Madda Walabu University

College of Natural and Computational Sciences

Department of Biology

Ethnobotanical Study of Medicinal Plants used to treat Human Diseases in Gura Damole District, Bale Zone Oromia Regional State, and Southeast Ethiopia

By: Behailu Assefa Aredo

Advisor: Moa Megersa (PhD)

A Thesis Submitted to Department of Biology for Partial Fulfillment for the Requirements of Masters of Science Degree in Biology

March, 2020

Bale Robe, Ethiopia

Madda Walabu University

College of Natural and Computational Sciences

Department of Biology

Approval Sheet 1

I the undersigned certify that I have read and approved his thesis and recommend to the Madda Walabu University to accept the thesis submitted by Behailu Assefa Aredo entitled "Ethnobotanical study of medicinal plants used to treat human diseases in Gura Damole District", in partial fulfillment of the requirements for the award of master of science degree in Biology.

Name of Advisor: Moa Megersa (PhD)

Signature _____

Date _____

Madda Walabu University

College of Natural and Computational Sciences

Department of Biology

Approval Sheet 2

We, the undersigned, members of the Board of examiners of the final open defense by Behailu Assefa Aredo have read and evaluated his thesis entitled with "Ethnobotanical study of medicinal plants used to treat human diseases in Gura Damole district", Oromia Regional State, Bale Zone, Southeast Ethiopia and examined the candidate. Therefore, this is to certify that the thesis has been accepted in partial fulfillment of the requirements for the degree of Master of Science in Biology.

Approved by Thesis Examining Board

Members of the board of examiners	Name	Signature	Date
Chairperson	_____	_____	_____
Advisor	_____	_____	_____
Internal Examiner	_____	_____	_____
External Examiner	_____	_____	_____

Statement of the Author (Declarations)

First, I declare that this thesis is my original work and that all sources of materials used for the thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for Master of Science degree in Biology at the Madda Walabu University. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

Brief quotations from this thesis are allowable without special permission provided that accurate acknowledgement of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of the major department or the dean of the school of graduate studies when in his/her judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

Name: Behailu Assefa Aredo

Signature: _____

Date _____

Acknowledgements

I am very grateful to the Almighty God for giving me the strength and sustaining me throughout my educational life up to this level and my advisor Moa Megersa (PhD) for his whole hearted guidance and comments on the research work from the proposal development up to the final thesis write up. I acknowledge Madda Walabu University for providing fund to conduct the study.

My special gratitude goes to the leadership of the Gura Damole district for their cooperation and assistance in carrying out my fieldwork studies. Moreover, I would like to give my heartfelt acknowledgement to the informants from each kebele for their participation by providing relevant responses to the questions. Without their participation the study would not have been realized.

I am also grateful to Mr. Addisu Feleke, Mr. Solomon Bezu and Ms. Yeshumnesh Belete for; giving me constructive information and assisted me during data collection. I am also grateful to my wife Emebet Bezu for her encouragements, care and support in my thesis. My friends Mr. Berhanu Aberea, Mr. Hailu Tolosa, Mr. Fanos Ayele and Mr. Mekuria Takola are acknowledged for their wonderful contribution which has helped me to finalize this thesis.

Acronomy

CSA ---------- Central Statistical Agency

DA ---------- Development Agents

FAO ---------- Food and Agricultural Organization

GDDAPDO ---------- Gura Damole District Agriculture and Postural Development Office

HH ---------- House holds

NMA ---------- National Metrological Agency

NGO ---------- Non-Governmental Organization

PA ---------- Peasant Association

SPSS ---------- Statistical package for Social Science

UNICEF ---------- United Nation Educational Fund

WFP ---------- World Food Program

Table of contents

List of tables

List of figures

Abstract

Documentation of medicinal plants and the associated knowledge in the study area is important for conserving the plants, ensuring their sustainable use and to preserving the knowledge for the next generation. The purpose of the study was to investigate Ethnobotanical information of medicinal plants used to treat human diseases in Gura damole district, Bale zone, Oromia region, Southeast Ethiopia. The study involved traditional healers, knowledgeable elders and local communities. Various ethnobotanical techniques were used to collect the data: semi-structured interview, focus group discussion, preference ranking and direct matrix combined with descriptive statistical analysis. Twelve key informants were purposely selected from 6 kebeles. A total of 30 plant species distributed in 21 families, were collected from the study area. Of the collected medicinal plants used for treatment of human ailments in Gura damole district, 11 species (36.6%) were shrubs, 9 species (30%) were trees, 8 species (26.6%) were herbs and lianas were 2 species, (6.6%). The majority of traditional medicines were administered orally, among which; drinking accounts 14 (46.67%), put on and rub 6(20.0%), fumigate 4(13.33%), chewing 3(10%), fumigate and washing accounts for 2 species (6.67%) and put on and chewing 1(3.33%), species were mentioned. Preference ranking showed the efficacy, popularity and preference people have for some species over the other in treating ailments. Carissa spinarum was the most preferred medicinal plant to treat evil eye. Agricultural expansion, charcoal trading and firewood collection, deforestation, drought, fire, and overgrazing resulted in major threat to medicinal plants and indigenous knowledge. Traditional medicinal plants are central to the indigenous cultures and material needs. 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. Raising awareness on threat for future sustenance, by development agents or agricultural workers through which sustainable management and conservation be practiced.

Key words: Ethnobotany, Gura damole district, Indigenous knowledge and Medicinal plant

1. Introduction

1.1. Background

Medicinal plants play an important role in human life for therapeutic purposes (Sofowora, 2003) and popularized worldwide due to great contribution by traditional practitioners (WHO, 2003). Many indigenous local communities have developed various traditional systems using locally available resources for the alleviation of health problems (Tesfaye and Sebsebe, 2009).

In developing countries up to 80% of populations depended on plants for their primary healthcare (Kurt and Andrew, 2002) and the value of medicinal plants to human livelihoods is essentially infinite (Hamilton, 2004). Medicinal plants have source for the invention of novel drugs (Wright, 2005). For instance, Quinine, which used to treat malaria was derived from the bark of the cinchona tree, has long played a major role (Rocco, 2004). Serpentine isolated from the root of Indian plant *Rauwolfia serpentine* in 1953, was a revolutionary event in the treatment of hypertension and lowering blood pressure (Verma and Singh, 2008). Ephedrine, a decongestant, is derived from Chinese shrub *Ephedra sinica* (BGCI, 1998).

According to Perumal and Gopalakrishnakone (2008) plant-based drugs provide outstanding contribution to modern therapeutics. In Ethiopia, most of the rural populations traditionally use many plants as sources of medicine for human and livestock ailments (Tesfaye *et al.,* 2009). Generally, traditional healers use roots, barks and other parts of the plant to prepare remedies (Alexiades, 2006) and in the process they have developed their own local knowledge. This knowledge is transferred orally from generation to generation through herbalists and knowledgeable elders. The indigenous knowledge system in Ethiopia is not fully documented when compared to available multiethnic, cultural and flora diversity (Fisseha *et al.,* 2009 and Mirutse *et al.,* 2009).

Scientific documentation is to preserve valuable traditional knowledge for future generations (Martin, 2005; Cotton, 2006). In Ethiopia, research and documentations on medicinal plants have started in recent times even though plants used traditionally as a source of medicine since time immemorial (Mesfin and Sebsebe, 2002). Many traditional remedies are remaining

hidden due to secrecy, migration of people, urbanization, and influence of modern medicine (Tafesse and Mekonnen, 2011).

However, there is no documentation of medicinal plants in Gura Damole district and its surroundings. Many elderly people in this area have well versed in traditional practices to provide remedies for human and livestock health problems. Like elsewhere in Ethiopia, people living in Gura damole district have traditional practices which they have accumulated for generations to treat both human and livestock aliments. Moreover, a wealth of plant species is believed to exist in the district and used by the traditional healers who serve the local community by their indigenous knowledge and practices. Despite all these realities, there are no written documents, well studied botanical information or ethnobotanical studies conducted in the District. Ethnobotanical studies are required to introduce the existence of traditional knowledge as well as the rich flora of the district and plant species of medicinal value that are used by traditional healers to treat various health problems. This fact is a good implication that there is a gap between local practices and believes medicinal plants of the district as well as botanical resources and the scientific community or the rest of the world. On the one hand, with the expansion of modern medical services and cultures, much of the traditional practices are getting less and less recognition because most of the knowledgeable elders may die without sharing their knowledge to the younger generation. Local communities of Gura Damole district have their own way of perceiving nature, their environment and health problems to react to them by making use of their indigenous knowledge and practices that they have accumulated for generations. Through Emic view, they classify plants, landscapes and health problems and come up with possible solutions. Their perception and beliefs helped them to solve practical problems in health, agriculture as well as environmental conservation.

Therefore, documentation of medicinal plants and the associated knowledge in this area is important for conserving the plants, ensuring their sustainable use and to preserving the knowledge for the next generation.

1.2. Statement of the problem

The size of the Ethiopian flora is estimated at 6,000 species of vascular plants of which about 10% are believed to be endemic (IBC, 2010). Although different literature sources published at different times reported the estimated number of medicinal plants to be variable, the

current account of medicinal plants of Ethiopia, as documented by the Institute of Biodiversity Conservation (IBC), about 887 plant species have been reported to be utilized in traditional medicine (TesemaTanto *et al.*, 2003).

It is worth remembering here the point put forward by Jansen (2011) that almost all plants in the Ethiopian flora are used medicinally sometime somewhere. Moreover, the Ethiopian Flora in various ecosystems fosters numerous plants used for various purposes. Hence, it was noted that the tentative list of indigenous medicinal plants provided by the National Herbarium of Ethiopia (in the published Flora of Ethiopia and Eritrea) may form the basis for collection, conservation and sustainable utilization of medicinal plant lore in the absence of diversity studies (IBC, 2010).

Ethnomedicinal plants of Ethiopia that the existing figure of medicinal plant species is a good indicator of very high chance of locating a dozen of more plants with therapeutic potential to allocate the direct pharmaceutical situations of Ethiopia (Abera Geyid *et al*., 2003). The implication is that there is a place to discover new knowledge. Similarly, detailed information on medicinal plants of Ethiopia could only be obtained when studies are undertaken in various parts of the country where little or no botanical and ethnobotanical explorations have been made (Tesfaye Awas, 2007).

The study was conducted in Oromia Regional State, Bale zone, Gura damole district. Study area is known by the traditional domestic animals herding and crop production and rarely uses of medicinal plants, extent of their contribution to the livelihoods. As far as my knowledge is concerned, there is no current study that has assessed the uses of medicinal plants and utilization of their livelihoods in the study area.

1.3. Objective of the Study

1.3.1. General Objective

The main objective of the study was to assess medicinal plants used by local people of Gura damole district as a remedy for various human diseases the indigenous knowledge of the people in the study area.

1.3.2. Specific Objectives

1. To document medicinal plants used to treat human health problems in the study area.

2. To identify plant parts used for medicinal purposes, methods of preparation and ways of administration.
3. To assess the current status and existing threats on medicinal plants of the study area.
4. To investigate how indigenous knowledge can be used in conservation of medicinal plants of the study area.

1.4. Research question

1. Are there medicinal plants used to treat human disease in Gura damole District?
2. What are medically important plants species used by indigenous people of the study area?
3. How do the people in the study area obtain and use the plant species to treat various diseases?
4. What are the existing threats to medicinal plants in the study area and how do local people conserve medicinal plants?

1.5. Significance of the Study

The present study was to bring traditional medicinal practices derived from medicinal plants practiced by traditional healers and indigenous people of Gura damole district and provision of information on the botanical resources in the district. Hence, it becomes important to conduct ethnobotanical study of medicinal plants in the area as there were no previous ethnobotanical works on medicinal plants in the district. It is hoped that the study results have bridge the gap between traditional practices, indigenous cultures and modern science. Moreover, compiling relevant information and documenting the information is important as it should be the basis for further ethnobotanical leads towards the development of modern drugs and pharmaceuticals from medicinal plants and those who would use information on the plant resources.

