ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
FACULTY OF LIFE SCIENCE
PLANT BIOLOGY AND BIODIVERSITY MANAGEMENT PROGRAMME UNIT

Ethnobotanical Study of Medicinal Plants in Guji Agro-pastorilists, Blue Hora District of Borana Zone, Oromia Region, Ethiopia

BY

Mersha Ashagre Eshete

April, 2011
Addis Ababa

DECLARATION

This is my original work and has not been presented for a degree in any university and all material sources are dully acknowledged.

Name: Mersha Ashagre Eshete

Signature: _____

Date: _____

This work has been submitted for examination with my approval as advisor.

Name: Prof. Ensermu Kelbessa

Signature: _____

Date: _____

Name: Dr. Gemedo Dalle

Signature: _____

Date: _____

List of Contents

List of Tables……Page

List of Figures……Page

Appendices

AKNOWLEDGEMENTS

In the first place, I would like to express my deepest gratitude to my advisors Prof. Ensermu Kelbessa and Dr. Gemedo Dalle for their consistent, invaluable guidance, inputs and comments in developing and completion of my thesis. Furthermore, I thank Prof. Ensermu Kelbessa for his help in identification of my plant collections as well as in his adjustment of conditions for taking the required courses.

I am thankful to the Department of Biology especially Dr. Dawit Abate and Dr. Tilaye Wube for their great help in continuing my education after a semester of withdrawal. My thanks also go to the National Herbarium, AAU, for providing me with all the available facilities in plant specimen identification and the National Meteorological Agency, Addis Ababa, for provision of meteorological data.

I am very grateful to the administrative officials at Bule Hora District for their provision of letter of support to travel freely in rural kebeles during ethnobotanical data collection. I am also thankful to members of sectoral offices at District level for their consistent provision of relevant information concerning the study area. I would like to extend my thanks to the informants of Bule Hora District who shared with me their knowledge on medicinal plants and other relevant information. My thanks are also extended to the administrators of the selected kebeles and development agents (DAs) for their collaboration to get access to key informants to get relevant data. I am also thankful to my field assistant and translator Ato Kasim Bati. Last but not least, I am very much indebted to my dear wife Atsede Dejene and my children for their support and encouragement in many ways throughout the course of my study.

ABSTRACT

An ethnobotanical study of medicinal plants and associated indigenous knowledge was conducted between March and June 2010 in Bule Hora District, Southern Oromia, Ethiopia. The objective of the study was to collect, record, organize and analyze information on the use, management and conservation of medicinal plants as well as status of indigenous knowledge of the local people. This area lies between latitudes 5^0 30′ and 5^0 50′ North and longitudes 38^0 0′ and 38^0 30′ East. The study involved traditional healers, knowledgeable elders and local communities. Different ethnobotanical techniques were used to collect and analyze the data such as semi – structured interview, guided field walk and observation, group discussion, preference ranking and paired comparison, use diversity matrix and fidelity level index, combined with descriptive statistical analysis. Sixty informants from eight kebeles were included in the study. A total of 106 plant species distributed in 98 genera and 46 families were collected from the study area and identified. In terms of number of species, Asteraceae appeared as the most prominent family that contains ten species in eight genera, followed by Rubiaceae containing nine species in eight genera and Lamiaceae that contain seven species in seven genera. From the total collected plants, 62 species (58.4%) are used for the treatment of 37 human ailments and 22 species (20.8%) for 25 livestock ailments, while 22 species (20.8%) are used to treat both livestock and human ailments. Widely used plant parts for human and livestock health care include leaves, roots, seeds, fruits and stems. Higher numbers of species (56.1%) were harvested for their leaves followed by roots, bark and stems (14.4%, 9.85% and 8.3% respectively). Large numbers (91.5%) of medicinal plants were cited to be used in fresh form. Shrub elements constitute the largest number with 45 species (42.5%) followed by herbaceous, 29 species (27.4%) and trees make the third growth forms with 17 species (16.0%) harvested for medicinal value.Oral administration is the dominant route (67.2%), followed by dermal (21.1%) in which pounding, crushing, chewing, rubbing, dry bath etc are recorded methods of preparation techniques. Modernization, introduction of new religion and acculturation have contributed in making the younger generation unwilling to practice and retain traditional knowledge. Even though the study area possesses diverse natural vegetation, the environment is under serious threat, mainly due to human induced pressure such as agricultural activities, fire wood collection, charcoal production and the need for construction materials. These have great effects on the availability of medicinal plants in particular and natural resources in general. Awareness raising on sustainable utilization of medicinal plants and their in – situ and ex- situ conservation are recommended.

