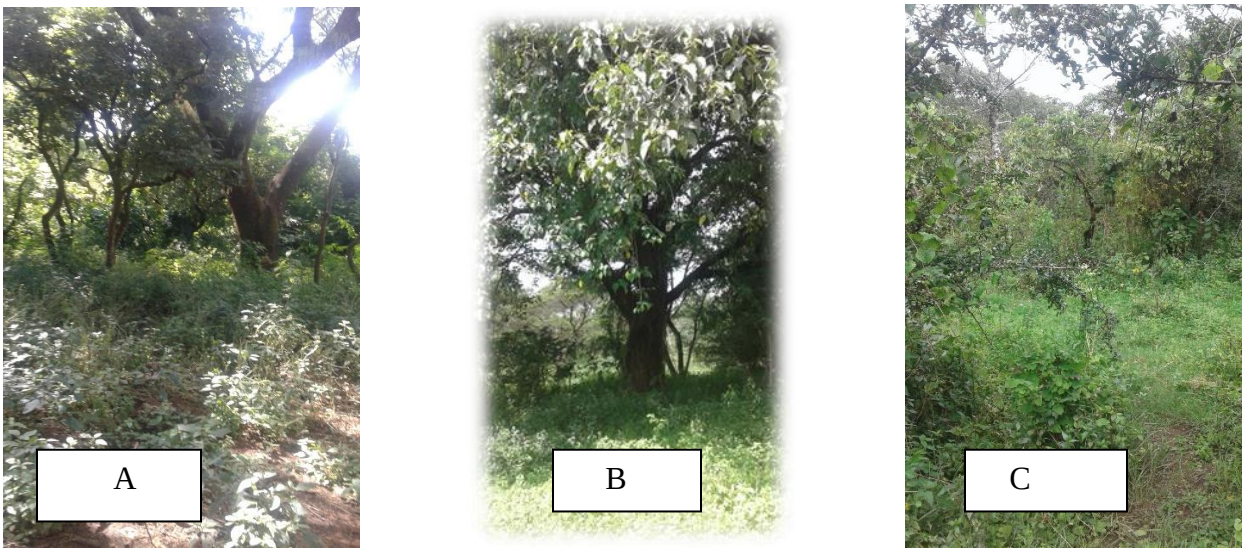

Figure 2. (A= Ambores forest, B= Ambera forest and C= Sositu forest)

[Photo courtesy by Yohannes Menberu, 2019]

3.9.4. Guided field walk

Guided field walk is a combination of observation and interview methods. In this method, the interviewer's guided the researcher from where the plants of interest were expected to be found.

3.10. Identification of medicinal plants

The available medicinal plants were recorded and identification of some common and well known species was made in the field including the local name, specific name and habit.

3.11. Data Analysis

3.11.1. Descriptive statistics

The study data was entered into micro soft Excel 2013 spread sheet and organized for statistical analysis. The percent and/or frequency of medicinal plant species, genera, and families, their habits, proportion of plant parts collected, manner of remedy preparation, and pathways of administration were all calculated using a descriptive statistical method.

3.11.1.1. Informant consensus factor

During the survey, informants were asked to mention (list) the kinds of plants found in the study area. The number of times a particular species mentioned by each informant was recorded. The informant consensus was

helpful to see how frequently a particular species was mentioned by and was helpful in analyzing that a particular plant mentioned by all informants is also the most widely used plant by the community. The informant consensus factor (ICF) was calculated for each category of condition to determine if the informants agreed on the claimed cure. The ICF was determined using the formula Nur -Nt/ = ICF (Nur -1). Where Nur is the number of individual plant use reports for a particular ailment category, and Nt is the total number of species used by all informants for this aliment category (Martin, 1995).It could be used to assess the information acquired during the group discussion.

3.11.1.2. Direct matrix ranking

Direct matrix ranking was conducted following Cotton (1996) for 6 multipurpose medicinal plants commonly reported by informants. Based on the relative benefits obtained from each plant, 6 key informants were preferentially selected and asked to give value to each attribute. The list of attributes included medicinal, FW-firewood, For-forage, Co-construction, Fu-furniture, Ch-charcoal, Fe-fence, Me-medicine. The average score for a direct matrix ranking of six medicinal plant species based on their general use values (5 = best, 4 = very good, 3 = good, 2 = less used, 1 = least used, and 0 = not used) . The scores were added in order to compare use values of medicinal plants and help to identify the main causes of over harvesting of the medicinal plants.

3.11.1.3. Preference ranking

Following Martin (1995), preference ranking was made for seven medicinal plants used to treat abdominal pain that was found to be the most frequently encountered disease in the study area and for which they have several alternative plants as readily. Six preferentially selected key informants were made to participate in this exercise. The informants were given the plants and asked to arrange the seven medicinal plants based on their personal preference of efficacy. The medicinal plant that was believed to be the most effective was given the highest value as 7, and the one with the least effectiveness received the lowest value as 1. Based on the total score of each species the rank was determined, and this helped to indicate the most effective medicinal plants used by the community to treat abdominal pain.

3.11.1 4.Fidelity level (FL)

For the most commonly reported diseases or conditions, the percentage of informants claiming the usage of a certain plant for the same principal purpose was determined using the equation below Alexiades (1996). FL (%) = NP/N×100 .Where NP is the number of informants that claim the use of a plant species to treat a particular disease, and N is the number of informants that use the plants as a medicine to treat any given disease.

4 .RESULTS

4.1. Medicinal plants in the study area

The study area has collected and documented a total of 50 species of medicinal plants used to treat various health problems. These plants were found to belong to 31 families. Out of these plants, 42 species (84 %) were noted to treat only human ailments while 5 species (10 %) are used to treat livestock ailments and 3 species (6%)were reported to be to treat both human and livestock ailments. In terms of species composition, family, Asteraceae contained 5 species, Fabaceae , Cucurbitaceae, Euphorbiaceae, Rutaceae&Rosaceae consisted 3 species each (Table 1).