2. Literature Review

2.1. Origin and development of Ethnobotany

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). This implies that humans are dependent on other organisms for their life. Although various animal and mineral products contribute to human welfare, the plant kingdom is most essential to human wellbeing especially in supplying his basic needs. This close interaction and dependency of humans on plants is studied under the field of Ethnobotany. It is difficult to tell exactly when the term Ethnobotany became part of modern science. However, it can be traced back to the time when humans started making conscious interaction with plants and animals. 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).

John Hershberger proposed the term Ethnobotany for the first time in 1895 (Balick, 1996). However, this term has been given different interpretations and definitions depending on the interest of workers involved in the study (Cotton, 1996). Hershberger (1896; cited in Cotton, 1996), defined Ethnobotany as the study of the use of plants by aboriginal peoples. Ethnobotany as the study of the relationship, which exits between humans and their ambient vegetation (Castetter, 1944; cited in Cotton, 1996). Martin (1995) defined Ethnobotany as a study of people's classification, management and use of plants.

Bye (1985) stated Ethnobotany as a science investigates the biological (including the ecological) basis of interaction and relationship between plants and people over evolutionary time and geological space. Ethnobotanical investigation documents the knowledge on cultural interaction of people with plants. It also tries to find out how local people have traditionally used plants for various purposes, and how they incorporated plants in to their cultural tradition and religions (Balick and Cox, 1996).

Therefore, traditional local communities worldwide have a great deal of knowledge about native plants on which they intimately depend (Langeheim and Thimann, 1982). As stated by Martin (1995) to achieve more detailed and reliable information of plants and plant use,

ethnobotanical study needs involvement of specialists from various disciplines, such as plant taxonomists, plant ecologists, anthropologists, linguists, economic botanists, pharmacologists and others. With such interdisciplinary and multidisciplinary approaches, Ethnobotany is aimed at gathering and documenting indigenous botanical knowledge, cultural practice, use and management of botanical resources and discovers benefits from plants (Langeheim and Thimann, 1982).

2.2. Indigenous knowledge

Indigenous knowledge refers to the accumulation of knowledge, rule, standards, skills, and mental sets, which are possessed by local people in a area (Quanash, 1998). The immediate and intimate dependency of local people 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. 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).

The complex knowledge, beliefs and practices generally known as indigenous knowledge develops and changes with time and space. Hence, such knowledge includes time-tested practice that developed in the process of interaction of humans with their environment (Alcorn, 1984). Therefore, it is the result of many generations long year's experiences, careful observations and trial and error experiments (Martin, 1995).

Indigenous knowledge is a body of knowledge built up by a group of people through generations of living in close contact with nature and it is cumulative and dynamic. It builds upon the historic experiences of people and adapts to social, economic, environmental, spiritual and political change. The quantity and quality of traditional knowledge differs among community members according to their gender, age, social standing, profession and intellectual capabilities. 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 one generation to the other generation verbally with great secrecy (Jansen, 1981). 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, hence there is a need for systematic documentation of such useful knowledge through ethnobotanical research (Amare Getahun, 1976).

2.3. Traditional medicinal plants

The world health organization WHO (2001) defined traditional medicine as the total combination of knowledge and practices that can be formally explained or used in prevention and elimination of physical, mental or social imbalance and relying exclusively on practical experience and observation handed down from generation to generation, whether verbally or in writing (Yilma Desta *et al*., 1996; cited in Fassil Kibebew, 2001).

According to Fassil Kibebew (2001), about 75-90 % of the rural population in the world (excluding western countries) relies on traditional medicines as their only health care system. According to WHO (2001), consultation of medicinal practitioners is very helpful for the development and incorporation of useful approaches in planning and budgeting system for health care provision of most developing nations and indigenous communities. In Africa, traditional medicine plays a central role in health care needs of rural people and urban poor. Here, it is said that, this situation would remain so long as modern medicine continues to be unable to meet the health care of the people of the continent effectively (Jansen, 1981).

Their value and role of this health care system will not diminish in the future, because they are both culturally viable and expected to remain affordable, while the modern health care service is both limited and expensive (WHO, 1998). Indigenous traditional medicinal practices were carried out essentially based on private practice, i.e. private agreement between consenting parties, and the knowledge of traditional practice in most cases has descended through oral folklore (Asfaw Debela *et al.,* 1999).

2.3.1. The Role of Medicinal Plants

It was stated that the great geomorphologic and topographic feature of Ethiopia is responsible for tropical, sub-tropical and temperate climatic conditions (Dawit Abebe *et al.,* 2003). The major implication of this reality regarding health problems in the country is that the evolution and diversity of disease and their causative agents as favored by the extreme physical and climatic features of the country. The situation led Ethiopians to have attempted to come up with remedies or practices that restore or enhance good health in response to the disease. However, knowledge of the remedies and practices was either based on oral tradition or on information that is codified in the early medico-religious manuscripts (Dawit Abebe *et al.,* 2003).

It was emphasized that the passing of time does not seem to obliterate the long history of the use of plant remedies by indigenous people of Ethiopia to treat variety of disease and aliments (Dawit Abebe *et al.,* 2003). Hence the persistence of traditional medicinal plant use to the present day is mainly attributed to priority preseason such as the possession of a conservative Ethnomedicinal tradition coupled to residence in an area with diverse flora over many generations (Dawit Abebe *et al.,* 2003).Moreover, the widespread use of traditional medicine among urban and rural population in Ethiopia could be owing to cultural acceptability, efficacy against certain type of disease, physical acceptability and economic affordability as compared to modern medicine (TilahunTekle Haimanot and Mirutse Giday, 2007).

Kim (2005) added that in ancient cultures, people methodologically and scientifically collect information on herbs and developed well defined herbal pharmacopoeias. Hence, much of the pharmacopoeias of scientific medicine of today were derived from the herbal lore of native people. Leonti *et al.* (2003) noted that the relevance of the historical depth of medicinal plant use from a variety of perspectives. Not only would it show unambiguously that indigenous cultures have an in depth knowledge of certain botanical taxa, which has been transmitted over centuries prior to it becoming important in the context of developing novel pharmaceuticals but also as importantly, such research would demonstrate the historical development of an intricate relationships between culture and its environment (Leonti *et al.,* 2003). The presence of various laboratories in academia, private institutions, and industry that are following leads from natural sources of plants and other organisms at global scale is

also a good indication of the possibility to discover potential drugs for combating disease (Fikadu Fulas, 2001 and Dawit Abebe *et al.*, 2003).

2.3.2. Integration of Traditional Practices and Modern Medicine

It was stated that the ancient and culture bounded medicinal practices which extend before the application of science to health matters is among the implications of traditional medicine. Hence, for the advancement of medical science in general and more to health of the society where they are practiced in particular, the different traditional medical systems have their own doctrines and concepts which can contribute to the advancement of medical science (Yilma Desta *et al.,* 1996).The relationship between biomedicine and local tradition of healthcare needs special attention. He added that although there is controversy among different authors regarding the two healthcare systems, a more general point emphasized by most authors is that biomedical and local practitioners should have more mutual understanding and respect for each other. A good justification is the presence of a growing mutual respect between representatives of traditional medicine and modern healthcare services in most societies (Mesfin Kasaye, 1996).

Kano (2003) noted that the basic science areas of herbal medicine provide a means of assuring the quality and safety of herbal remedies leading to the discovery of clinically important drugs. Photochemical analysis should be conducted for the validity and safety use of reported medicinal plants taking note of negotiation to safeguard the intellectual property rights of traditional healers. On that note, scientists cannot underestimate the no-scientific aspects of traditional healers rather; their role must be to help improve the medicinal aspect, the usage of medicinal plants. Hence integration of traditional practices and modern medicine can result in successful drug discovery and help to fulfill the health demand of the needy community (Jager, 2005, Kebu Ballemie *et al.*, 2004).

2.4. Medicinal plants and Ethnomedicinal studies conducted in Ethiopia

2.4.1. Traditional medicinal plants in public healthcare system

Plants have been used as a source of traditional medicine in Ethiopia from the time immemorial 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 Ethiopian people (Pankhurst, 1965; 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 (Fassil 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. It is common for people living in rural and urban areas to treat some common ailments using plants available around them. For example, *Hagenia abyssinica* is used to expel tapeworm and *Rutachalepensis*is used for various health problems treatment (Abbink, 1995).

Various ethnobotanical studies have been conducted in different parts of Ethiopia, though it is not enough comparing with the size and diversity of cultures in the country. Among the research conducted on ethnobotanical study of medicinal plants in Ethiopia, Ermias Lulekal *et al.* (2008) collected the highest number. Ethnomedicinal uses of 230 plants species were documented from Mana Angetu District, which is found in Bale Zone of Oromia Region. Of these, 181 (78.70%) were used as human medicine, 27 (11.74%) as livestock medicine and the remaining 22 (9.7%) were for treating both human and livestock ailments. A similar study by Mirutse Giday (2001), on Zay people indicated as herbs stood first in which Zay people derive their medicine (55%), followed by trees and shrubs (33%). Whereas, the study conducted by Debela Hunde *et al*. (2004), in Boosat around Welenchiti area, stated that shrubs rank first with 59% followed by herbs 14% by which indigenous people of Boosat derive theirs and their livestock remedies.

A more recent study in Ethiopia particularly in Bale zone still indicates the wealth of local people to use plant species to treat their ailments. Local people harvest different plant parts for the preparation of traditional remedies. For instance, the study conducted by Jima and Megersa (2018) in Berbere district indicated that roots are the plant parts harvested to prepare majority of traditional medicine. In other study by Demie *et al.* (2018) leaves reported to be the dominant plant parts used for preparation of remedy. 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, most people lack access to health care and where available the quality is largely below standard (Abbiw, 1996).

Therefore Archer (1990) and Nijar (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).

2.5. Threats and conservation of medicinal plants in Ethiopia

2.5.1. Threats to medicinal plants

People use many wild species of plants for food, medicine, clothing, shelter, fuel, fiber, income generation and the fulfilling of cultural and spiritual needs throughout the world (Zemede Asfaw, 2001). Ethiopia's traditional medicine as elsewhere in Africa 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 by Ethiopian people are harvested from wild habitats (Mirutse Giday, 1999; Tesfaye Awas, Zemede Asfaw, 1999 and Demie *et al.*, 2018) 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, over harvesting, 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 Zemede Asfaw (2001), medicinal plants are at conservation risk due to over use and destructive harvesting. Root and bark collection may kill the plant in harvest (Dawit Abebe and Ahadu Ayehu, 1993). 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. Recent finding of Haile Yineger (2005) confirms the fact that of the total plant parts to prepare remedies root is widely used with 64 species (35.5%) followed by leaf 47 species (25.97%) which hence affects sustainable utilization. In a study made by Kebu Ballemie *et al.* (2004) the order of importance of the threat factors on medicinal plants in Fentalle area were harvest of medicinal plants for firewood, charcoal, drought, agriculture, house use and trade.

Decline in the knowledge and utilization of medicinal plants of Zay people is due to environmental degradation and intense deforestation (Mirutse Giday, 2001). Debela Hunde *et al.* (2004) also asserted that modern education as having an impact on the medicinal plant knowledge. They pointed out that those students who attended modern schools are showing unwillingness to learn from their parents, which is an evidence for the gradually disappearing traditional knowledge.

2.5.2 Conservation of traditional medicinal plants

Conservation is defined as the sustainable use of biological resources. The concept of sustainability is now seen as the guiding principle for economic and social development, particularly with reference to biological resources.

Ideally all plants should be conserved as evolving populations in their natural ecosystem although it is not practically feasible for all species. Hence, it was recommended that both in situ and ex situ conservations are two complementary conservation measures that are being practiced by the conservation strategy in Ethiopia (Abebe Demissie, 2012).However, it was emphasized that the two conservation measures have their own drawbacks so that an accurate knowledge of the genetic structure of a species is important for capturing genetic diversity in the species, otherwise conservation must be based on known ecological characteristics of the species. In summary, it was stated that achievements in agricultural practices in countries with ancient and deeply rooted healing tradition such as India and China in particular, where Ethiopians have to learn much, have long been neglected and have not been available for a broad audience (Edwards, 2011).