Key words: Ethnobotany, indigenous knowledge, ailments, medicinal plants.

1. INTRODUCTION

1.1. Background and Justification

Ethnobotany is the study of people's classification, management and use of plants. It is defined as "local people's interaction with the natural environment: how they classify, manage and use plants available around them" (Martin, 1995). From the beginning of humanity, indigenous people have developed their own locality specific knowledge on plant use, management and conservation (Cotton, 1996). This complex knowledge, systems of beliefs and practices generally known as indigenous knowledge or traditional knowledge develops and changes with time and space, with change of resources and culture. Indigenous knowledge has developed as a result of human interaction with their environment. In this view, ethnobotanical studies are useful in documenting, analyzing and communicating knowledge and interaction between biodiversity and human society, how diversity in nature is used and influenced by human activities (Martin, 1995; Balick and Cox, 1996; Cotton, 1996).

Ethnobotanical studies are useful not only for documenting, analyzing and disseminating indigenous knowledge of local people but also to indicate interaction between biodiversity and human society, how diversity in nature is used and influenced by human activities (Martin, 1995). The ethnobotanical approach is also important as it involves local communities in the conservation of biodiversity. This is based on the idea that the healthiest ecosystems of the world are under the control of local communities, and local communities manage many species for which science has little information.

Thus, the need to undertake ethnobotanical researches and to document medicinal plants and associated indigenous knowledge has come to be an urgent task as already underlined by Pankhurst (2001) and Hamilton (2003). Since ancient times, plants have been indispensable sources of both preventive and curative traditional medicine preparations for human beings and livestock (Dery *et al.*, 1991). Some authors indicated that 70-80% of the world's population uses plants to solve basic medical problems (Farnsworth and Soejarto, 1991). Moreover, approximately 99% of veterinary care in developing countries is based on the use of plant extracts (Lectchemo and Craker, 1996). It was estimated that

25,000 to 75,000 species of higher plants have been used in traditional medicine worldwide (Farnsworth, 1985).

In the direct and intimate relationships as well as indispensable dependency of human beings upon plants for their livelihood, plants provide multiple and diverse uses for indigenous societies (Njau, 2001; Endalew Amenu, 2007). Various plants and plant products have been closely associated with many social cultures, customs and mythological rituals such as personal decoration (e.g. cosmetics and tattooing) and entertainment (e.g. musical instruments), arts and crafts and even magico- religious beliefs (Jain, 1986). Plants have significant medicinal value both in developing and developed counries. About half of the world's medicinal compounds are still extracted from plants (Frankel *et al*., 1995). Due to this reason, medicinal plants play a significant role in the health care of local people.

Ethiopia is a country with various types of climatic, topographic, soil features and different altitudes. This makes the country to have a rich and diverse fauna and flora. But little emphasis has been given to ethnobotanical (ethnomedicinal) studies over the past decades (Dawit Abebe, 2001; Mirutse Giday, 1999), even if there has been some attempt in investigating medicinal plants and indigenous knowledge on sustainable use and management of plant resources.

It is reported that nearly 80% of the population in Ethiopia use plant- based traditional medicine as their primary health care system (Dawit Abebe, 2001) and this wide use could be mainly attributed to the fact that it makes use of locally available plant resources (Dawit Abebe and Ahadu Ayehu, 1993; Seyani and Chikuni, 1997). The majority of medicinal plants, with exceptions are harvested from wild habitats, which are currently under great threat (WCMC, 1992). There are reports indicating that many potentially useful plants are disappearing throughout the world, and Ethiopia is not exceptional.

Loss of medicinal plants is attributed to conversion and destruction of habitats, overexploitation and use of destructive harvesting techniques (WCMC, 1992; IWU, 1993; IUCN, 1993; Haile Yineger, 2005; Mirutse Giday, 2007).