Table 1.Distribution of collected species in different families

No.	Family	Number of plants	Percentageof plants (%)
1	Acanthaceae	1	2
2	Alliaceae	2	4
3	Amaranthaceae	1	2
4	Ancardiaceae	1	2
5	Apiaceae	1	2
6	Apocynacea	1	2
7	Arecaceae	1	2
8	Asteraceae	5	10
9	Brassicaceae	1	2
10	Caricaceae	1	2
11	Celasteraceae	1	2
12	Combretaceae	1	2
13	Crassulaceae	1	2

14	Cucurbitaceae	3	6
15	Euphorbiaceae	3	6
16	Fabaceae	3	6
17	Lamiceae	1	2
18	Linaceae	1	2
19	Moraceae	2	4
20	Myrsinaceae	1	2
21	Myrtaceae	1	2
22	Oleaceae	2	4
23	Phytolaccaeceae	1	2
24	Polygonaeceae	2	4
25	Ranunculaceae	1	2
26	Rhamnaceae	1	2
27	Rosaceae	3	6
28	Rubiaceae	1	2
29	Rutaceae	3	6
30	Solanaceae	2	4
31	Zingiberaceae	1	2

4.2. Medicinal plants used to treat human and livestock diseases

A total of 50 plant species in Ayehu -Woreda that were said to treat 47 various human and cattle illnesses. A total of 28 families were employed to treat human illnesses out of a total of 31 families and the rest families were used to treat livestock diseases .(Table 2).

Table 2.Medicinal plants used for human disease treatment

Family	No. of species	Percent
Alliaceae	1	2.38
Asteraceae	3	7.14
Rutaceae	3	7.14
Ranunculaceae	1	2.38
Rubiaceae	1	2.38
Apiaceae	1	2.38
Caricaceae	1	2.38
Cucurbitaceae	3	7.14
Euphorbiaceae	3	7.14
Combretaceae	1	2.38
Apiaceae	1	2.38
Solanaceae	1	2.38
Myrsinaceae	1	2.38
Myrtaceae	1	2.38
Rosaceae	3	7.14
Oleaceae	2	4.76

Acanthaceae	1	2.38
Crassulaceae	1	2.38
Linaceae	1	2.38
Celastraceae	1	2.38
Lamiceae	1	2.38
Arecaceae	1	2.38
Phytolaccaeceae	1	2.38
Polygonaeceae	2	4.76
Rhamnaceae	1	2.38
Ancardiaceae	1	2.38
Fabaceae	3	7.14
Zingiberaceae	1	2.38

Table 3.Medicinal plant used to treat livestock diseases

Family	No. of species	Percent
Alliaceae	1	20
Fabaceae	1	20
Asteraceae	1	20
Moraceae	1	20
Solanaceae	1	20

Table 4 .Medicinal plant used to treat both human and livestock diseases

Family	No. of species	Percent
Asteraceae	2	66.67
Brassicaceae	1	33.33

4.3. Medicinal plants used to treat human ailment only, livestock only and both human and livestock ailments

84 %of the 50 medicinal plants collected were used to cure human disease, 10% to treat livestock ailments, and 6% to treat both human and livestock ailments. (Table 5).

Table 5. Number of medicinal plants treat human, livestock and both human and livestock disease

Category	Number of medicinal plant	Percentage
Human	42	84
Livestock	5	10
Both	3	6
Total	50	100

4.4. Habitats of medicinal plants

The 46%of medicinal plant species were collected in the wild, with the remainder coming from agricultural fields, household gardens, and roadside. (Table 6). The fact that high number of medicinal plant species was obtained from wild suggests that; the wild environment is highly exploited for its medicinal plant resources hence needs prior conservation attention.

Table 6. Medicinal plant distribution in various ecosystems

Habitat type	No. of medicinal plants	Percentage
Agricultural field	13	26
Home garden	6	12
Road side	8	16
Wild	23	46
Total	50	100

4.5. Habits of medicinal plants

Herbs were the most commonly reported species (34.04%), followed by shrubs (31.91%), trees (29.79%), and climber species (29.79%). (Fig 3).

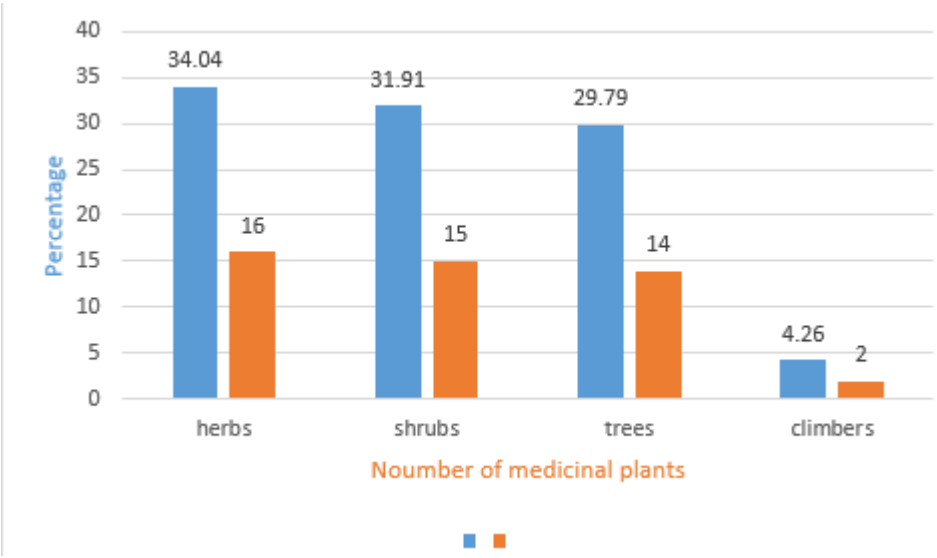

Figure 3. Medicinal plant habits for human and livestock use

4.6. Plant part(s) used for medicine

Respondents reported using various parts of medicinal plants for medicinal products during the study. As shown in (Table 7), leaves were the most commonly used plant component with 33.98% followed by roots with 29.13%.

Table 7. Plant parts used for traditional medicine preparations in Ayehu-Guagusa Woreda

Plant parts	Total responses	% of total
Leaves	35	33.98
Roots	30	29.13
Seeds	12	11.65
Fruits	6	5.83
Stems	5	4.85
Bulbs	4	3.88
Sap	5	4.85
Latex	2	1.94
Bark	1	0.97
Flower	2	1.94
Bud	1	0.97

4. 7.Preparation methods of remedies

Concerning the preparation of traditional medicine, the local people apply numerous ways of preparation of traditional medicines for human and livestock diseases .The technique of preparation is determined by the type of disease that is being treated. Crushing (50%) was the most common way of medicinal plant preparation, followed by squeezing (13.75%), chewing (12.5%), boiling (11.25%), soaking (5%), and roasting (3.75 %) roasting and crushing (2.5%) and chopping and boiling (1.25%) (Table 8).