Moreover, it was underlined that appropriate knowledge about the ecology, regeneration, germination strategies, propagation and horticulture of many species is still fragmentary. However, more and more attempts are being made to cultivate useful medicinal plant species

in field gene banks which is among the recent progresses in medicinal plants conservation that tries to tackle lack of knowledge (Govil *et al.,* 2005; IBC, 2010)

3. Methodology

3.1. Description of the study area

3.1.1. Geographic location and Topography of study area

The study was conducted in Gura damole district, Bale zone, Oromia regional state, Southeast Ethiopia. The district is located at about 575 km from the capital city, Addis Ababa. Geographically, the study area is located 7°05' N and 40° 12'E its altitudinal range is 900-2200 m a.s.l. The study area receives bimodal rainfall (NMA, 2018). The mean annual temperature of the study area is 22˚C; while, the annual rainfall is 1600mm.The district possess two major rainy seasons which are autumn ('Arfasa') in Afaan Oromo which extends from September to February and winter ('Genna') from March to August which covers 60 % and 40% respectively.

The study was carried out in 6 rural kebeles selected from 15 rural kebeles of the district following stratified random sampling technique based on accessibility and availability of people practicing different uses of medicinal plant which of namely; Sado Werke, Raytu, Shabo Retebo, Engoye ilani, Yedi and Jibri (Gura Damole District Agriculture and postural development office profile, 2018).

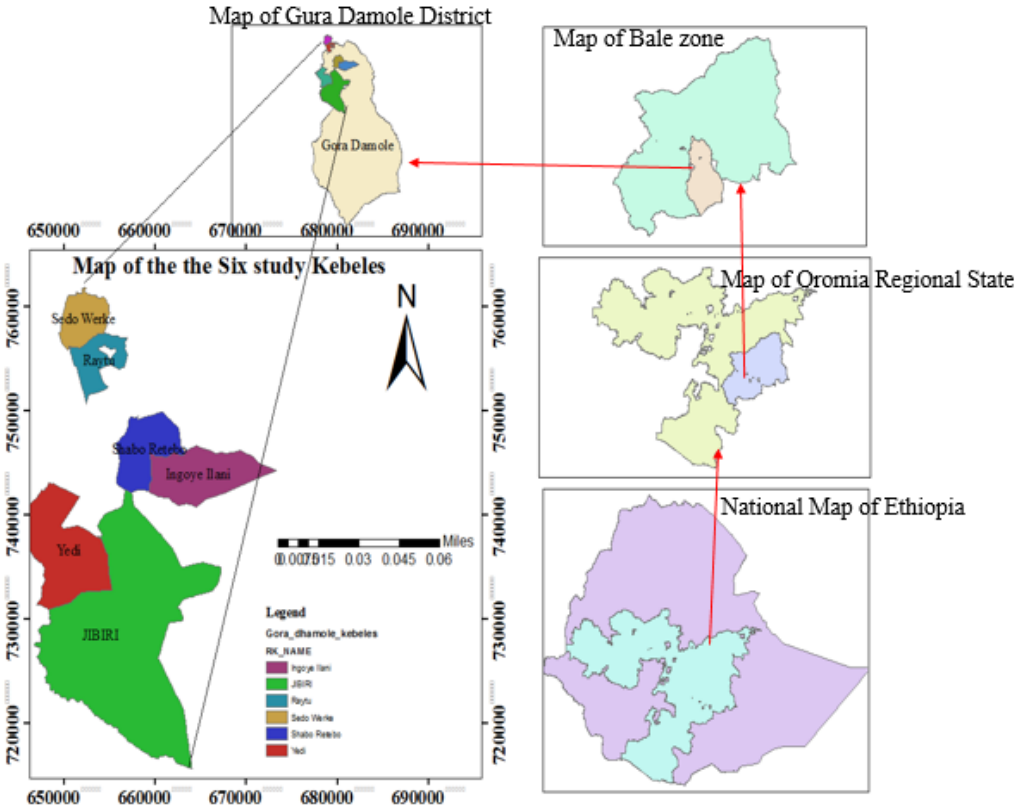

Figure 1: Map of the study area

3.1.2. Geomorphology and vegetation types

The undulating topography of the district lands is characterized by diverse geomorphologic features. The district is characterized by plain and hilly topography was rugged, highly dissected by deep valleys and river gorges that have western drainage system. Unpublished data from the district agricultural office indicates that 50% of the land area was plain followed by 28% hilly, 5% cliffs and 25% other topographic features. With respect to soil type, 60% of the soil belongs to red soil followed by 20% black soil, 15% gray soil and the remaining 5% belongs to others (Personal communication with the district Agricultural office).

The natural vegetation of the study area belongs to the dry evergreen montane vegetation type (White, 1983; Dawit Abebe, 1993; Friis and Sebsebe Demissew 2001). The area is dominated by remnant trees such as *Acacia abyssinica, Cordia africana, Croton macrostachyus, Erythrina brucei, Ficus species, Hagenia abyssinica, Juniperus procera, Podocarpus falcatus,* and others. Moreover, the western extremes of the district are characterized by dense impenetrable scrublands and Acacia woodlands (Dawit Abebe, 1993).

3.1.3. Farming Practice

The economic activity of the local community is based on agriculture (crop production and animal husbandry). But the area highly depends on animal husbandry. The common domestic animals are Camel, Cattle, Goat, and Donkey. The common crop productions are Maize, Wheat, Barley, and Sorghum (Gura Damole District Agriculture and postural development office profile, 2018).

The agricultural system of Gura damole district is predominantly a cereal farming system (GDDAPDO, 2018). The crops are mainly cereals, pulses and oil crops with root crops generally being of minor importance. On the other hand, integration between crops, livestock and trees is very weak compared to other agricultural systems. Livestock provides draught power, but manure is not important in the cropping system (GDDAPDO, 2018).

3.1.4. Population

The 2013 CSA estimated report indicated that, the population of Gura damole district is projected to be 38, 125. Of which, about 19, 479 are Male whereas, 18, 646 are Female. With

6,925household out of these the 6sites covers 1,578 households (Gura damole District Agriculture and postural development office profile, 2018).

3.1.5. Major diseases

The major diseases of the study area were Evil eye, Fibril illness, sudden sickness, Common cold, Hepatitis and Headache. (Table 1).

Table 1: The most dominant diseases cited by the study key informants

SN	Diseases name	Local Name	High	Medium	Low
1	Evil eye	Budaa/ Jiinnii	✓		
2	Fibril illness	Miichii	✓		
3	Sudden sickness	Dingatagna	✓		
4	Common cold	Qufaa	✓		
5	Eye disease	Dhibee Ijaa		✓	
6	Hepatities	Dhibee Simbiraa	✓		
7	Stomach disease	Dhibee Garaa		✓	
8	Headache	Bowwoo	✓		
9	Gonnorhoea	Cophxoo			✓
10	Teeth disease	Dhukkubbii Ilkaanii			✓

Source: Key informants of the study area, 2019

3.1.6. Economic activities and Sources of livelihood

Regarding to livestock herding like traditional oxen fattening are very important practice supporting the Livelihood of the farmers and also bee keeping is being practiced (Gura damole district Agriculture and postural development office profile, 2018).

Depending on the location, local people must travel for 1to 4 hours to reach market places. The nearest large market beyond Raitu Anole is in the Gura Damole District, Goro in the Goro District, Haro Dumal and Bele in the Berbere District (Gura Damole District Agriculture and postural development office profile, 2018).

3.2. Data Collection Methods

3.2.1. Reconnaissance survey

A reconnaissance survey of the study area was conducted from August 01 to 30/2019 and determined to include 6 study kebeles. The study was carried out in three altitudinal varying six sites. Areas with higher Yedi, Jibri and Engoye sites were lower altitude while Sado Werke, Raitu and Shabo Retebo sites were located in higher altitude.

3.2.2. Informant selection

A total of 90 respondents were selected by using random sampling technique from the six study sites. Totally, 12 key informants were selected, 2 individual from each study site. Key informants were purposively selected based on the recommendation of knowledgeable elders, local authorities and developmental agents. Moreover, they were selected based on the explanation that particular informants gave during an interview. Local healers were also considered as key informants since they are expected to have intensive knowledge of medicinal plants.

3.2.3. Ethnobotanical data collection

Ethnobotanical data collection was carried out to collect data on medicinal plants used to treat human ailments in Gura damole district as described by Martin (1995) and Cotton (1996).The techniques used for ethnobotanical data collection were semi structured interviews as described by Cotton (1996) and Martin (1995), field observation, preference ranking and direct-matrix ranking according to Alexiades (1996). The respondents' background, treatment methods, local name of medicinal plants used, source of collection (wild/cultivated), growth form, plant part used, methods of preparation and application, threats to medicinal plants and conservation practices of respondents were carefully recorded. Observations were made on the morphological features and habitats of each medicinal plant species in the field.

The frequency of citation for each of the reported ailments was used as a basis to identify the most frequently occurring human ailment in the study area.

The status of all the medicinal plants was recorded as abundant, less abundant, rare or very rare as per healers' perception during the semi structured interviews. To determine the most threatened medicinal plants in the study area, researcher short listed all medicinal plant species. The area covered all habitat types occurring in the area: rocky/hilly areas, flat top mountain/plateaus, valleys and reverie areas, and plain areas.

3.2.4. Specimen collection and Identification

Specimens of medicinal plants found to be major components of the vegetation of the district were collected and crosschecked for their local names with the help of key informants and development agents. Botanical names were given by taken to Madda Walabu University and

using various volumes of the Flora of Ethiopia and Eritrea books and available floras (Bekele-*Tesemma et al.* 1993, Edwards *et al.* 1995, 1997, 2000, Fichtl and Admasu 1994, Hedberg and Edwards 1989, 1995, Hedberg *et al.* 2004, 2006, November *et al.* 2002).

3.3. Data Analysis

The collected Ethnobotanical data were entered into Excel spreadsheet 2010 and summarized. Data collected during informal survey was partially analyzed on the daily basis and followed with complete analysis. Quantitative data from household semi-structured interviews were collected, coded and the variables were selected for summarizing and organizing to present comparative result of medicinal plan uses and conservation. The results of the semi-structured interviews were analyzed by using computer program which is Statistical Package of Social Science (SPSS version 20) and Micro soft EXCEL.

3.3.1. Descriptive statistics

Descriptive statistical methods such as frequency, percentage was employed and graphs and tables showing the results generated.

3.3.2. Preference Ranking

A preference ranking technique was employed with informants to rank some selected medicinal plant species according to their value or desirability. According to Martin (1995), preference ranking is one of the methods used to rank five to seven items and arrange those items based on a given criterion. Each rank is given an integer value, 1, 2, 3, 4, and 5with the most important item given the highest value, while the least important assigned the smallest value. The plant believed to be the most desirable one gets the highest value and the one with the least the lowest value. The numbers are summed for all respondents, giving an overall ranking for the items by the selected group of respondents.

Preference ranking of all the medicinal plant species (6 species) reported by traditional healers to treat evil eye was conducted following Martin, (1995) and Alexiades, (1996), so as to show healers' perception on the relative degree of efficacy of the 6 species and get useful information to identify target plants for future pharmacological investigations. The key informants for purposes of ranking these species were selected randomly from among all informants who reported to treat the ailment.

3.3.3. Paired comparison

Paired comparison can be used for evaluating the degree of preferences or levels of importance of certain selected plants/ parts of plants (Nemarundwe and Richards, 2002). A list of the pairs of selected items with all possible combinations is made and sequence of the pairs and the order within each pair is randomized before every pair is presented to selected informants and their responses recorded and total value was summarized. In this study, 12 key informants to indicate the efficacy and popularity of six medicinal plants species used to treat evil eye and rank was made based on the report of the informants.