The study of Ethiopian medicinal plants has not been realized as fully as that of India, China, Brazil or other traditional communities elsewhere. There have been some organized ethnobotanical studies in the recent past in different parts of the country (Amare Getahun, 1976; Kloos, 1976; Jansen, 1981; Mesfin Taddese, 1986; Dawit Abebe, 1986; Mesfin Taddese and Sebsebe Demissew, 1992; Dawit Abebe and Ahadu Ayehu, 1993; Abbink, 1995; Mirutse Giday, 1999; Bayafers Tamene, 2000; Zemede Asfaw, 2001; Fekadu Fullas, 2001; Gemedo Dalle *et al*., 2005; Haile Yineger, 2005; Tizazu Gebre, 2005; Etana Tolosa, 2007; Endalew Amenu, 2007; Mirutse Giday, 2007; Tilahun Teklehaymanot and Mirutse Giday, 2007).

However, considering the country's varied flora and socio- cultural diversity, these studies are not enough and have covered few areas of the county. The current plant use trend in Bule Hora District shows that the environment is facing problems of resource depletion and loss of indigenous knowledge like other areas of the country. Thus, intensive ethnobotanical research plays a vital role to draw information on plants and related indigenous knowledge for conservation and sustainable utilization. Since ethnomedicinal healing systems vary across cultures, more studies are required. Like many other parts of the country, there is no such ethnomedicinal research and documentation carried out in Bule Hora District, Borana Zone, Southern Oromia. This study therefore, aimed at documenting indigenous knowledge on use and management of medicinal plants by herbalists to treat human and livestock ailments as well as assessing of the existing threats to these medicinal plants in Bule Hora District. This is believed to add up to the country's database of medicinal plants and in documenting indigenous knowledge of the people.

1.2. Statement of the Problem

Until this study was carried out in formerly called Hegeremariam District but now named as "Bule Hora District" any kind of ethnobotanical study was not conducted. But the area is rich in different natural resources even if they are being destroyed now due to human induced pressures such as deforestation for conversion of natural habitat into agricultural field. The indigenous people living in the study area also have their own unique cultural interactions with plants. They use many wild and domesticated species of plants for the fulfillment of cultural and spiritual needs. Over usage of medicinal plants from the wild and the lack of knowledge about proper conservation practices result in genetic erosion. The loss of medicinal plant taxa is a common problem in Ethiopia for sustainable use (Ensermu Kelbessa *et al.,* 1992). In addition to this, the rapid economic growth and cultural changes threaten the traditional lifestyle of indigenous people. As a result there is a greater danger for the loss of many useful medicinal plants together with traditional knowledge.

1.3 Significance of the Study

Nowadays, there is a great need to identify new medicinal plants due to the lack of cures for some diseases like cancer, HIV/AIDS and growing resistance of existing disease causative agents. Moreover, ethnobotanical research has led to the development of many commercial plants-derived medicines. As a result, there is no doubt for the necessity of indigenous knowledge of traditional medicine for the discovery of new medicines of plant origin so as to satisfy the increasing demand of drugs and medicines by human beings. This study has its own contribution to give clue for the discovery of new medicine through recording, compiling and documenting of medicinal plants and their associated indigenous knowledge used by the local people for proper utilization and management of plants. This in turn has a substantial input for the livelihood of local people to solve economic, environmental and health problems as well as provide a basis for further ethnobotanical studies that contribute towards protection and conservation of useful plants. From this and many other facts such as habitat destruction and loss of many medicinal plant taxa, it is essential and reasonable to care for and conserve ancient heritage and indigenous knowledge (Dawit Abebe and Ahadu Ayehu, 1993).

1.4 Objectives of the Study

1.4.1 General objective

The general objective of the study is to record and analyze medicinal plants and associated traditional knowledge of the agro – pastoralist communities in Bule Hora District, Southern Oromia.

1.4.2 Specific objectives

The specific objectives are:

- To collect, identify and document traditional medicinal plants used in the study area for the treatment of human and livestock health problems;
- To gather, record and document indigenous knowledge of the people on medicinal plants in the study area;
- To determine the most popular medicinal plants used in the study area.
- To analyze factors, if any, contributing to depletion or conservation of medicinal plants and/or associated knowledge in the study area;
- To provide recommendations that would contribute to the development of strategies for conservation and sustainable use of medicinal plants in the study area.
- To contribute to the on-going efforts towards building the ethnobotanical database of Ethiopia in order to facilitate further actions in the management and utilization of medicinal plants.

2. LITERATURE REVIEW

2.1 The Emergence and Progress 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). 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. The relationship between humans and plants is as old as human existence on earth. This close interaction and dependency of humans on plants is studied under the field of ethnobotany. Ethnobotany tries to find out how local people have traditionally used plants for various purposes and how they incorporate plants into their cultural traditions to develop attitudes and beliefs (Balick and Cox, 1996).