Table 8.Preparation methods of herbal medicine reported by people of Ayehu-Guagusa Woreda

Forms of preparation	Total responses	% of total
Crushing	40	50
Squeezing	11	13.75
Chewing	10	12.5
Boiling	9	11.25
Soaking	4	5
Roasting	3	3.75
Roasting and crushing	2	2.5
Chopping and boiling	1	1.25

4. 8.Conditions of preparation of remedies

The finding showed that fresh plant material was utilized 40 (54%) of the was dried plant material was used 10 (13%), and either fresh or dried plant material was used 25 (33%) (Fig 4).

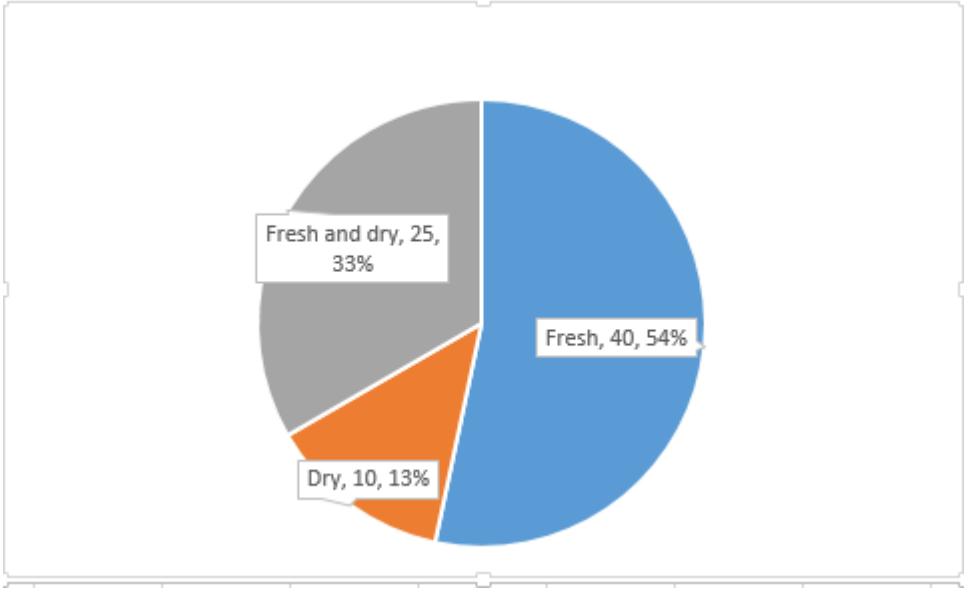

Figure 4. . Conditions of plant remedy preparation in Ayehu district

4.9. Dosage and route of administrations

The path of administration includes oral, dermal, nasal, ear canal and optical. From the reported route of Administration the highest use was through oral (60.60%) followed by dermal (22.73%) ((Fig 5).

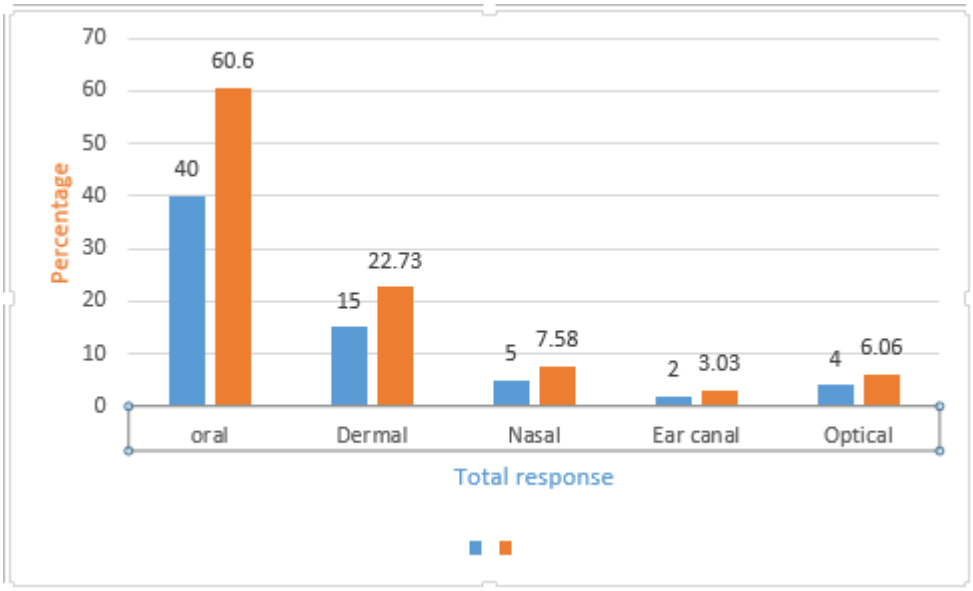

Figure 5.Path of plant remedy administration for human and livestock use

4.10. Ways of applications of plant remedies

Traditional medicines have been prepared in different ways, it includes drinking (32.28 %), painting (15.75%), eating (14.17 %), put on and tide (11.02 %), chewing (8.66 %), smoking (7.09 %), dropping (5.51 %) swallowing (3.94 %) (Table 9).

Table 9.Ways of application of plant remedies in human and livestock ailment treatment

Ways of Applications	Total Responses	Percentage (%)
Drinking	41	32.28
Painting	20	15.75
Eating	18	14.17
Put on and tie	14	11.02
Chewing	11	8.66
Smoking	9	7.09
Dropping	7	5.51
Swallowing	5	3.94

4.10.1 Informant consensus factor (ICF)

The diseases in the study area have been divided into different categories based on the location of the disease's occurrence, the disease's condition, and the disease's treatment similarity.The study's finding showed that diseases that were common in the research field had a higher informant consensus factor. It is also demonstrated that medicinal plants are beneficial in the treatment of certain ailments and well known by community members also have higher ICF values (Table 10).

Table 10. Informant Consensus Factor (ICF)

Disease categories	Nt	Nur	ICF
Abdominal pain,intestinal pain, diarrhea , intestinal parasite	4	60	0.95
Animal diseases,leeches, colic, fever	6	28	0.81
Diabetes ,blood pressure	3	10	0.78
Evil eye	4	8	0.57
Joint pain	3	15	0.86
Malaria, rabies viruses	3	27	0.92
Organ diseases; eye, ear , kidney	4	54	0.94
Respiratory system problems, common cold, cough, asthma. Bronchitis	5	42	0.9
Skin problems, wound ,venereal ,fungal	5	58	0.93
STDs , gonorrhea	4	30	0.89
Swelling	4	18	0.82
Tonsillitis ,goiter	5	13	0.67

4.10. 2.Fidelity level index (FLI)

Fidelity level (FL) values were calculated for some commonly used medicinal plants against the some commonly reported ailments: *Allium sativum* (against common cold and kidney pain), *Croton macrostachyus* (against malaria and skin fungal disease), *Euphorbia ampliphylla* (against rabies and leprosy), *Phytolaccadodecandra* (against rabies), *Rutachalepensis* (against common cold), *Embeliaschimperi* (against hepatitis and tapeworm) and *Vernoniaamygdalina* (against abdominal pain) (Table 11).