3.3.4. Direct Matrix Ranking

Direct matrix ranking exercise was employed following Martin (1995) and Cotton (1996) in order to compare multipurpose based on information gathered from informants, number of multipurpose species were selected out of the total medicinal plants and use diversities of these plants was listed for 12 randomly selected key informants to assign use values to each species. Each chosen key informant was asked to assign use values (5=best, 4=very good, 3=good, 2=less used, 1=least used and 0= not used). The values (average score) of each species was summed up and ranked.

4. Results and Discussions

4.1. Results

4.1.1. Demographic characteristics of respondents

Of the total households included in the study the majorities were male-headed households (79.8%) followed by female-headed households (20.2%). The information presented in (Table 2) reveals that the respondents between 50–60 years old accounts for 24% of the sampled households, and only 17% of the respondents were between 18–30 years. The respondents 31 – 49 years accounts 59 % this indicated that most of the population of the study area were aged category. Moreover the majority of respondents were married about 87% and a few of them were single 3%, divorced 7%, and widowed 3% household heads (Table 2).

It is also indicated that the size of the households per family, 57% of the total respondents surveyed, had a family size of 5 to 6 children. Approximately 33% of participants were between three to four children in a family size. 6% of the sampled households had a family size ranging from 1 to 2 and only 4% of the sampled households had a family size ranging from 7 to 8. The average household size is 6 individuals per household. This, in turn, shows, in addition to an increase in family size, that related changes have occurred in the pattern of agriculture, expanding the cultivated area, mainly in forestland (Alemu M, 2011).

Accordingly, significant proportions (20%) of the sampled households were can't read and write. The percentages of respondents who attended primary school (grade 1-8), secondary school (grade 9-10) and preparatory school (grade 11-12) were 47%, 30%, 3%, respectively. This indicates that as grade level increases, the number of households attending education decreases. Above grade 12 diploma and degree were not recorded in the study areas.

Table 2: Demographic characteristics of respondents of the study area

No	Demographic	Characteristics	Frequency	Percent
1	Sex	Male	72	79.8
		Female	18	20.2
		Total	90	100
2	Age	18-30	15	17
		31-49	53	59
		50-60	22	24
		Total	90	100
3	Marital Status	Single	3	3
		Widowed	6	7
		Married	78	87
		Divorced	3	3
		Total	90	100
4	Household size	1_2	5	6
		3_4	30	33
		5_6	51	57
		7_8	4	4
		Total	90	100
5	Educational Status	Can't read and write	18	20
		Reads and writes	3	3
		Grade1-8	42	47
		Grade 9-10	27	30
		Total	90	100

4.1.2. Medicinal plant species used to treat human diseases

A total of 30 medicinal plant species from 21 families were recorded (Appendix1). The most dominant families were *Solanaceae* and *Asteraceae* ranked first (3 species each) and followed by *Cucurbitaceae, Fabaceae, Euphobiaceae* and *Lamiaceae* with 2 species each (Table 3). The remaining families represented by 1 species each (Table 3).

Table 3: List of Medicinal plant families in the study area

No	Scientific name	Family	Local name (in Afan Oromo)	Habit
1	*Aloe pubescens*	*Aloaceae*	Hargisa	H
2	*Bidens pilosa*	*Asteraceae*	Maxxanne	H
3	*Calpurnia aurea*	*Fabaceae*	Ceekataa	T
4	*Carissa spinarum*	*Apocynaceae*	Hagamsa	S
5	*Coccinia grandis*	*Cucurbitaceae*	Gaaleexaruu	L
6	*Croton macrostachyus*	*Euphorbaceae*	Bakkanniisaa	T
7	*Curcumis ficifolius*	*Cucurbitaceae*	Hancotee	H
8	*Dodonaea angustifolia*	*Sapindaceae*	Ittacha	S
9	*Ehretia cymosa*	*Boraginaceae*	Ulaaga	S
10	*Embelia schimperi*	*Myrsinaceae*	Haanquu	T
11	*Eucalyptus globulus*	*Myrtaceae*	Baargamooadii	T
12	*Gomphocarpus integer*	*Ascelpiadaceae*	Harmallaa	H
13	*Nicotiana tabaccum*	*Solanaceae*	Tamboo	S
14	*Olea europaea subsp.cuspidata*	*Oleaceae*	Ejersa	T
15	*Oscimum gratissimum*	*Lamiaceae*	Daamaakasee	S
16	*Osyris quadripartita*	*Santalaceae*	Waatoo	S
17	*Phytolacca dodecandra*	*Phytolacaceae*	Handoodee	S
18	*Podocarpus falcatus*	*Podocarpaceae*	Birbirsa	T
19	*Premna schimperi*	*Lamiaceae*	Urgeessaa	S
20	*Rhamnus staddo*	*Rhamnaceae*	Qadiidaa	S
21	*Rhus vulgaris*	*Anacardiaceae*	Daboobeessaa	S
22	*Ricinus communis*	*Euphobiaceae*	Qobboo	S
23	*Rubia cordifolia*	*Rubiaceae*	Laaleessaa	L
24	*Rubus steudneri*	*Rosaceae*	Goraa	S
25	*Silene macrosolen*	*Caryophyllaeae*	Waaggartii	S
26	*Solanecio angulatus*	*Asteraceae*	Raafuuosolee	H
27	*Solanum incanum*	*Solanaceae*	Hiddi	S
28	*Tamarindus indica*	*Fabaceae*	Rooqaa	T
29	*Vernonia amygdalina*	*Asteraceae*	Ebicha	T
30	*Withania somnitera*	*Solanaceae*	Unso	S

The medicinal plants to treat human ailments constitute shrubs (11species, 36.6%), trees (9 species, 30%), herbs (8 species, 26.6%) and lianas (2species, 6.6%) (Figure 4).

Table 4: Medicinal plant families in the study area with the corresponding numbers of species

Families	Species	Proportion (%)
Solanaceae	3	15.8
Asteraceae	3	15.8
Cucurbitaceae	2	10.5
Euphorbaceae	2	10.5
Fabaceae	2	10.5
Lamiaceae	2	10.5
Apocynaceae	1	5.3
Boraginaceae	1	5.3
Aloaceae	1	5.3
Myrsinaceae	1	5.3
Oleaceae	1	5.3
Caryophyllaeae	1	5.3
Santalaceae	1	5.3
Rosaceae	1	5.3
Podocarpaceae	1	5.3
Myrtaceae	1	5.3
Phytolacaceae	1	5.3
Sapindaceae	1	5.3
Rubiaceae	1	5.3

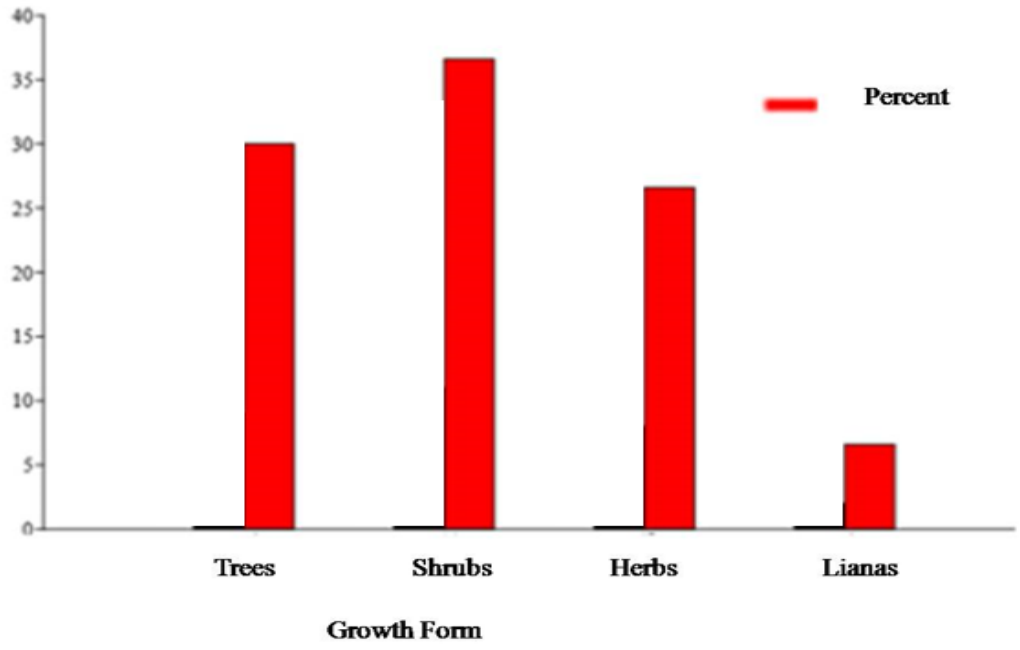

Figure 2: Growth forms of medicinal plants used for human ailment treatment

4.1.3. Plant parts used of the medicinal plants

The plant parts used for medicinal purposes, the practitioners mostly harvest Leaves (14 species 46.7%), Root (11 species 36.7%), Stem (2 species 6.6%) and Seed (3 species 10%) of the total recorded (Figure 3 and Appendix 2).

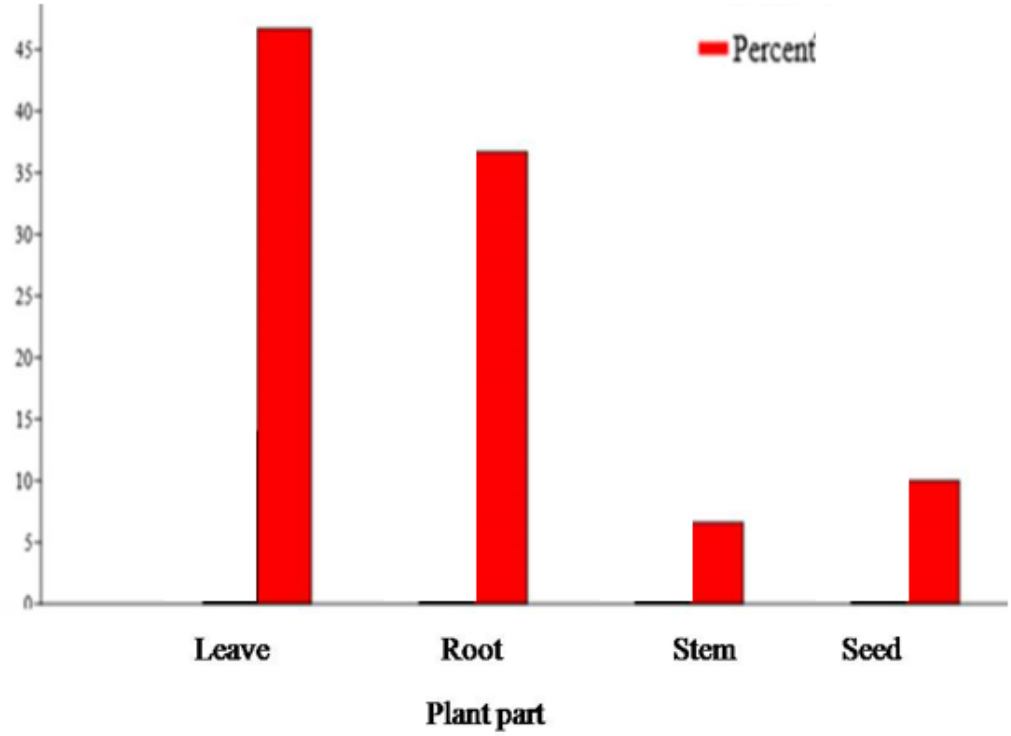

Figure 3: Distribution of medicinal plant parts used for human ailment treatment

4.1.4. Route of Administration

The result of this study revealed that the application methods plants for medicines are applied in several methods, among which put on and rub, put on and chewing, drinking, fumigate, chewing and fumigate and wash were mentioned (Table 5). Drinking accounts for 46.7%.