The term Ethnobotany was first coined by John Harshberger in 1895 (Jain, 1986). However, it has different interpretations and definitions depending on the interest of various workers. Cotton (1996) defined ethnobotany as the study of the use of plants by aboriginal people or the relationship between human societies with natural vegetation. On the other hand, Martin (1995) defined ethnobotany as the study of people's classification, management and use of plants.

In any case, ethnobotany is a broad term, which is considered the study of direct interaction and interrelationships between humans and plants (Martin, 1995). It is both an interdisciplinary and multidisciplinary science (Jain, 1986; Martin, 1995) which focuses on compiling, analysing, documenting and use of indigenous knowledge (IK) on plants as well as the proper utilization, conservation and management strategies (Martin, 1995). Moreover, Cotton (1996) and Balick and Cox (1996) described ethnobotany, as a useful science to explain the useful plants and associated indigenous knowledge of local community as well as their utilization and management. Hence, ethnobotanical study is very crucial for biodiversity and human society and to understand how it is valued and influenced by human activities within different human societies (Martin, 1995).

2.2 Indigenous Medicine

The term indigenous medicine (traditional or folk medicine) describes medicinal knowledge system, which developed over centuries within various societies before the era of modern medicine (Dawit Abebe, 1986). Traditional medicine has been defined by the World Health Organization as " the sum total of all knowledge and practices, whether explicable or not, used in the diagnosis, prevention and elimination of physical, mental or social imbalances and relying exclusively on practical experience and observation handed down from generation to generation, whether verbally or in writing"(WHO, 2002). This system of health care is also known as folk medicine, ethnomedicine, or indigenous medicine. World Health Organization estimates that at least 80% of the populations in most developing countries rely for their primary health care on traditional forms of health care (WHO, 2002).

Traditional medicine has maintained its popularity in all regions of the developing world and its use is rapidly spreading in the industrialized countries. In China, for example, traditional herbal preparations account for 30-50% of the total medicinal consumption (WHO, 2003). In Ghana, Mali, Nigeria and Zambia, the first line of treatment for 60% of children with high fever resulting from malaria is the use of herbal medicines at home. Despite its existence and continued use over many countries, and its popularity and extensive use during the last decade, traditional medicine has not been officially recognized in most countries.This is not only because of poverty where people cannot afford to buy expensive modern medicines, but traditional systems are also more culturally acceptable and meet the physiological needs in a way modern medicine does not. 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 countries and indigenous communities (WHO, 2001). 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). The value and role of this health care system will not diminish in the future, because it is culturally viable and expected to remain affordable, while the modern

health care service is both limited and expensive (WHO, 1998). Private agreement between consenting parties and the knowledge of traditional practice in most cases has descended through oral folklore (Asfaw Debela *et al*., 1999). The secrete of information retained by traditional healers is relatively less susceptible to distortion and less accessible to the public (Dawit Abebe,1986). However, the knowledge is dynamic as the practitioners make every effort to widen their scope by reciprocal exchange of limited information with each other (Abbink, 1993). The quantity and quality as well as the safety and efficacy of data on traditional medicine are far from sufficient to meet the criteria needed to support its use worldwide. One of the reasons for the lack of research data is due to health care policies (Balick and Cox, 1997; Hassan, 2007).

Traditional medicine in Ethiopia includes medicinal preparations from plants, animals and mineral substances, as well as spiritual healing, hydrotherapy, bone setting, etc. Traditional medicine is largely practiced by traditional medicine practitioners, although, particularly for certain common health problems, it is also practiced at home by the elderly and by mothers (Pankhurst, 1965; 1990 ; Abbink, 1995). It is accessible to most people and is important for primary health care delivery and its use is wide spread in developing countries (Zhang, 2000; Tabuti, 2004). In Ethiopia, about 80% of human population and 90% of livestock rely on traditional medicine (Mekonin Bishaw, 1990; Tesema Tanto *et al*., 2003). Socio- cultural appeal, the cultural acceptability of healers and local pharmacopoeias, accessibility, affordability, and effectiveness against a number of health problems seem to foster its widespread use (Mwambazi, 1996; Kebede Deribe *et al.,* 2006). Ethiopian traditional medical system is characterized by variation and is shaped by the ecological diversities of the country, socio-cultural background of the different ethnic groups as well as historical developments that are related to migration, introduction of foreign culture and religion (Pankhurst, 1965; 1990; Sikkerveer, 1990; Dawit Abebe and Ahadu Ayehu, 1993). Traditional medical practitioners treat both people and domestic animals. Most of the health services rendered by these practitioners are focused on communicable diseases among people and domestic animals.