Table 11. Fidelity index of some medicinal plants

Name of Medicinal Plants	Examples of ailment treated	N p	N	FL	FL%
Allium sativum	Common cold and kidney pain	30	32	0.94	94
Croton macrostachyus	Malaria and skin fungal disease	26	28	0.93	93
Embeliaschimperi	Hepatitis and Tape worm	11	15	0.73	73
Euphorbia ampliphylla	Rabies and leprosy	20	23	0.87	87
Phytolaccadodecandra	Rabies	15	18	0.83	83
Rutachalepensis	Common cold	13	17	0.76	76
Vernoniaamygdalina	Abdominal pain	10	14	0.71	71

4.10.3. Preference ranking

After selecting six key informants, a preference ranking of seven medicinal plants that have been reported to treat abdominal pain was conducted. The informants were asked to rank the medicinal plants in order of efficacy, with the highest number (7) indicating the most effective plant for treating abdominal pain and the lowest number (1) indicating the least effective plant for treating abdominal pain. *Zingiberofficinale* scored 32 ranked first indicating that it is the most effective in treating abdominal pain followed by *Allium sativum* and the least effective was *coriandrumsativum* (Table12).

Table 12. Medicinal plants used to treat abdominal pain are ranked in order of preference

List of medicinal plants	R1	R2	R3	R4	R5	R6	Total	Rank
Allium sativum	7	5	6	5	6	2	31	2nd
Coriandrumsativum	3	3	2	1	3	2	14	7th
Lepidiumsativum	5	5	3	5	4	4	26	3rd
Rubussteudneri	4	2	3	2	2	3	16	6th
Trigonellafoenum-graecum	4	4	4	2	5	3	20	5th
Vernoniaamygdalina	5	4	5	5	3	2	24	4th
Zingiberofficinale	7	6	5	7	4	3	32	1st

4.10.4 .Direct matrix ranking

Direct matrix ranking was conducted following Cotton (1996) for 6 multipurpose medicinal plants commonly reported by informants. Based on the relative benefits obtained from each plant, 6 key informants were preferentially selected and asked to give value to each attribute. The list of attributes included medicinal, FW-firewood, For-forage, Co-construction, Fu-furniture, Ch-charcoal, Fe-fence, Me-medicine. The scores were added in order to compare use values of medicinal plants and help to identify the main causes of over harvesting of the medicinal plants. The average score for a direct matrix ranking of six medicinal plant species based on their general use values (5 = best, 4 = very good, 3 = good, 2 = less used, 1 = least used, and 0 = not used) was calculated as follows: (Table 13).

Table 13. Ranking of multipurpose medicinal plants

Species	Use categories								Total	Rank
	Fw	For	Co	Fu	Fo	Ch	Fe	Me		
Arundinaria alpina	4	3	5	5	0	0	5	4	26	1st
Carissa spinarum	3	0	1	1	4	3	4	4	20	5th
Embeliaschimperi	2	2	0	2	3	2	5	5	21	4th
Eucalyptus globulus	4	0	5	3	0	5	4	3	24	2nd
Rubusapetalus	5	2	0	0	3	3	5	5	23	3rd
Rubussteudneri	2	1	2	0	4	2	4	4	19	6th
Total	20	8	13	11	14	15	27	25	133	
Rank	3rd	8th	6th	7th	5th	4th	1st	2nd		

4.11. Factors threatening medicinal plants

The primary threats to medicinal plants in Ayehu-Guagusa Woreda were identified through interviews with informants. Agricultural encroachment, charcoal manufacture, plant use for house construction, firewood collecting, fodder, and drought have all been mentioned as contributing factors to the decline of natural vegetation in general, and medicinal plants in particular .(Table14).

Table 14. Ranking of threats to medicinal plants

Threat	R1	R2	R3	R4	R5	R6	Total	Rank
Agricultural expansion	5	5	4	4	5	5	28	1
Charcoal	4	5	3	3	4	4	23	2
Construction	3	4	4	4	3	4	22	3
Drought	3	4	3	3	3	2	18	6
Fire wood	3	2	4	4	4	4	21	4
Fodder	3	3	2	4	4	3	19	5

4.12. Threatened medicinal plants

Six key informants were used to rank five medicinal herbs according to their threat level.The results indicated that *Rumex nervosusVahl* was the most threatened medicinal plant followed by *Echinop skebericho and Phoenix reclinata* and the least threatened were *Kalancho epetitiana* and *Embeliaschimper* respectively. The ranking of five medicinal plants based on the degree of threats was conducted using 6 key informants (Table15).

Table 15.Ranking of threatened plants using six key informants

Threatened plants	Informants							
	R1	R2	R3	R4	R5	R6	Total	Rank
Echinops kebericho	5	4	5	4	3	5	26	2nd
Embelia schimperi	3	2	3	3	3	4	18	5th
Kalancho epetitiana	2	3	4	4	4	3	20	4th
Phoenix reclinata	4	3	4	2	4	4	21	3rd
Rumex nervosusVahl	4	4	5	4	5	5	27	1st

4.13. Administration and protection of medicinal plants

Informants reported that the healers know time and processes of gathering and storing medicinal plants. Seed, leaf, fruit or root are harvested, dried and preserved in roof corners or outside house, and dried parts are powdered and stored in different containers like pots, bottles or tied with clothes and used when needed. Indigenous people of the area have strong and genuine belief on healing power of plants and they know their habitat, distribution, harvesting technique, time of harvest and the status of a plant in the area.

5. DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1. Discussion

5.1.1. Medicinal plants in the study area

A total of 50 medicinal plants were collected and documented from the studied area to treat various health conditions. The presence of 50 plants utilized by local populations to treat 47 different types of human and livestock illnesses shows the deep established culture of medicinal plant use in the studied area. Out of these, larger number of medicinal plants (42) were used for the treatment of human disease. This result shows that the local communities have better knowledge on and give more emphasis to the uses of medicinal plants to treat human ailments than livestock diseases. This result is similar with other results which were documented in other regions of Ethiopia (Tesfaye and Sebsebe Demissew, 2009); (Mirutse et al.., 2009); (Moa, 2010); (Getaneh, 2011).