Table 5: Application methods of plant remedies in human ailment treatment

No	Application methods	Number of plants	Percent
1	Put on and rub	6	20
2	Put on and chewing	1	3.3
3	Drinking	14	46.7
4	Fumigate	4	13.3
5	Chewing	3	10
6	Fumigate and wash	2	6.7

4.1.5. Ranking of Medicinal plants in the Study Area

4.1.5.1. Preference Ranking

The result of the preference ranking indicated that, the most important medicinal plant species preferred by respondents were *Carissa spinarum* used to treat evil eye followed by *Ehretia cymosa* whereas, *Withania somnitera* was the least preferred (Table 5).

4.1.5.2. Direct matrix ranking

The result of the direct matrix ranking indicated that, the most important medicinal plant species with multipurpose uses was *Carissa spinarum*, followed by *Ehretia cymosa* whereas, *Solanum incanum* was the least preferred (Table 6). Moreover, major medicinal plant and plant parts were involved in direct matrix ranking exercise in order to evaluate their relative importance to the people (Table 6).

Table 6: Average score of key informants) preferable medicinal plants and based on their mostly use values

	key informants (n = 12)						
Plant species	A	B	C	D	E	Total	Rank
Bidens pilosa	4	0	0	0	0	4	4
Carissa spinarum	5	3	0	0	2	10	1
Curcumis ficifolius	3	0	0	0	0	3	5
Ehretia cymosa	4	2	0	0	0	6	2
Solanum incanum	2	0	0	0	0	2	6
Withania somnitera	5	0	0	0	0	5	3

Where: A = Medicine, B = Firewood, C = Charcoal, D = Construction, E = Fence and n = number of key informants

4.1.6. Medicinal plant current status and threats to medicinal plants

4.1.6.1. Medicinal plant current status

According to respondents, it is recognized that the vegetation cover of the locality has dramatically changed over time. Results of this study showed that *Carissa spinarum*, *Curcumis ficifolius* and *Solanum incanum* were the most dominant medicinal plant species (Table 7).

Table 7: The most Medicinal plant current status of the study area

No	Scientific name	Informant consensus	Frequency (%)	Relative Frequency
1	*Carissa spinarum*	22	61.1	6.5
2	*Solanum incanum*	19	52.8	5.6
3	*Ehretia cymosa*	9	25.1	2.7
4	*Bidens pilosa*	17	47.2	5.1
5	*Aloe pubescens*	16	44.4	4.7
6	*Embelia schimperi*	11	30.5	3.3
7	*Olea europaea subsp.cuspidata*	6	16.7	1.8
8	*Curcumis ficifolius*	19	52.8	5.6
9	*Withania somnifera*	6	16.3	1.7
10	*Silene macrosolen*	7	19.4	2.1
11	*Croton macrostachyus*	14	38.9	4.2
12	*Tamarindus indica*	8	22.2	2.4
13	*Gomphocarpus integer*	18	50.1	5.3
14	*Osyris quadripartita*	16	44.4	4.7
15	*Rubus steudneri*	16	44.4	4.7
16	*Oscimum gratissimum*	20	55.5	5.9
17	*Nicotiana tabaccum*	15	41.6	4.4
18	*Solanecio angulatus*	3	8.3	0.9
19	*Podocarpus falcatus*	3	8.3	0.9
20	*Ricinus communis*	12	33.3	3.6
21	*Premna schimperi*	14	38.9	4.2
22	*Eucalyptus globulus*	6	16.7	1.7
23	*Coccinia grandis*	5	13.8	1.5
24	*Vernonia amygdalina*	16	44.4	4.7
25	*Dodonaea angustifolia*	8	22.2	2.4
26	*Phytolacca dodecandra*	7	19.4	2.1
27	*Rubia cordifolia*	10	27.8	2.9
28	*Calpurnia aurea*	14	38.9	4.2

4.1.3.2. Threats to medicinal plants

The study results showed that the numbers of medicinal plant species are being threatened in the study area (Table 8).The major factors claimed as threats were, Agricultural expansion followed by deforestation and drought, overgrazing ,fire collection, charcoal (Table 8).

Table 8: Average score for direct matrix ranking of six factors of threats for medicinal plants and six commonly threatened all plants

	Respondents (n = 90)							
	A	B	C	D	E	F	Total	Rank
Agricultural expansion	4	5	5	4	5	5	28	1st
Overgrazing	0	3	3	4	0	2	12	4th
Fire	4	1	0	0	0	4	9	5th
Deforestation	5	5	3	0	5	4	22	2nd
Charcoal and firewood	0	0	0	0	0	1	1	6th
Drought	3	3	2	3	4	3	18	3rd
Total score	16	17	13	11	14	19		
Rank	3rd	2nd	5th	6th	4th	1st		

Where: - A = *Carissa spinarum, B = Solanum incanum, C = Oscimum gratissimum, D = Nicotiana tabaccum, E = Curcumis ficifolius and F = Croton macrostachyus;* n = number of key informants; Level of measurements5 = Best, 4 = Very good, 3 = Good, 2 = less, 1 = Least and 0 = no value

4.1.7. Indigenous knowledge

Cross tabulation of the result on the mean number of species reported by each respondent versus Raytu kebele also showed highly significant difference (Table 9). However, no significant correlation was observed between the educational level of respondents and the number of species reported by each respondent.

Table 9: Statistical tests of significance

No	Variables tested	Coeff.	Std.err.	t	P	R
1	Education	0.11081	0.15044	0.73653	0.46339	0.00407
2	Age of respondents	-0.0158	0.02461	-0.641	0.52323	0.00257

The result of this study indicated that the mean score of age class and education level from the study area (Table 9). The compared indigenous knowledge to medicinal plants in their area for age class of 18-30 showed less knowledgeable than 31- 49 and 50 - 60 (Table 9). Similarly, the compared educational status to different mean sources for the study area showed that Grade 1-8were less knowledgeable than Read and write and can't read and write respondents (Table 9).

4.1.7.1. Informant Consensus

Of the 30 medicinal plants claimed to treat human health in the study are, all were not equally important. Among the plant species, *Carissa spinarum* was cited by 18 respondents followed by *Silene macrostachyus* by 12 respondents (Table 10).

Table 10: Informant Consensus

SN	Scientific name	People who cited the plant	Percent
1	*Bidens pilosa*	8	8.9
2	*Carissaspinarum*	18	20
3	*Curcumis ficifolius*	7	7.8
4	*Ehretia cymosa*	9	10
5	*Embelia schimperi*	10	11.1
6	*Gomphocarpus integer*	6	6.7
7	*Oscimum gratissimum*	4	4.4
8	*Silene macrostachyus*	12	13.3
9	*Solanum incanum*	5	5.6
10	*Withania somnitera*	11	12.2

4.2. Discussion

4.2.1. Medicinal plant species used to treat human diseases

A total of 30 medicinal plant species were recorded, where one species can treat a single disease or a number of diseases (Appendix 1).Other studies came up with higher number of species used among some of the major ethnic groups in the country. For instance, the Oromo people (the major ethnic group in Ethiopia) residing in Mana Angetu district, southeastern Ethiopia use 230 plant species to prepare traditional medicine (Lulekal *et al.* 2008) and the Konta people in southern Ethiopia use about 120 species (Hailemariam*et al.* 2009). On the other hand, the Zay people use relatively fewer species (33) of medicinal plants (Giday, 2001). This could be an indication for the assumption that the loss of tradition (cultural shift) in minorities is greater than in larger groups (Lusebaand Van Der Merwe, 2006).

The results of this study indicated that, *Solanaceae* and *Asteraceae* mostly represented by three species each, and *Fabaceae*, *Euphobiaceae* and *Lamiaceae* represented by two species each plant families as the contributor of higher number of species used for medicinal purposes. The results of this study showed that, *Asteraceae* family as the contributor of higher number of plant species used for medicinal purposes than other families is in line with similar studies conducted elsewhere in Ethiopia (GideyYirga *et al.* 2008, Yineger *et al.* 2008, Mesfin *et al*. 2009, Demie *et al*., 2018), whereas other researchers reported that Fabaceae is the leading family with the highest number of medicinal plants (Yineger and Yewuhalaw 2007, Megersa *et al.* 2013, Birhanu and Ayalew 2018). Both finding are reasonable since the two families are both represented by higher number of species in the Ethiopian flora (Megersa *et al.*, 2013).

Herbaceous plant forms cannot withstand drought and, in most cases, they are likely being over-utilized (including the whole plants). Contrary to our findings, a relatively higher number of shrubs and herbs were previously reported elsewhere in Ethiopia (Amenu 2007, Hailemariam *et al.* 2009, Demie *et al.*, 2018). Similarly, other studies conducted in Boosat sub district, central eastern Ethiopia Hunde *et al*. (2006), in Gimbi district, western Ethiopia Tolassa (2007), in Wonago district, southern Ethiopia Mesfin *et al.*(2009), and in Mana Angetu district, southeastern Ethiopia Lulekal *et al.*(2008) showed that shrubs are the most frequently used growth forms. These variations could be attributed to agro-ecological diversity of the country that favors different plant forms, and socio-cultural factors which determine specific knowledge in different communities (Bekele 2007).

The result of this study indicated that the mode of application may vary, an appreciable number of the medicinal plants recorded in this study are also medicinally important in other parts of Ethiopia (Gidey 2001, Hunde *et al.* 2006, Amenu 2007, Teklehaymanot and Gidey 2007). Some of the plants that were reported in common include; *Carissa spinarum, Solanum incanum, Embelia schimperi, Nicotiana tabaccum, Vernonia amygdalina, Croton macrostachyus* and *Oscimum gratissimum*. These similarities indicate use of medicinal plant species and the existence of associated knowledge shared among ethnic groups. The fact that some of the reported plants are having similar uses elsewhere in the world supports their likely pharmacological effectiveness having been tested in different areas by different cultures (Hailemariam *et al.* 2009).

Carissa spinarum scored the highest mark and ranked first as it was cited by highest number of respondents indicating that it was the most effective in human ailment treatment followed by *Nicotiana tabaccum.* Ethnobotanical investigations done elsewhere in Ethiopia also reported that *Carissa spinarum* and *Nicotiana tabaccum* was used for human ailment treatment (Tadesse Mekonnin, and Demissew Sebsibe, 1992 and Balemie *et al*., 2004).

4.2.2. Plant parts used for traditional medicine preparation

Analysis of the plant parts of the medicinal plants used in the study area revealed that local people were recorded to use the leaves, roots, seeds, bark, stem, tuber and whole plant to prepare remedy. All parts of various plant species are used against a variety of diseases. In some cases, more than one part of the same species, especially a combination of leaves and stems, are used in the preparation of different medicines. This finding is in line with many Ethno botanical surveys showing that leaves were the most frequently used in areas such as China, India, Thailand, Bangladesh, Peruvian Amazon and Colombia (Singh and Singh, 2009; Kadir *et al.,* 2013; Vásquez *et al.,* 2013; Island *et al.,* 2013), Many indigenous communities elsewhere also utilized mostly leaves for the preparation of herbal medicines (Ayyanar and Ignacimuthu, 2011).

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, preparation of medicinal teas and the presence of more bioactive ingredients in leaves developed in response to phytophagous organisms since they are the most vulnerable parts of a plant. The use of more than one medicinal plant species was reported by healers to treat health problems, which

could be attributed to the additive or synergistic effects of the mixtures. The leaves were predominantly used part compared with others, this is because they were collected very easily than underground parts, flowers and fruits (Giday *et al.,* 2009) and in scientific point of view leaves are active in photosynthesis and production of metabolites (Ghorbani, 2005). Beside this another important reason of using leaves could be concerning conservation of the plants as digging out roots might be the cause of death of the plant and putting the species in a vulnerable condition (Kadir *et al.,* 2012).

Traditional healers reported that most of the Ethno medicinal plant species used by healers to treat human ailments were reported to be rare and the abundance of Ethno medicinal plant species differed significantly with respect to the plant part used, plant condition, marketability and multiple uses of the species. This might be due to impact of such factors on anthropogenic pressure and the survival of Ethno medicinal plant species.