The plant parts that are used in the preparation of medicine include roots, stems, barks, leaves, flowers and seeds (Wondwosen Teshome, 1999). The major specializations of

traditional medicine are bone setting, mid-wifery, spiritual healing, magic, sorcery and herbalism. Drugs are prepared in various dosage forms including liquids, ointments, powders and pills. Drugs are also prescribed in a non-formulated form, additives are usually incorporated, and more than one drug is used in a single dosage form. Drugs were administered using different routes, the main ones being: topical, oral and respiratory. When side effects became severe, antidotes were claimed to be used. The healers imposed restriction when patients took certain types of drugs. Drugs are stored usually in containers such as bottles, papers, pieces of cloth, leaves and horns and were kept any where at home (Dawit Abebe and Ahadu Ayehu, 1993; Worku Abebe, 1984).

2.3 Local Knowledge

Local knowledge refers to the accumulation of knowledge, rules, standards, skills and mental sets, which are possessed by local people in a particular 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 protection and a host of other activities (Thomas, 1995). This knowledge is not static rather it develops and changes with time and space. It evolves and responds to changes in the physical and social environment (Alcorn, 1984). Indigenous knowledge of a people, as defined by the Convention on Biological Diversity (CBD), is knowledge held by a people based on a "combination of cultural distinctiveness and prior territorial occupancy relative to a more recently arrived population with its own distinct and subsequently dominant culture". It thus falls within the definition of traditional knowledge but not vice versa (Brigdel, 2003). Indigenous knowledge is usually unwritten and preserved only through oral tradition, and it refers to the knowledge system of indigenous people and minority cultures (Khasbagan, 2008).

According to Stephen and Justin (2003), indigenous knowledge is knowledge that is unique to a given culture or society. It is the basis for local- level decision making in agriculture, health care, food preparation, education and natural resource management. Traditional knowledge (TK) is used to sustain the community and its culture and to

maintain the genetic resources necessary for the continued survival of the community. Indigenous people developed this knowledge through practical experience and skill to solve the problems that they faced on day to day activity. This life long experience is generally known as indigenous knowledge. It is also referred to as "traditional knowledge", "folk knowledge", "ancient wisdom" or "ethno science" (Woyek and Gorjestani, 1998). Indigenous knowledge encompasses the beliefs, knowledge, practices, innovations, arts, spirituality, and other forms of cultural experience and expression that belong to indigenous communities worldwide.

Indigenous knowledge is the basis for local-level decision making in agriculture, health care, food preparation, education, natural resource management, and a host of other activities in rural communities. Woyek and Gorjestani (1998), also define IK as the knowledge that is locally situated and related to a more or less set of common values, beliefs, experiences and practices held by a particular tribal group, kinship or indigenous community. It includes practices and technologies, such as seed treatment and storage methods and tools used for planting and harvesting. Traditional knowledge also encompasses belief systems that play a fundamental role in a people's livelihood, maintaining their health, and protecting and replenishing the environment (Stephen and Justin, 2003).

Traditional knowledge is unique in nature and may include experimentation in the integration of new plant of tree species into existing farming systems or a traditional healer's tests of new plant medicines. The term "traditional" used in describing this knowledge does not imply that this knowledge is old or not technical in nature, but "traditional based". It is "traditional" because it is created in a manner that reflects the traditions of the communities, therefore not relating to the nature of the knowledge itself, but to the way in which that knowledge is created, preserved and disseminated. Traditional knowledge is collective in nature and is often considered the property of the entire community, and not belonging to any single individual within the community.

Local knowledge is transmitted through specific cultural and traditional information exchange mechanisms for example, maintained and transmitted orally through elders or specialists (breeders, healers, etc), and often to only a selective few people within a

community (Alcorn, 1984; Martin, 1995; Thomas, 1995; Quanash, 1998; Stephen and Justin, 2003). It can also be transmitted from generation to generation in the form of songs, proverbs, stories, folklore, community laws, common or collective property and inventions, practices and rituals. Based on the suggestion of Woyek and Gorjestani (1998) the following are traits that distinguish IK from modern scientific or western knowledge.