The presence of traditional knowledge and practice on large number of medicinal plants by communities of Ayehu Woreda shows that the indigenous people of the area still depends on traditional medicine of plant origin. Traditional remedies are used by 75-90 percent of the world's rural population (excluding western countries) as their only source of health care due to its accessibility and low cost, affordability and efficacy. Fisseha Mesfin (2007) reported 30 plant species. In terms of species composition, family, Asteraceae contained 5 species which may related to its abundance and distribution in the study field. But families; Cucurbitaceae, Euphorbiaceae, Rutaceae, Fabaceae and Rosaceae consisted 3 species each .The remaining families contained two or one species each. Similarly the dominance of family Asteraceae for the treatment of human diseases was reported in the work of EndalewAmenu (2007) and, SeyoumGetaneh (2009).

5.1.2. Medicinal plant habits and origins

Most medicinal plants were collected from the wild (46%) in this study. But the rest were collected from home gardens (12%), roadside (16%) and agricultural fields (26%).).The findings are similar to those found aile Yineger and DelenasawYewhalaw, 2007; ErmiasLulekal et al., 2008; TesfayeHailemariam et al., 2009; GetuAlemayehu, 2010; Nigussie Amsalu, 2010; Emiru Birhane et al., 2011; Gidey Yirga et al., 2011 where wild areas are the most important sources of medicinal plants. This shows that in order to acquire medicinal plants in the study area, practitioners primarily use wild sources or the natural environment rather than home garden 16 (34.04%) were herb species followed by, 15(31.91) shrub species, 14 (29.79 %) tree species and 2 (4.26%) climbers. This shows that herbs, followed by shrubs, are the most commonly used medicinal plants in the field of study. In comparison with trees and climber species, this may be due to a high degree of abundance and distribution of herbs in the study field. DebelaHunde (2004), who researched Boosat medicinal plants around Welea, has also previously recorded a relatively large number of herbs and shrubs for medicinal purposes.

5.1.3. Plant parts used, conditions and mode of preparation

Results of plant parts used for medicinal purposes indicated that, the local communities mostly use leaves (33.98%) followed by roots (29.13%). Other plant parts were also used to prepare traditional medicine, i.e., seeds (11.65%), fruits (5.83%), stem (4.85%), bulbs (3.88 %), sap (4.85%), latex (1.94%), barks (0.97%), flowers (1.94%) and buds (0.97%).Data review found that the leaf is the most commonly used component of remedy preparation. Previous reports in Ethiopia have also shown that leaves were the most commonly use; followed by roots to treat various health problems Mirutse Giday, 2001; Haile Yineger and Delenasaw Yewhalaw, 2007; (Mirutse, 2009); (Tesfaye, 2009). Given the maximum frequency of leaves utilized for medicinal reasons in the study, the threat of medicinal plant destruction was found to be small, as root, bark, and stem harvest pose a significant harm to the mother plant. Medicinal plant harvesting that includes roots, rhizomes, bulbs, barks, and stems has a major impact on the survival of mother plants, according to Dawit Abebe and Ahadu Ayehu (1993).Traditional medicinal plant remedy formulations can be done in a variety of ways.Crushing (50%) was the most common and popular method of preparation, followed by squeezing (13.75%), chewing

(12.5%), and boiling (11.25%).In a similar study, Haile Yinger and DelensawYewhalaw (2007) found that crushing was the most popular method of preparation in Oromia Reginal State, Southwestern Ethiopia .In this study, the community people also use some other products as additives in their preparations. For example, water, oil, butter, salt, milk, honeys are some of the additives that the community people reported to be used to improve the flavor and reduce adverse effects such as vomiting and diarrhea so that the efficacy of the traditional medicine would be maintained or increased. Such additives were also reported by some previous researchers (Dawit Abebe, 1986; Mirutse Giday, 1999).

The finding showed that herbal remedies are made with fresh ingredients 40(53.33%), 10 (13.33%) were used as dried plant material and 25 (33.33%) either fresh or dried similarly, a study conducted by previous researchers Endalew Amenu (2007); Haile Yineger and DelenasawYewhalaw (2007);Moa Megersa (2010) and Nigussie Amsalu (2010),showed that using fresh materials for various health problems is more than dry materials because theingredients are not lost before use compared to the dried forms.

5.1.4. **The path of administration of medicinal plants**

The path of administration includes oral, dermal, optical ear and nasal .Overall, oral administration was reported as a dominant path of administration (60.6%) followed by dermal route (22.73%). Both the oral and dermal routes allow the prepared medicines to quickly physiologically react with the pathogens and increase their curative capacity. This result coincides with some prior findings (DawitAbebe, 1986).The amounts of medicine to be delivered were stated to be determined by a rough estimate of the patient's age and physical condition. As a result, the medicine dosage was not precise. DawitAbeebe and AhaduAyehu (1993) reported that lack of precision in the dosage a major drawbacks of practicing traditional remedy.

The prepared traditional medicines are applied in a number of methods, among which drinking (32.28%), painting (15.75%), eating (14.17%), put on and tie (11.02%), chewing (8.66%), smoking (7.09%), dropping (5.51%) swallowing (3.94%) and others (1.57%).This observation is consistent with others, Alemayehu Kefyalew, 2010; EskedarAbebe, 2011).

5.1.5. Top ranking medicinal plants

Six respondents were asked to compare *Zingiber officinale, Allium sativum Vernonia amygdalina, Lepidium sativum, Trigonellafoenum-graecum, Rubussteudneri and Coriandrum sativu* based on their efficacy to identify the most effective medicinal plant used for treating abdominal pain. According to Mohammed Adafa (2009), in Tuhuledere, *Allium sativum* is the most recommended species in the treatment of numerous ailments, followed by *Nigella sativa.*