4.2.3. Medicinal plant current status and associated threats

According to respondents, it is likely that the vegetation cover of the locality has changed over time. Obviously, there is a chance of finding plant species either clumped together in one spot or evenly distributed in a given area. Similarly, this study revealed that about 61.1% of the most frequent plants in the district are *Carissa spinarum*. A similar study undertaken in the central rift valley of Ethiopia Giday, (2001) has also reported the abundance of valuable medicinal plants decreased with time. These observations indicate that valuable medicinal plants in different parts of the country are being depleted. This could be due to the fact that they are over utilized for diversity of uses and disappeared from some parts, or that the destruction of their habitat through deforestation restricted their occurrence to only some sites.

Abundance for medicinal plants shows30 species have declined with time. Therefore, the abundances of a majority of the medicinal plants declined within the given period. Some of these (e.g., *Solanecio angulatus* and *Podocarpus falcatus*) have shown dramatic declines. The decreasing trend in abundance of medicinal plants could be attributed to the fact that most of the species are heavily harvested because of the multiple uses they have. A similar observation was made in Uganda by Nanyunja (2003) where the author stated that the trend in abundance of medicinal plants could be related with the multiple uses of the species.

In general, wild vegetation resources including medicinal plants in different parts of the country are continuously shrinking. The loss of medicinal plants could be due to multiple factors such as deforestation (expansion of agriculture), charcoal production, cutting trees for construction, and fire wood collection, among others. These resources are openly accessed. Repeated drought incidences and poverty (the lack of livelihood options) have aggravated the situation. Drought in the 1970s was mentioned by informants as a major historical event which contributed to the degradation of plant resources.

4.2.3.1. Threats to medicinal plants

The study revealed that medicinal plants are under pressure from various anthropogenic and natural factors. Local people's perceptions of factors threatening the medicinal plants were determined through priority ranking among some selected informants. Pressures from agricultural expansion, Charcoal and firewood, deforestation, drought and fire have were the main factors for threating medicinal plant species. Similar studies were reported by Balemie *et al.* (2004) and Lulekal *et al.* (2008) as main factors for environmental degradation as well as the depletion of medicinal plants. In general, several studies in different parts of Ethiopia have shown that wild plant resources including medicinal plants are subjected to a number of anthropogenic and natural factors such as agricultural expansion, collection for fuel and construction, recurrent drought and overgrazing (Mesfin *et al.*, 2009).

4.2.4. Indigenous knowledge as conservation of medicinal plants

In a broad sense, conservation is achieved through in-situ and ex-situ means. In-situ conservation is conservation of species in their natural habitat. Some traditional medicinal plants have to be conserved in-situ due to difficulty for domestication and management (Zemede Asfaw, 2001). 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, this can be possible 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 (Zemede Asfaw, 2001).

The conservation of medicinal plants and use was independent of the educational level of traditional healers. This suggests that traditional healers could inherit the knowledge and use

of Ethno medicinal from parents as long as they belong to a knowledgeable family member irrespective of their educational status. This finding is in agreement with the work of who reported that the proportion of healers who transferred their knowledge and those who did not was similar irrespective of their educational level. Results also revealed that many of the traditional healers reported to transfer their knowledge and use of Ethno medicinal plants orally to their favorite family member. Such transfer of indigenous knowledge is liable to erosion as it could vanish when knowledgeable elders die before the knowledge is transferred or during resettlements of individuals or communities.

The experiences of the local people were recorded during the interviews (Table 9). The two species frequently reported by local dwellers were *Carissa spinarum* and *Silene macrostachyus.*

In the study area, the tragedy is that the knowledge on medicinal plants depth and width become lesser and lesser due to its secrecy, to gain the knowledge, influence of modern education, religious and awareness factors, which all results in gradual disappearance of indigenous knowledge on medicinal plants (personal observation). Ethno medicinal knowledge diminishes with the death of elderly knowledgeable members of the society, since less and less young people are willing to acquire the knowledge (Caniago and Siebert, 1998).

5. Conclusion and Recommendation

5.1. Conclusion

Results from this study revealed that local people in Gura Damole district use plant species for preparation of traditional medicine to treat human diseases. A total of 30 plant species belonging to 21 families were recorded from the study area. *Asteraceae* and *Solanaceae* were the leading Family by which local people of the district derive their medicine for treatment of various ailments as they were represented by 3 plant species and trees stood first by which local people of the study area derive their remedy. Indigenous people of the study area have their own ways of managing resources as they are endowed with specific culture, tradition and ethical norms. The present study revealed people of the area have different depth and width of knowledge of natural resources in general and medicinal plants in particular in their locality. Thus, local peoples know when, where and how to use these plant resources around their locality. Peoples of the study area partly depend on this resource for their day-to-day health care.

5.2. Recommendations

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

- ✓ Indigenous people of the study area should involve in conservation and management plans of plant resources or their indigenous knowledge in their locality.
- ✓ Traditional medicinal plants are central to the indigenous cultures and material needs. Therefore, formal and non- formal education systems should be designed to create positive attitude among the young by integrating in to the curricula about the traditional use of plants in general and medicinal plants in particular.
- ✓ Raising awareness on threat for future sustenance, by development agents or agricultural workers through which sustainable management and conservation be practiced.
- ✓ 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.
- ✓ Encouraging people to grow medicinal plants in home gardens, mixing with crops in farmlands and live fences.
- ✓ Promoting the establishment of local botanical garden at least at district level is recommended.

References

Abbink, J. Medicinal and ritual plants of Ethiopian Southwest. An account of recent research. Indigenous Knowledge and Development Monitor 3(2): 6-8. 1995.

Abbiw, D.K. Misuses and abuses of self- medication with medicinal plants: The case of Erythropbleum in Ghana. In: (Vander Mesen and Vander Burget (Eds.)). The Biodiversity of African plants: Proceeding of the 14th AETFAT Congress. 27 August 1994. Pp. 700-718. 1996.

Abebe Demissie. Biodiversity Conservation and Sustainable use of Medicinal Plants:Problems and Prospects. In: Conservation and Sustainable use of Medicinal Plants in Ethiopia (Medhin Zewdu and Abebe Demissie, eds.), Proceedings of the National workshop on Biodiversity Co. 2012.

Abera Geyid, Dawit Abebe, Asfaw Debela and Kelbesa Urga. Screening of Ethnomedicinal Plants of Ethiopia for their antimicrobial effects. Proceedings of a National Workshop held in Addis Ababa, Ethiopa, 30 June- 2 July 2003, EHNRI, Pp.81-91. 2003.

Aketch, C.A. A Preliminary survey of conservation status of some plant species in Kenya. In: Edwards, S. and Zemede Asfaw. (eds.). The Status of some plant resources in parts of Tropical Africa. Botany 2000: East and Central Africa. NAPRECA Monograph series No 2, pp, 54-65.Addis Ababa University, Addis Ababa, Ethiopia, 1992.

Alcorn, B.J. Huastec Mayan Ethnobotany. University of Texas Press, Austin, USA, 1984.

Alexiades, M. Collecting ethnobotanical data. An introduction to basic concepts and techniques. In :(Alexiades, M. and Sheldon J.W.eds.). Selected Guideline for ethnobotanical research: A Field Manual, pp.58-94. The New York. Botanical Garden, U.S.A, 1996.

Alexiades, M.N.,. Collecting Ethnobotanical Data: An Introduction to Basic Concepts and Techniques. In: Alexiades, M.N. (Ed.), Selected Guideline for Ethnobotanical Research: A Field Manual. The New York Botanical Garden, New York, pp: 52-94. 2006.

Amare Getahun. Some common medicinal and poisonous plants used in Ethiopian folk medicine. Pp. 63. Addis Ababa University, Ethiopia. 1976.

Archer, F.M. Planning with people. Ethnobotany and African uses of plants in Namaqualand (South Africa). In: (Peters, C.R., and Jejoly. J., eds.). Proceeding of the 12th plenary meeting of AETFAT. Pp. 959- 972. Mitt. Institute, Allg. Bot.Hamburg. 1990.

Asfaw Debela, Dawit Abebe and Kelbessa Urga. An overview of traditional medicine in Ethiopia: Prospective and Development Efforts. In: (Tamirat Ejigu, ed.). Ethiopian Pharmaceutical Association. Silver Jubilee Anniversary, Special Issue. pp. 45-53. Ethiopian Pharmaceutical Association. Addis Ababa, Ethiopia. 1999.

Balick, M.J. and Cox, P.A.R. Plants, People and Clture. The Science of Ethnobotany. Scientific American Library, New York, USA. 2006.

BGCI Medicine. Botani Gardens Conservation International/British air ways/ International Center for Conservation). `Plants Education. Fact sheets 3 pp4. 1998.

Bidgood, S. Ethiopian artifacts made with plant materials: Vanishing wonders. Biol. Skr. 54:311-318. 2011.

Birhanu, and S. Ayalew, "Indigenous knowledge on medicinal plants used in and around Robe Town, Bale Zone, Oromia Region," Journal of Medicinal plant Research, vol. 12, no. 16, pp. 194-202, 2018.

Bye, R.A. Botanical perspectives of ethnobotany of the Greater South West. Econ. Bota. 39 (4):375-386. 1985.

Cotton, C.M. Ethnobotany: Principles and Applications. John Wiley and Sons, New York, 412pp. 1996.

Cotton, C.M.,.Ethnobotany: Principles and Application. John Wiley and Sons Ltd., New York. 2006.

Dawit Abebe and Ahadu Ayehu. Medicinal plants and Enigmatic Health practices of Northern Ethiopia. B.S. P.E. 1993.

Dawit Abebe and Ahadu Ayehu. Medicinal plants and Enigmatic Health practices of Northern Ethiopia. B.S. P.E. 1993.

Dawit Abebe, Asfaw Debela and Kelbessa Urga. Medicinal and other useful plants of Ethiopia. EHNRI, Addis Ababa, Ethiopia. 2003.

Dawit Abebe. The Role of Medicinal Plants in Healthcare coverage of Ethiopia, the possible Integration. Proceedings of the National workshop on Biodiversity Conservation and Sustainable use of Medicinal Plants in Ethiopia. IBCR, Addis Ababa. Pp. 6-21. 2010.

Debela Hunde. Use and Management of Traditional Medicinal Plants by Indigenous People of Bosat Woreda, Wolenchiti area: An ethnobotanical approach. M.Sc. Thesis, Addis Ababa, Ethiopia. 2001.

Dewick. Medicinal Natural Products: Abiosynthetic Approach, Willey and Sons, UK. 2009.

Edwards, S. Flora of Ethiopia and Eritrea Vol. 2 Part 1. Magnoliaceae to Flacourtiaceae.The National Herbarium Addis Ababa Ethiopia and Upsala Sewden. 2011.

Ensermu Kelbessa, Sebsebe Demissew, Zerihun Woldu and Edwards, S. Some threatened Endemic plants of Ethiopia. In: (Edwards, S. and Zemede Asfaw eds.). The status of some plants in parts of tropical Africa. pp. 35-55. NAPRECA, No.2. Botany 2000: East and Central Africa. 1992.

Ermias Lulekal. Ethnobotanical Study of Medicinal Plants and Floristic Composition of the Manna Angatu Moist Montane Forest, Bale. M.Sc. Thesis. Addis Ababa, Ethiopia. 2005.

Fassil Kibebew. The status and availability of oral and written knowledge on traditional health care in Ethiopia. In: (Medhin Zewdu and Abebe Demissie eds.). Conservation and Sustainable Use of Medicinal plants in Ethiopia. Proceeding of the National workshop on Biodiversity Conservation and Sustainable use of medicinal plants in Ethiopia, 28 April- 01 May 1998, pp. 107-119. IBCR, Addis Ababa. 2001.

Fichtl, R. and Admasu Adi. Honeybee Flora of Ethiopia. Margraf Verlag, Wikersheim, Germany. Pp.510. 1994.

Fikadu Fulas. Ethiopian Traditional Medicine: Common Medicinal Plants in Perspectiv. Siox city, USA. 2001.

Fisseha, M., D. Sebsebe and T. Tilahun,. An ethnobotanical study of medicinal plants in wonago wereda, SNNPR, Ethiopia. J. Ethnobiol. Ethnomed., 5: 28. 2009.