- Unique to a particular culture and society.
- Basis for local decision making in agriculture, health care, and natural resource management.
- Essentially implicit knowledge based on oral forms of communication and practical learning.
- Embedded in community practices, institutions relation and rituals.

Global development strategies have changed in recent years. People's participation and inclusion is now high on the development agenda and including IK in research and application is the latest trend in this change. Although it was once seen as a barrier to development, IK is now firmly accepted by most lead development organizations including WHO, the United Nations Development Program (UNDP) and the World Bank (WHO, 2003; World Bank, 1998). In the case of Ethiopia, indigenous knowledge is perpetuated from one generation to the other generation verbally with great mystery. Such secret and verbal transfer makes the indigenous knowledge vulnerable to distortion and in most cases some of the wisdom is lost at each point of transfer (Alcorn, 1984; Farnsworth, 1994).

Therefore, there is a direct need to carryout an ethnobotanical study for systematic collection and documentation of such a significant indigenous knowledge. This is because such knowledge has much to offer for modern society. For example, it is being used increasingly to assist food and agriculture; resource management, sustainable development and the conservation of biological diversity, health, trade and economic development. Among such indigenous knowledge system in many countries is the knowledge and application of traditional medicine. It is known as ethnomedicinal knowledge that 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, passes 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 (Amare Getahun, 1976), hence there is a need for systematic documentation of such useful knowledge through enthobotanical research.

2.4. Ethnobotanical Study and Drug Discovery

All over the world, indigenous people discovered and developed the medicinal uses of native plants, but it is from the herbal medicine of ancient Greece that the foundations of Western medicine were established (Kong *et al.,* 2003). Western medicine can be traced back to the Greek physician Hippocrates (460-377 BC), known as the father of Medicine. He believed that a disease had a natural cause and used various herbal remedies in his treatments (Kong *et al.,* 2003).

Ethnobotanical studies give a clue for the discovery of many modern drugs or western medicine. A typical example for this is the early Rome writing, especially the works of Dioscorides (1st century AD). Although Greek by birth, Dioscorides was a Roman military physician whose travelled with the army brought him in contact with many useful plants. He compiled this information in De Materia Medica, which contained an account of over 600 species of plants with medicinal value. It included descriptions and illustrations of the plants, along with directions on the preparation, uses, and side effects of the drugs. Such information had important value for the development of western medicine (Kong *et al*., 2003). This indicates that an ethnobotanical investigation on traditional medicinal plants conducted with modern theories and techniques can enrich Western medicine by absorbing new ideas and concepts from traditional plant medicine from all over the world. There are two major approaches for the "discovery" of plant derived pharmaceuticals. The first approach is the random approach. In this approach, a large number of plants are collected and screened for biochemical activity. Generally, there is a low success rate from the random collection process although the discovery of the drug taxol, currently used in some cases of breast and ovarian cancer, was discovered

through this method (Temperly, 2002). The second major approach is the targeted approach, and the ethhnobotanical drug discovery process is one form of the targeted approach. In an ethnobotanical drug discovery process the plants used by traditional healers are eventually formulated into a medicine used in a clinical setting (Temperly, 2002).

The development of useful and widely used drugs like Digoxin and Digitoxin, from *Digitalis* leaves; quinine from the *Cinchona* bark; reserpine from *Rauvolfia serpentine* ; morphine from *Papaver somniferum*; cocaine from *Erythroxylum coca* and the anti-cancer Vincristine and Viblastine from *Catharanthus roseus* of Madagascar and again anti-cancer compound, bruceatin, from the Ethiopian plant, *Brucea antidysentrica*, just to name a few, are examples of the contributions of traditional medicinal practice for modern drug discovery (Kong *et al*., 2003).

All the above and many other plant drugs that we use today were known by the ancient indigenous people. For example, in India, herbal medicine dates back several thousand years to the Rig-Veda, the collection of Hindu sacred verses. This has led to a system of health care known as Ayurvedic medicine. One useful plant from this body of knowledge is snakeroot, *Rauvolfia serpentine*, used for centuries for its sedative effects. Today the active components in snakeroot are widely used in Western medicine to treat high blood pressure (Jain, 1986). Foxglove plant (*Digitalis purpurea*) was used by traditional healers to treat heart disorders which is commonly known as dropsy (inefficient working of the heart leads to retention of fluid and hence to general swelling of the body). It was William Withering in 1785 discovered that the only active ingredient to cure this disease is the leaf of Foxglove. Since then this plant and related species of *Digitalis lanata* have been thoroughly investigated. As a result two of the active constituents isolated from *Digitalis purpurea* are dogoxin and digitoxin. Now both of them are official drugs in the British and other pharmacopoeia (Sofowora, 1982).