FL values for medicinal herbs that are widely used by communities to treat one or a few ailments will be higher than for medicinal herbs that are less commonly used (TilahunTeklehaymanot and Mirutse Giday, 2007). For instance, multiple informants claimed that *Allium sativum was* useful to treat malaria, hence it received a 94 percent FL.In a similar study, EndalewAmenu (2007) found that *Allium sativum* was the previous plant species used to cure malaria in the Ejajiarea. The results revealed that some medicinal herbs were utilized more frequently than others .The medicinal plants were supposed to be effective in treating certain disease had higher ICF values, which indicated that these diseases were more common than those with low ICF. Additionally, medicinal plants that are effective in treating specific diseases and are well-known among community members have higher ICF values. With the ICF values ranging from 0.95 to 0.67 per illness category. Due to the high prevalence of the disease in the area, respiratory system problems had the highest ICF value (0.94), while tonsillitis and goiter had the lowest (0.67) may be due to the unusual occurrence of these diseases and the fact that most are successfully treated by local healers. According to Tilahun Teklehymanot 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 close to 1 indicates that the respondents rely most on the same taxa to manage specific disease condition, While low values of ICF close to 0 indicate that the informants disagree on the taxa to be used in the treatment of a given ailments.In this study, a number of medicinal plants were identified as multipurpose species that can be used for a range of purposes. Medicinal, fodder, food, firewood, constructions, forage, fencing, charcoal, and furniture making are some of the most popular uses. Six commonly reported multipurpose species and eight use-categories were included in a direct matrix rating exercise to assess their relative relevance to local people and the amount of existing threats related to their use values. *Arundinariaalpina* and *Eucalyptus globulus* were ranked 1st and 2nd and hence are the most preferred medicinal plants

by local people for various uses and are the most abundant species as the informants reported, which was not evidently shown by their distribution scarcity and time required for collection of these species. Similarly, the values for use reports were summed up and ranked across the selected species. The results show that the local people harvest eight multipurpose species primarily for fencing, medicine, firewood, charcoal, food, construction, furniture, and forage, with the first, second, third, fourth, fifth, sixth, seventh, and eighth places, respectively.

5.1.6. Threats and protection in the research field of medicinal plants

Informants reported that they must travel a long distance to obtain medicinal plants. The ethnobotanical knowledge on uses of medicinal plants is secrete and transferred from one generation to the next orally. The result of the present study showed that agricultural expansion, firewood, construction, charcoal, fodder and drought were ranked as the most severe threats not only to medicinal plants but often plants of the Ayehu District as a whole. According to information provided from key informants, agricultural expansion is the most serious threat to medicinal plants, followed by Charcoal. Similarly, this observation is consistent with others (Mirutse Giday, 2001).

Indigenous people of the area have strong and genuine belief on healing power of plants and they know their habitat, distribution, harvesting technique, time of harvest and the status of a plant in the study area. In the study area, for example, 14 medicinal plants were found in the majority of home gardens and farm borders, indicating that these plants are used in daily life as medicine or for other purposes.According to ZemedeAsfaw (2001), cultivation for medicinal value accounted for 6% of the plants maintained in home gardens in Ethiopia. Medicinal plants were also kept or protected in close proximity because of their scent, as a live fence to keep enemies at bay, as spices, and as food.Because of their uses for construction, fuel wood, and other value, plants are also left as forest remnants in agricultural fields.Agricultural growth and firewood are the main threatening elements, according to BehailuEtana (2010).

5. 2.CONCLUSION AND RECOMMENDATIONS

5.2. 1.Conclusions

In the study area, 50 medicinal plants were identified, with 42 species being used to cure human ailments, 5 species being used to treat livestock ailments, and 3 species being used to treat both livestock and human ailments. The majority of medicinal plant species were obtained from the wild (46%) followed by agricultural field (26%), home garden (12%), and road side (16%). Herbal remedies were prepared from fresh materials (53.33 %), dried plant materials (13.33 %) and fresh or dried (33.33%). Herbs were highly utilized (34.04%) for medicinal purpose than shrubs, trees, and climbers. leaves (33.98%) ere used for medicinal purpose more than other plant parts for preparation of human and livestock remedies. The cures were taken with various additives and solvents, with water being the most commonly utilized. The majority of the medicinal herbs were administered orally (60.6%), followed by dermal application (22.73 %).Agricultural expansion, charcoal production, construction, firewood collecting, plant fodder usage, and drought were the greatest threats to medicinal plants and associated information in the field of study, in that order. Secrets, oral-based knowledge transfer, young people's unwillingness to learn, species extinction, contemporary education's effect, and awareness issues are among the major threats to indigenous knowledge. To prevent the erosion of indigenous knowledge and ensure its long-term use, timely awareness-raising campaigns are required to improve the local community's understanding of the importance and management of medicinal plants, as well as to raise awareness among healers.

5.2.2. Recommendations

The following recommendations are made based on the study's findings

- ✓ The Woreda Agricultural Office must be educated, encouraged, and supported the local people in order to conserve and manage medicinal and whole plant resources in their area.
- ✓ The Woreda health office pay attention to standardization of measurement and hygiene of the medicines made from plants by training both the healers and other members of the local society.
- ✓ The Woreda Agricultural Office and local elders must be trained how to grow medicinal plants in home gardens alongside agricultural crops.
- ✓ Local people collect plants from the forest for various purposes with little awareness of the threat, therefore agricultural workers in the Woreda must create awareness among the communities to guarantee sustainable harvesting is conducted.
- ✓ The Government should be encourage and license the indigenous knowledge and skill of traditional medicine practitioners.
- ✓ The Woreda Agricultural Office raising awareness of the young generation to avoid negative impacts on the Medicinal plants and associated knowledge in the field of study.
- ✓ The Woreda Administration and Woreda Health Office have to promote the local herbal medicine practitioners to enhance the utilization of traditional medicine through licensure and other incentives.
- ✓ The prior attention should be given for *Rumex nervosusVahl because Rumex nervosusVahl which was ranked first according to my findings.*
- ✓ To give more support to the finding of this research, further scientific investigations are needed for *Croton macrostachyus* and *Lepidium sativum* to extract active contents and run pharmaceutical research.

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9. APPENDICES

Medicinal plants used by the Ayehu- Woreda communities, Awi

Zone, Amhara Regional State, Ethiopia: Threats and conservation methods.

Appendix I: Semi structure interview Date_____Kebele_____

Name of informant_____Sex; Male_____Female_____Age_____

Occupation _____Religion_____Level of education_____

1. What are the most serious or common human health issues in your area?

2. What are the most serious or prevalent livestock health issues in your area?

3. What are some plants that are used to treat human and cattle diseases?

4. Which parts of the plant do you utilize to cure a specific disease?

5. What further applications do you have for the medicinal plants you listed in question 3?

6. Which part of the medicinal plants you mentioned above are effective in treating diseases?

7. How are the medicinal plant parts gathered?

8. How are the collected plant parts processed?

9. Are the processed plant parts used immediately or are these stored for a latter use?

10. Does the dose differ between sexes and among age groups?

11. Are there any restrictions in taking remedies (e.g., pregnancy, age)?

12. Are medicinal plants easily accessible?

13. Do you have a place where you keep the medicine?If so, in what way and for how long?

14. Where do plants grow? In the wild_____ or in home gardens? _____

15. How are the prepared remedies taken by the patients(s)? Dermal _____, Oral_____, Nasal _____, optical _____or Through the Ear

16. Preparation forms of the plant in your locality (crushed, pounded. powder, latex/extract with cold water/boiled/juice _____

17. What are the major threats to medicinal plants?

18. How do you conserve the medicinal plants?

19. Have you:

A) Ever propagated any of the medicinal plants known to you? If so,

B) How did you propagate them, through seeds or by vegetative means?