Friis, I. and Sebsebe DEmissew. Vegetation maps of Ethiopia and Eritrea. A review of existing maps and the need for a new map for the flora of Ethiopia and Eritrea. Biol. Skr. 54: 399-439. 2001.

G. Demie, M. Negash, and T. Awas, “Ethno botanical study of medicinal plants used by indigenous people in and around Dirre Sheikh Hussein heritage site of South-eastern Ethiopia,” Journal of Ethno pharmacology, vol.220, 2018.

Getachew Addis, Dawit Abebe and Kelbessa Urga. A Survey of Traditional Medicinal Plants in Shirka Ditrict, Arsi Zone, Ethiopia. Ethiop.Pharmaceutical Journal 19:30-47. , 2001.

Govil, J.N., Pandey, J., and Shivakumar, B.G. Book Review: Recent Progress in Medicinal Plants, Vol. 5-Crop improvement , production technology, trade and commerce (1st edn.). Phytomedicine 12. 2005.

Haile Yineger. A study of Ethnobotany of Medicinal plants and Floristic Composition of the Dry Afromontane Forest at Bale Mountains National Park. M.Sc. Thesis. Addis Ababa, Ethiopia. 2005.

Haile, Y. and Y. Delenasaw,. Traditional medicinal plant knowledge and use by local healers in sekoru district, Jimma Zone, South western Ethiopia. Journal Ethnobiol. Ethnomed.,3. 2007.

Hamilton, A.C., Medicinal plants, conservation and livelihoods. Biodivers Conserv.,13. 2004.

Hedberg, I. Botanical methods in ethno pharmacology and the need for conservation of medicinal plants. Journal of Ethno pharmacology. 38: 121-128. 1993.

IBC. Biodiversity Conservation and Strategic Action plan for Ethiopia, Volume II, United Version. Iinstitute of Biodiversity Conservation, Addis Ababa, Ehiopia. 2010.

Jager. Is Traditional Medicine Better off 25 years latter? Journal of Ethnopharmacology 100. 2005.

Jansen, P.C.M. Spices, Condiments and Medicinal Plants in Ethiopia. Their taxonomy and Agricultural Significances. Centre for Agricultural Publishing and Domestication, Wageningen, Nethelands. 2011.

Judd, W.S., Cambell, C.S., Kellogg, E.A., Stevens, P.F. and Donguhue, M.J. Plant Systematics: A phylogenetic Approach, 2nd edition, Sinauer Associates, Inc., Sundeland, Systematics: A phylogenetic Approach, 2nd edition, Sinauer Associates, Inc., Sundeland, USA. 2012.

Kano, B. Integration of Traditional Medicine with Modern Medicine. In: Traditional Medicine in Ethiopia, Proceedings of a National Workshop held in Addis Ababa, Ethiopia, 30 June- 2 July 2003. EHNRI, Addis Ababa, Ethiopia. 2003.

Kebu Ballemie, Ensermu Kelbessa and Zemede Asfaw. Indignous Medicinal Plant Utilization, Management and Threats in Fantalle Area, Eastern Shoa, SINET: Ethiopia. Journal Sci., 3. 2004.

Kim, H.S. Do not put too much value on conventional medicine. Journal of Ethnopharmacology 100. 2005.

Kokwaro, J.O. Medicinal Plants of East Africa. East African literature Bureau, Nairobi Kenya. 2006.

Kurt, H. and M. Andrew,. Twenty years of research into medicinal plants. Phytochem. Rev., 1: 275-285. 2002.

Langenheim, J.h. and Thiemann, K.U. (1982). Plant Biology and its Relation to Human Affairs. University of California, Santa Cruz, New York. Pp. Pp. 12-45

Langenheim, J.H. and Thimann, K.V. Botany: Plant Biology and its Relation to Human Affairs. John Willey and Sons Inc. University of California, USA. 2002.

Leonti, M., Sticher, O. and Heinrich, M. Antiquity of Medicinal Plant Ussage in two Macro-Mayan ethnic groups (Mexico). Journal of Ethnopharmacology, 88. 2003.

Martin, G.J. Ethnobotany: A method Manual. Chapman and Hall, London. Pp. 265-270. 1995.

Martin, G.J.,.Ethnobotany: A Method Manual. Champan and Hall, London. 1995.

Medhin, Z., G.M. Tsige and A. Kaleab,. Global perspectives of medicinal plants. In: Medhin, Z. and D. Abebe (Eds.), Conservation and sustainable use of medicinal plants in Ethiopia. Proceeding of the National Workshop on Biodiversity and Sustainable Use of Medicinal Plants in Ethiopia. IBC. Addis Ababa, 2001.

Mesfin Kasaye. Integration of Traditional Medicine with Modern Healthcare services. In: Proceedings of the workshop on Development and Utilization of Herbal Remedies in Ethiopia. Nazareth, 4-6 June 1996, EHNRI (eds.). 1996.

Mesfin, T. and D. Sebsebe,. Medicinal Ethiopian Plants. Inventory, Identification and Classification. In: Edwards, S. and Zemede Asfaw (Eds.), Plants used on African traditional medicine as practiced in Ethiopia and Uganda, East Africa. Botany 200: N NAPRECA, Monograph Series . No. 5: 1-19. Addis Ababa University, Ethiopia, 5, 2002.

Mirgissa Kaba. Utilization of plant medicine for the treatment of health problems. The case of Oromo of Chora District Illubabor Zone, Western Ethiopia. The Ethiopian Journal of Health Development, 10(3): 161-166. 1998.

Mirutse Giday. An Ethnobotanical study of medicinal plants used by the Zay People in Ethiopia. M.Sc. Thesis. Uppsala, Sweden. 1999.

Mirutse Giday, Zemede Asfaw, Thomas Equist and Zerihun Woldu. An Ethnobotanical Study of Medicinal Plants used by the Zay people in Ethiopia. Journal of Ethnopharmacology 85. 2003.

Mirutse, G., A. Zemede, W. Zerihun and T. Tilahun,. Medicinal plant knowledge of the bench ethnic group of Ethiopia: An ethnobotanical investigation. Journal of. Ethnobiology and Ethnomedicine.,5. 2009.

Moa Megersa, Z. Asfaw, E. Kelbessa, A. Beyene, and B. Woldeab, “An ethnobotanical study of medicinal plants in Wayu Tuka district, east Welega zone of Oromia regional state, west Ethiopia,” Journal of Ethno biology and Ethno medicine, vol. 9, article 68, 2013.

Nijiar, G.S. Trips and biodiversity: The threats and responses: A third World View, pp.1- 36. Third World Network, Penang, Malesiya. 1996.

Ohigashi, H.,. Utilization and Production of Medicinal Plants. In: Makiu (Ed.), Medicinal Crops in Ethiopia Current Status and Future Potential. JAICAF. 2008.

Pankhurst, R. A historical examination of traditional medicine and surgery. Ethiopian medicinal Journal. 3 (4): 160. 1965.

Ragunathan, M. and M. Solomon,. Ethnomedicinal survey of folk drugs used in Bahirdar Zuria District, Nortwestern Ethiopia. Indian Journal of Traditional Knowledge, 8. 2007.

Rios, J.L. and Recio, M.C. Medicinal Plants and antimicrobial activity. Journal of Ethnopharmacology 100. 2005.

Sebsebe Demissew and Ermias Dagne. Basic and Applied Research on Medicinal Plants of Ethiopia. Proceedings of the National workshop on Biodiversity Conservation and Sustainable use of Medicinal Plants in Ethiopia. IBCR, Addis Ababa. 2011.

Soejarto, D.D., Frong, H.H.S. and Tan, G.T.Ethnobotany/Ethnopharmacology and mass bioprospecting: Issues on Intelectual property and benefit sharing. Journal of Ethnopharmacology 100. 2005.

Sofowora, A.,. Medicinal plants and traditional medicine in Africa. Journal of Ethnobiologyand Ethnomeddicne, 6. 2003.

Stace, A.C. Plant Taxonomy and Biosystematics (2nd edition). Cambridge University Press, UK. 2010.

Tafesse, M. and L. Mekonnen,. The role of traditional veterinary herbal medicine and its constraints in animal healthcare system in Ethiopia. In: Medhin, Z. and D. Abebe (Eds.), Conservation and sustainable use of medicinal plants in Ethiopia. . Proceeding of the National Workshop on Biodiversity and Sustainable Use of Medicinal Plants in Ethiopia, IBCR, Addis Ababa, 2011.

Tamirat Bekele. Vegetation Ecology of the Remnant Afromontane Forests on the Central Plateau of Shoa, Ethiopia. Acta Phytogeogr., Upsala. 1993.

Tesema Tanto, Mirutse Giday, Nugusu Akililu and Teshome Hunduma. Stocktaking and Informationon the Medicinal Plants of Ethiopia. In: National Biodiversity Strategy and Action Plan Project Medicinal Plant Team, IBDA, Addis Ababa. 2003.

Tesfaye Awas. Plant Diversity in western Ethiopia: Ecology, Ethnobotany and Conservation. PhD DissertatioN, Faculty of Mathematics and Natural Sciences, University of Oslo, Norway. 2007.

Tesfaye, A. and D. Sebsebe,. Ethnobotanical study of medicinal plants in Kafficho people, Southwestern Ethiopia. In: Birhanu, T. and B. Shiferaw (Eds.), Proceedings of the 16th International Conference of Ethiopian Studies. Addis Ababa, Ethiopia. 2009.

Tesfaye, H., D. Sebsebe and A. Zemede,. An ethnobotanical study of medicinal plants used by local people in the lowlands of Konta special Wereda, Southern Nations, nationalities and peoples regional state, Ethiopia. Journal Ethnobiol. Ethnomed., 5. 2009.

Thomas, H. Indigenous Knowledge, Emanicipation and Alination. Journal of knowledge transfer and utilization. 8 (1): 63-73. University of Washington. 1995.

Tilahun Tolossa Jima and Moa Megersa Ethno botanical Study of Medicinal Plants Used to Treat Human Diseases in Berbere District, Bale Zone of Oromia Regional State, South East Ethiopia

Tilhun Teklehaymanot and Mirutse Giday. Ethnobotanical Study of Medicinal Plants used in the Zegie Peninsula, Northwestern Ethiopia. Journal of Ethnobiology and Ethnomedicine. 3. 2007.

Tsige Gebre-Mariam. Applied Research in Medicinal Plants. In: Conservation and Sustainable use of Medicinal Plants in Ethiopia (Medhin Zewdu and Abebe Demissie, eds.), Proceedings of the National workshop on Biodiversity Conservation and Sustainable use of Medicinal Plants. 2010.

Verma, S. and Singh, S.P. Current and future status of herbal medicines. *Veterinary World*. 1. 2008.

White, F. Vegetation of Africa, a descriptive memoir to accompany the UNESCO/ACTFA/UNSO Vegetation map of Africa. UNESCO, Natural Resource. Res. 20. 1983 .

WHO. Regulatory situation of herbal medicines: A Worldwide Review. Pp. 1-9. WHO/TRM/98.1,Geneva. 1998.

WHO. African traditional medicine: Our culture, our future. Afr. Health Monitor, 4(1). 2003 .

Wright, C.W.,. Plant derived antimalarial agents: New leads and challenges. Phytochemistry, 4. 2005.

Yilma Desta, Asfaw Debela and Getachew Assefa. Traditional Medicine in: Global and National perspectives. In: Proceedings of the workshop on Development and Utilization of Herbal Remedies in Ethiopia. EHNRI, Nazareth, Ethiopia, 4-6 June 1996.

Zemede Asfaw and Ayele Nigatu. Homegardens in Ethiopia: Characteristics and Plant Diversity. SINET:Ethiop. Journal Science. 18. 2005.

Zemede Asfaw. Survey of Indignous food plants, their preparations and homgardens in Ethiopia. In; Indignous African food Crops and useful Plants. UNU/IRNA Assessment series no.B6.B.N.O kigbo (series editor). 2007.