There have been about sixty new herb-derived drugs developed by Chinese scientists over the past four decades. An illustrative example is the discovery of artemisinin. Chemical studies on many species of Artemisia have been carried out in many places since the 1930's, but China was the first to discover its anti-malarial activity and this

yielded a new anti-malarial drug in 1972. Artemisinin is different from the old generation of anti-malarial drugs (quinine extracted from the bark of *Cinchona ledgeriana)* because of its novel bioactive peroxide group, which is effective in treating chloroquine-resistant and severe cases without side effects, which is also a common feature of many Chinese herbal medicines (WHO, 2001). No one would seriously challenge the fact that human beings are still largely dependent on plants in treating ailments. And a surprising number of present day drugs still come from natural products specifically from medicinal plants (Aikman, 1974 as cited by Abbiw, 1996).

Nowadays cancer and HIV/AIDS are the most dangerous diseases to human beings, thus research into these diseases has been prioritized. The National Cancer Institute (NCI) has several ongoing collaborative programs which screen plants for the possibility of new drugs and active plant chemicals for the treatment of cancer and HIV/AIDS. Indigenous knowledge and medicinal plants have been collected from the African countries of Cameroon, the Central African Republic, Gabon, Ghana, Madagascar and Tanzania. Collections are now being concentrated in Madagascar (one of the most rapidly disappearing rainforest regions in the world), and collaborative programs have been established in South Africa and Zimbabwe (Kong *et al*., 2003).

After a series of long term and painstaking works, some plant-derived anticancer drugs have received Food and Drug Administration (FAD) approval for commercial production. They are:

- Vinblastine- A chemical discovered in the Madagascar periwinkle in the 1950s.Vinblastine is the first drug of choice in the treatment of many forms of leukemia and since the 1950's it has increased the survival rate of childhood leukemias by 80%.
- Taxol/Paclitaxel- A chemical discovered in the Pacific Yew tree (*Taxus brevifolia*) is now the first drug of choice in several tumorous cancers including breast cancer.
- Irinotecan- Another chemical analog which has been developed from another plant alkaloid discovered in the same tree, *Camptotheca acuminate*, for the treatment of metastatic colorectal cancer.

- ❖ Topotecan- An analog (synthesized chemical) of a plant alkaloid discovered in the Chinese tree species, *Camptotheca acuminate*, for the treatment of ovarian and small cell lung cancer.

Since 1986, only five chemicals showed significant activity against AIDS among more than 40,000 screened plant samples. The following are plants and chemicals which are still under research for cancer and AIDS: *Calophyllum lanigerum*, *Calophllum teysmanii, Conospermumin curvum, Ancistrocladus korupensis* and *Camptotheca acuminate* (Kong *et al*., 2003). These facts are more than enough to say that traditional medicinal practices are the base for western medicine or modern drugs.

Environmental Health Perspective (EHP) proposed an approach, based on ethnomedicinal information, to experimentally pursue plants as a source of drugs. The approach was designed primarily for implementation by developing countries, where lack of hard currency often prevents sophisticated types of research from being conducted. The possibility of drug development in the form of stable, standardized crude extracts and eventual development of the active principles from these plants was envisioned (Fabricant and Farnsworth, 2001). The following are steps of the modern ethnobotanical drug discovery process.

- Folk knowledge of plant's possible therapeutic activity accumulates in the indigenous culture.
- A healer uses the plant for his or her patients.
- The healer communicates the knowledge about this plant to a formally trained scientist.
- The scientist collects and identifies the plant. Generally, one to two kilograms of plant parts are collected in the field. The plant parts are either dried or placed in a preservative.
- The scientist will test extracts of the plant with a bioassay protocol to look for the desired pharmacological activity. To produce the extracts, plants are macerated, placed in a solvent and shaken for twenty four hours. The solvent will be removed in an evaporator and the plant extract will be freeze-dried. Generally, only 0.5 to 1 gram of crude extract will be produced from every one to two kilogram sample.