C) Ever collected medicinal plant wildlings and planted in your backyard?

20. If the answers for the above questions are "No", are you not worried about the sustainability of medicinal plants?

21. What happens if medicinal plants get scarce or disappear?

22. What are the technical challenges for propagating medicinal plants?

Thank you!!

Appendix II: List of medicinal plant species used for Human; Livestock ailments and Both in Ayehu District: Scientific name; Family name; Local name; Habit; Plant parts used; mode of Preparation ;Disease treated ; Route administration in study area.

Scientific name	Family name	Local name	Habit	Plant parts used ; mode of Preparation and application	Disease treated	Routeof administration	Human or Livestock or Both
Allium sativum L	Alliaceae	Nechshinkurt	Herb	Bulbs: Boil with water and drunk	Kidney pain	Oral	Human
				Bulbs**:** Eating with salt	Common cold	Oral	
Allium cepa L	Alliaceae	Key shinkurt	Herb	Bulbs is peeled & chopped and will be mixed with seeds of	Fever	Oral	Livestock
				*Lepidiumsativum*a& water and then drunk			
Acmellacaulirhiza Del	Asteraceae	Yemdir Berber	Herb	*Flower: Chewing the flower and swallow*	Tonsillitis	Oral	Human
Artemisia abyssinicaSch.Bip.exA.rich	Asteraceae	Arite	Herb	Leaves: Chewing the leaves	Stomachache	Oral	Human
Clausenaanisate	Rutaceae	Lemeche	Tree	Roots: The fresh roots and the leaf of *Combertumterminilia*Frisse*tal* are crushed and mixed with water and drunk	Evil eye	Oral	Human
*Clematis simensis*Fresen	Ranunculaceae	Yeazohareg	Climber	Leaves: Fresh leaf juice with water then a apply infected site	Swelling	Dermal	Human
				Root: Crush the roots mixed with water and then drunk	Diarrhea	Oral	
Coffea Arabica L	Rubiaceae	Buna	Shrub	The seed from the fruit is roasted and powdered and will be mixed with boiled water and *Rutachapelensis*then drunk at night	Common cold	Oral	Human
Carissa spinarum L.	Apocynaceae	Agam	Shrub	Roots: Crush the roots and smoke or tie on the neck	Evil eye	Nasal	Human

Carica papaya L	Caricaceae	Papaya	Tree	Sap: The leaves or stem juice paint on wound surface	Wound	Dermal	Human
				Leaves: Boil the dry leaves with water and drunk	Blood pressure	Oral	
				Seeds :chewed and swallowed	Intestinal parasite	Oral	
*Cucurbita pepo*L.	Cucurbitaceae	Duba	Climber	Seeds: Crush the seeds and eat with injera	Tape worm	Oral	Human
Cucumisficifolius A. Rich	Cucurbitaceae	Yemidirembuay	Herb	Roots: Chewing the root and swallowing the juice	Snake bit	Oral	Human
				Roots: Yemidiremboay together with Yegibmrkuz (*Steganotaeniaaraliaceae*) root crushed and put on wound site	Wound	Dermal	
Croton macrostachyus Del	Euphorbiaceae	Bisana	Tree	Buds: Eat fresh shoot tip with injera	Malaria	Oral	Human
				Buds**:** The buds are squeezed, and the contents are dumped on the afflicted spot.	Fungal skin disease	Dermal	
*Combertumterminilia*Frisse*tal*	Combretaceae	Abalo	Shrub	Fruit: Crush the fruit and mix with honey and paint on wound	Leprosy	Dermal	Human
Coriandrumsativum L	Apiaceae	Dinbilal	Herb	Seeds: Boil the seeds with water and drunk	Ascariasis	Oral	Human
*Citrus limon*L	Rutaceae	Lomi	Tree	Leaves: Boil the leaves with stem of sugar cane and drink hot decoction	Asthma	Oral	Human
CyathulapolycephalaBak	Amaranthaceae	Chigogo	Herb	The leaves are chopped and squeeze then drop the extract to the ear	Febrile Sickness	Ear	Human
Datura stramonium L	Solanaceae	Astenagir	Herb	Leaves: Crush the leaves and paint on infected area	Dandruff	Dermal	Human
*Euphorbia ampliphylla*Pax	Euphorbiaceae	Qulqual	Tree	Latex: prepare bread from teff powder and milky juice after that eat and drunk	Rabies	Oral	Human
				Flower: The flower mix with honey and paint on wound site	Leprosy	Dermal	
*Embeliaschimperi*Vatke	Myrsinaceae	Enkoko	Herb	Leaves: Crushed leaves with Niger	Hepatitis	Oral	Human

				then drunk			
				Seeds: Crush the seeds and mixed with water then drunk	Tape worm	Oral	
Erythrinabrucei L	Fabaceae	Korch	Tree	Leaves: Dry leaves are crushed and spread the powder on wound site	Wound	Dermal	Livestock
*Echinopskebericho*Mesfin	Asteraceae	Kebercho	Shrub	Roots: Smoke the nasal cavity with dried root	Cough	Nasal	Livestock
EchinopslongisetusA.Rich	Asteraceae	Kosheshile	Herb	Root: Fresh root boiled with water is applied on the horse skin	Stabbing pain	Dermal	Both
				Stems: The stems will be tied on pain surface	Colic		
*Eucalyptus globulus*Labill	Myrtaceae	Nechbahirzaf	Tree	Leaves: Chopped Eucalyptus globulus leaves are boiled in water and repeatedly inhaled.	Bronchitis	Nasal	Human
Hageniaabyssinica (Bruce) J. F. Gmel	Rosaceae	Kosso	Tree	Fruits: Crush the fruit and mix with water and then drunk	Tape worm	Oral	Human
Jasminum grandiflorum L	Oleaceae	Tembelel	Climber	Roots: Dried root boiled vapor is inhaled nasally	Common cold	Nasal	Human
				Leaves:The leaves will be crushed and drip on eye	Eye pain	Optical	
Justicia schimperiana T. Anders	Acanthaceae	Smizza	Shrub	Buds: Squeeze seven buds and crushed the seed of *Rhamnusprinoides*L'Herit (Gesho) and mixed with lemon then apply on the infected site	Fungal skin disease	Dermal	Human
*Kalanchoepetitiana*A. Rich	Crassulaceae	Andawula	Herb	Roots: Fresh root crushed and mixed with honey then drunk	Tonsillitis	Oral	Human
				Roots: The roots of *Kalanchoepetitiana* are squeezed andadded few drops through ear	Ear pain	Ear	