Zemede Asfaw. The role of Homegarden in Production and Conservation of Medicinal Proceedings of the National workshop on Biodiversity Conservation and Sustainable use of Medicinal Plants in Ethiopia. IBCR, Addis Ababa. 2001.

Zemede Asfaw.. The Enset-Based Homegardens of Ethiopia. In: Eyzaguire, P.B., and Linars, O.F. (eds) Homegardens and Agrobiodiversity. Smithsonian Institution, Washington. 2004.

Zemede, A.,.Ethnobotany of Nations, Nationalities and Peoples in Gambella, BenishangulGumuz and Southern Regions of Ethiopia. Addis Ababa University Press, Addis Ababa, Ethiopia. 2005.

Appendices

Appendix 1. Checklist of Semi-structured interview items for collecting ethno botanical data

I. General Information

1. Date: …….Residence Area/village/ …….kebeles ……
2. Name of respondent …….. Sex ……..age ……
3. Marital status ……. Occupation/main job/ ……
4. Religion: Orthodox …… Protestant…… Muslim …….. Others ……...
5. For how long have you lived in the area? (Circle one).
   A. Since birth B. for the last 20 years C. for the last 10 years D.for less than 10 years
6. Educational background (what is the last grade attended?)
7. List the traditional way of classifying Forests/vegetation/ and landscapes in your area.
   - Vegetation ……. - Landscapes ……
8. What are the most common diseases of humans in your area?
9. List the signs and symptoms of a given diseases in your area?
10. How do people prevent and control a given disease in your area?

II. Ethno botanical Data

1. Mention plant types used to treat a given disease in the area /give local names/.
   1.1. Plants used to treat human diseases

2. Where do the plants grow? (From where they can be obtained?)
   2.1. In the wild?
   2.2. In Home gardens?
   2.3. Both in the wild and Home gardens?
3. What is the habit of the plant? Tree (T), Shrub(S), Herb (H), Liana (Li), Climber (Cl).
4. What are the most common habitats of a given medicinal plant?

5. What pare of the medicinal plant is used? Leaf (L), Root (R), Bark (B), Stem (St), Flower (Fl), Fruit (Fr), Seed (Se), Latex (Lx), and Whole plant (WP).
6. What is the method/condition of preparation of the medicinal plant?
   6.1. Crushed/C/, powdered/P/, concoction, deconcoction, infusion, used alone/Ua/, mixed with others/Mw/ Fresh/F/, Dry/D/, Fresh or Dry (F/D) Dosage: Does it vary among age groups, sex? If yes, state for each.
7. Way of administration: External/dermal, oral, nasal, ear.
8. Are there any side effects of the medicine? If yes is there any antidote?
9. Which member of the community uses the medicinal plant most and why?
10. Is the medicinal plant marketable?
11. Is the medicinal plant easily accessible? If not why?
12. What do the trend of accessibility look like as compared to the past 10 years?
13. How do the knowledge of medicinal plants use transferred in the community?
14. Is there any interference between modernization and medicinal plant use in the area?
15. Are community members who frequently depend more on medicinal plants than modern medicine? Why?
16. Which plant species in Q18 are the most preferred? Why?
17. Are there any taboos associated with medicinal plants in the area?
18. What are the major problems associated with medicinal plants in the area?
19. What do you think is the solutions for the above problems?
20. How are the medicinal plants conserved in the area?
21. Is there any efforts made to conserve the medicinal plants in the area?
22. Any information on other/non-medicinal/ uses of the medicinal plant.

Thank you!

Appendix1: List of medicinal plant species recorded in the study area

No	Scientific name	Family	Local name (in Afan Oromo)	Habit
1	*Aloe pubescens* L.	*Aloaceae*	Hargisa	H
2	*Bidens pilosa* L.	*Asteraceae*	Maxxanne	H
3	*Calpurnia aurea* (Aith.) Benth.	*Fabaceae*	Ceekataa	T
4	*Carissa spinarum* L.	*Apocynaceae*	Hagamsa	S
5	*Coccinia grandis (*L.) Voight	*Cucurbitaceae*	Gaaleexaruu	L
6	*Croton macrostachyus* Hochst.	*Euphorbaceae*	Bakkanniisaa	T
7	*Curcumis ficifolius* A. Rich.	*Cucurbitaceae*	Hancotee	H
8	*Dodonaea angustifolia* L. f.	*Sapindaceae*	Ittacha	S
9	*Ehretia cymosa* Thonn.	*Boraginaceae*	Ulaaga	S
10	*Embelia schimperi* Vatke	*Myrsinaceae*	Haanquu	T
11	*Eucalyptus globulus* Labill.	*Myrtaceae*	Baargamooadii	T
12	*Gomphocarpus integer* (N.E.Br.) Bullock	*Ascelpiadaceae*	Harmallaa	H
13	*Nicotiana tabaccum* L.	*Solanaceae*	Tamboo	S
14	*Olea europaea subsp.cuspidata* (Wall. and G.Donn) Cif.	*Oleaceae*	Ejersa	T
15	*Oscimum gratissimum* L.	*Lamiaceae*	Daamaakasee	S
16	*Osyris quadripartita* Decne.	*Santalaceae*	Waatoo	S
17	*Phytolacca dodecandra* L Her.	*Phytolacaceae*	Handoodee	S
18	*Podocarpus falcatus* (Thunb) R.Br. ex Mirb.	*Podocarpaceae*	Birbirsa	T
19	*Premna schimperi* Engl.	*Lamiaceae*	Urgeessaa	S
20	*Rhamnus staddo* A.Rich.	*Rhamnaceae*	Qadiidaa	S
21	*Rhus vulgaris* Meikle	*Anacardiaceae*	Daboobeessaa	S
22	*Ricinus communis* L.	*Euphobiaceae*	Qobboo	S
23	*Rubia cordifolia* L.	*Rubiaceae*	Laaleessaa	L
24	*Rubus steudneri* Schweinf.	*Rosaceae*	Goraa	S
25	*Silene macrosolen* Steud. Ex A.Rich.	*Caryophyllaeae*	Waaggartii	S
26	*Solanecio angulatus (*Vahl) C. Jeffrey	*Asteraceae*	Raafuuosolee	H
27	*Solanum incanum* L.	*Solanaceae*	Hiddi	S
28	*Tamarindus indica* L.	*Fabaceae*	Rooqaa	T
29	*Vernonia amygdalina* Del.	*Asteraceae*	Ebicha	T
30	*Withania somnifera* (L.) Dun.	*Solanaceae*	Unso	S

Where: T = Trees, S = shrubs, H = herbs and L = lianas

Local name	Scientific name	Family	Habit of the plant	Disease treated	Parts of the plant	Method of preparation	Method of administration
Hagamsa	*Carissa spinarum*	*Apocynaceae*	Shrub	Evil spirit and eye	Root	Drying the bark of the root and grinding	Fumigate the smoke and rubbing the medicine on the body of the filled person
Hiddii	*Solanum incanum*	*Solanaceae*	Herb	To stop bleeding cutting part of human organ	Leaf	Cut the leaf and crush	Put the crushed leaf on the bleeding part
				Sudden stomach ache	Root	Chewing the bark of the root	Chewing and swallowing the liquid
Hancotee	*Cucumis ficifolius*	*Cucurbitaceae*	Herb	Sudden stomach ache	Root	Drying and crushing the root	Mixing with water and drinking
Ulaagaa	*Ehretia cymosa*	*Boraginaceae*	Shrub	Fibril illness	Leaf	Cut the leaf	Rubbing the liquid of the leaf on the affected area
Maxxannee	*Bidens pilosa*	*Asteraceae*	Herb	Snake poison	Root and leaf	Chewing the leaf	Put on the bitten part
Hargiisaa	*Aloe pubescens*	*Aloaceae*	Herb	Headache	Stem	Boiling the juice of the plant with milk	Simply drinking the liquid
Hanquu	*Embelia schimperi*	*Myrsinaceae*	Tree	All stomach disease and parasite	Seed	Drying and grinding the seed make powder and mix with water	Simply drinking
Unso	*Withania somnitera*	*Solanaceae*	Herb	Evil eye and sprit	Root	Drying, grinding, make powder	Fumigate, washing the body with the prepared powder
Waggartii	*Silene macrosolen*	*Caryophyllaeae*	Herb	Evil eye and sprit	Root	Drying, grinding and make powder	Fumigate, rub on the body, wash the body with the medicine
Ejersa	*Olea europaea subsp.cuspidata*	*Oleaceae*	Tree	Influenza and fibril illness	Leaf	Cutting the leaf	Simply chewing the leaf
Bakkanniisa	*Croton macrostachyus*	*Euphobiaceae*	Tree	Gonorrhea	Root	Drying, grinding and make powder and mix with water	Drinking
Roqaa	*Tamarindus indica*	*Fabaceae*	Tree	Stomach disease	Seed	Mixing the seed with water	Drinking the liquid part of the seed
Harmallaa	*Gomphocarpus integer*	*Ascelpiadaceae*	Shrub	Liver disease	Root	Drying, grinding and make powder and mix with honey and water	Boiling and drinking
Waatoo	*Osyris quadripartita*	*Santalaceae*	Shrub	Cold	Root and stem	Drying, grinding, make a powder	Fumigate to the filled person
Daboobeessaa	*Rhus vulgaris*	*Anacardiaceae*	Tree	Urination problem	Leaf	Cutting fresh leaf	Chewing the fresh leaf
Goraa	*Rubus steudneri*	*Rosaceae*	Shrub	Stomach disease	Root	Drying, grinding, make a powder and mix with water	Boiling and drinking
Daamaakasee	*Oscimum gratissimum*	*Lamiaceae*	Shrub	Fibril illness	Leaf	Cut and crush the fresh leaf	Rubbing on the affected body
Tamboo	*Nicotiana tabaccum*	*Solanaceae*	Herb	Evil ey e and sprit	Leaf	Drying, grinding, make a	Fire and fumigate

						powder	
Raafuuosolee	*Solanecio angulatus*	*Asteraceae*	Herb	Evil eye and sprit	All part of the plant	Drying, grinding, make a powder	Boil with oil and drinking ,rubbing on the body
Qadiidaa	*Rhamnusstaddo*	*Rhamnaceae*	Shrub	Hepatitis	Leaf	Drying, grinding, make a powder	Boil with water and drinking
Birbirsa	*Podocarpus falcatus*	*Podocarpaceae*	Tree	Eye infection	Leaf and Bark	Drying, grinding, make a powder	Mixing with water and drinking
Qobboo	*Ricinus communis*	*Euphobiaceae*	Shrub	Rabies	Seed and Leaf	Drying, grinding, make a powder	Mixing with water and drinking
Urgeessaa	*Premna schimperi*	*Lamiaceae*	Tree	Teeth infection	Leaf	Cut and crush Fresh leaf	Put the medicine on the infected teeth
Baargamoo	*Eucalyptus globulus*	*Myrtaceae*	Tree	Stomach diseases	Leaf	Drying, grinding make a powder	Mixing with water and drinking
Gaaleexaruu	*Coccinia grandis*	*Cucurbitaceae*	Latex	All disease problem inside the	Root	Drying, grinding ,make a powder	Mixing with water and drinking
Ebicha	*Vernonia amygdalina*	*Asteraceae*	Shrub	Headache and eye disease	Leaf	Drying, grinding, make a powder	Fumigate the smoke with in the mouth and Nose
Ittacha	*Dodonaea angustifolia*	*Sapindaceae*	Shrub	Eye disease	Leaf	Cut and crushing fresh leaf	Drop the liquid of the leaf on the infected eye
Handoodee	*Phytolacca dodecandra*	*Phytolacaceae*	Shrub	Stomach disease problem	Root	Cutting fresh root	Chewing the root
Laaleessaa	*Rubia cordifolia*	*Rubiaceae*	Latex	Sex problem in males	Root	Drying, grinding, make powder and mix with water	Drinking
Ceekataa	*Calpurnia aurea*	*Fabaceae*	Tree	Stomach disease and Amoeba	Leaf	Cut and crush the fresh leaf and squeeze the liquid	Drinking the leaf juice