Lepidiumsativum L.	Brassicaceae	Feto	Herb	Seeds: Crushed seed mixed with water is given orally for cattle	Intestinal parasite	Oral	Both
*Linumusitatissimum*L	Linaceae	Telba	Herb	Seeds: Crush the seeds and mix with honey and tie on wound site	Wound	Dermal	Human
Maytenusalbutifolia (Lam.) Exell	Celasteraceae	Koba	Tre**e**	Bark: Dried, roasted stem bark powder with butter and apply on infected site	Venereal diseases	Dermal	Human
Nicotianatabacum L	Solanaceae	Timbaho	Shrub	Leaves: Fresh leaf juice with water is given orally	Leech	Oral	Livestock
Ocimum lamiifolium Hochst. Ex Benth.	Lamiceae	Demakese	Shrub	Leaves: Squeeze the leaves and drunk with tea	Common cold	Oral	Human
*Olea europaea*subsp. *Cuspidata*	Oleaceae	Woira	Tree	The leaf is chopped, squeezed and mix in water and juice is drunk.	Abdominal pain	Oral	Human
Phoenix reclinata Jacq	Arecaceae	Selen	Tree	Leaves: The leaves will be squeeze and paint on goiter	Goiter	Dermal	Human
*Phytolacadodecandra*L'Herit	Phytolaccaeceae	Endod	Shrub	Seeds: Crushed seed mixed with sugar and water then drunk	Rabbis	Oral	Human
Rumexabyssiincusjacq	Polygonaeceae	Mekimeko	Shrub	Root: Crushed the root and mix with water then drunk	Blood pressure	Oral	Human
				Root: Crushed the root and mix with water then drunk	Tape worm		
				The leaves are chopped and squeeze the apply on infected site	Wound	Dermal	
				The leaves are chopped and squeeze the apply on infected site	Wound	Dermal	
RumexnervosusVahl	Polygonaceae	Embuacho	Shrub	Leaves: Squeeze the leaves then drunk	Intestinal parasite	Oral	Human
				Leaves: Squeeze the leaves then drop in to infected eye	Eye pain	Optical	
Rutachalepensis L	Rutaceae	Tenadam	Herb	Leaves: Boil the leaves with tea then drunk	Common cold	Oral	Human

*Rhamnusprinoides*L'Herit	Rhamnaceae	Gesho	Shrub	Seven leaf buds are chewing and swallowing	Tonsillitis	Oral	Human
RubussteudneriSchweinf.	Rosaceae	Kega	Shrub	Fruits: eat fresh fruit	Tape worm	Oral	Human
*Rubusapetalus*Poir	Rosaceae	Enjory	Shrub	Leaves and fruits**:** Dried leaf and fruit soaked with water then given orally	Gastritis	Oral	Human
Ricinuscommunis L.	Euphorbiacea	Chaqma	Shrub	Sap: Pour and apply in to the eye	Eye pain	Optical	Human
Schinusmolle	Ancardiaceae	Kudobererie	Tree	The seed of *Schinusmolle*is powdered and mixed with honey and then drunk	Tonsillities	Oral	Human
Trigonellafoenum-graecum. L	Fabaceae	Abish	Herb	Seeds: Crushed seeds mixed with water and sugar and then drunk	Abdominal pain	Oral	Human
Vernoniaamygdalina Del.	Asteraceae	Girawa	Tree	Leaves: Crush the leaves into powder and mix with water then drunk	Abdominal pain	Oral	Both
Viciafaba L.	Fabaceae	Bakila	Herb	The seed of *Viciafaba*is boiled using water and add little salt then mixed with senafich finally eat	Common cold	Oral	Human
Zehneria scabra L	Cucurbitaceae	Haregressa	Climber	Leaves: The leaves are boiled with water inhaled continuously	Common cold	Nasal	Human
Zingiberofficinale Rose	Zingiberaceae	Zingible	Herb	Stems: Chewing with salt	Abdominal pain	Oral	Human

Appendix III.Number of medicinal plants in each family

Table 1. Number of medicinal plants in each family

No.	Family	Number of plant species	Percentage of plant species (%)
1	Acanthaceae	1	2
2	Alliaceae	2	4
3	Ancardiaceae	1	2
4	Apiaceae	1	2
5	Amaranthaceae	1	2
6	Arecaceae	1	2
7	Apocynacea	1	2
8	Asteraceae	5	10
9	Brassicaceae	1	2
10	Caricaceae	1	2
11	Celasteraceae	1	2
12	Combretaceae	1	2
13	Crassulaceae	1	2
14	Cucurbitaceae	3	6
15	Euphorbiaceae	3	6
16	Fabaceae	3	6
17	Lamiceae	1	2
18	Linaceae	1	2
19	Moraceae	2	4
20	Myrsinaceae	1	2
21	Myrtaceae	1	2
22	Oleaceae	2	4
23	Phytolaccaeceae	1	2
24	Polygonaeceae	2	4
25	Ranunculaceae	1	2
26	Rhamnaceae	1	2
27	Rosaceae	3	6
28	Rubiaceae	1	2
29	Rutaceae	3	6
30	Solanaceae	2	4
31	Zingiberaceae	1	2
Total	31	50	100

Appendix IVRepresentative medicinal plants in the study area.


*Cucurbita pepo*L


*Rubussteudneri*Schwei


RumexnervosusVahl


*Ficussur*Forssk

[Photo courtesy by Yohannes Menberu, 2019]

Declaration

I, Yohannes Menberu Tsehaye confirm that the work presented in this thesis is my own. Where information has been derived from other sources, Ican confirm that this is stated in the thesis. The content in this thesis has never been presented for a degree at Addis Ababa University or any other university before, and all sources of resources used in the thesis are acknowledged.

Name Yohannes Menberu

Signature_____

Date: September, 2021

Place: Addis Ababa University

As an academic advisor, I have given my approval for this thesis to be examined.

Advisor: Prof. Legesse Negash

Signature _____

Date_____