- The scientist will isolate a pure compound by using the bioassay to trace the source of the activity in the plant extract.
- The scientist will determine the structure of the pure substance (Temperly, 2002).

Once the pure substance has been identified, it is now possible to calibrate appropriate dosage, perform clinical trials and perhaps move the drug into commercial development. The discoveries of digitalis and quinine bear witness to the fact that the ethnobotanical approach to drug discovery has been spectacularly successful. The drugs listed in Table 1 show drugs prescribed in north America and Europe that were driven from ethnobotanical leads (Balick and Cox, 1996).

Table 1. Drugs discovered from ethnobotanical leads

Drug	**Medicinal use**	**Plant species**	**Familly**
Ajmaline	Heart arrhythmia	*Rauvolfia spp.*	Apocynaceae
Aspirin	Analgesic, inflammation	*Filipendula ulmaria*	Rosaceae
Atropine	Ophthalmology	*Atropa belladonna*	Solanaceae
Benzoic	Oral disinfectant	*Styrax tonkinensis*	Styracaceae
Caffeine	Stimulant	*Camellia sinensis*	Theaceae
Camphor	Rheumatic pain	*Cinnamomum camphora*	Lauraceae
Cascara	Purgative	*Rhamnus purshiana*	Rhamnaceae
Cocaine	Ophthalmologic	*Erythroxylum coca*	Erythroxylaceae

Source: Adapted from Balick and Cox (1996).

2.5. Medicinal Plants and Ethnomedicine in Ethiopia

In Ethiopia, plants have been used as a source of traditional medicine from antiquity to solve different health problems and human sufferings (Asfaw Deblla *et al*., 1999; Kebede

Deribe *et al*., 2006). 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). The use of plants in religious ceremonies as well as for magic and medicinal purposes is very common and widely distributed in Ethiopia (Amare Getahun, 1976). 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. Even today, it is common for people living in rural and urban areas to treat some common ailments using plants available around them (example, *Hagenia abyssinica* to expel tapeworm, *Ruta chalepensis* for various health problems) (Abbink, 1995).

The work of Dawit Abebe and Ahadu Ayehu (1993) in northern Ethiopia clarified that major portion (87%) of the parts used in traditional medicine come from plant source, while animal parts and minerals contribute only a small supply. The majority of Ethiopians depend on medicinal plants as their only source of health care, especially in rural areas where access to villages is lacking due to the absence of roads. At this very moment, somewhere in the rural hinterland of the Ethiopian rural communities, a local farmer may have just gathered leaves or root parts from a local medicinal plant found near the homestead. In a nearby village, a mother might be in the midst of preparing a traditional plant treatment believed to 'restore strength', relieve stomach cramps, heal a skin condition, and 'ward off the evil-eye' or perhaps to help alleviate symptoms of a respiratory tract infection. It is much routine use of local medicinal plants by ordinary members of local communities across the country's diverse and largely rural landscape that accounts for the widely cited 80% estimate of the population who continue to use traditional plant-derived medicines for their primary health care needs (Dawit Abebe and AhaduAyehu, 1993; IBCR, 1999).

The study of Ethiopian medicinal plants has not been realized as fully as that of India or other traditional communities elsewhere (IWU, 1993). In Ethiopia there is limited development of therapeutic products and the indigenous knowledge on usage of medicinal plants as folk remedies are getting lost owing to migration from rural to urban areas, industrialization, rapid loss of natural habitats and changes in life style. There is also a lack of ethnobotanical survey carried out in most parts of the country. In view of

these, documentation of the traditional use of medicinal plants is an urgent matter and important to preserve the knowledge (Tesema Tanto *et al*., 2003; Tilahun Teklehaymanot and Mirutse Giday, 2007).

In Ethiopia, conventional veterinary services have been playing a paramount role in the control and prophylaxis of livestock diseases in the last three decades. However, they can't yet deliver complete coverage in preventive and curative health care practices because of inadequate labor, logistical problems, an erratic supply of drugs, and the high cost of drugs and equipment. As a result, the majority of those raising stock in rural areas are far from the site of veterinary stations, and those who have access to veterinary services may not be able to afford to pay for them (Teshale Sori *et al*., 2004). Ethnoveterinary alternatives comprises traditional surgical and manipulative techniques, traditional immunization, magico-religious practices and beliefs, management practices and the use of herbal remedies to prevent and treat a range of disease problems encountered by livestock holders (Tafesse Mesfin and Mekonnen Lemma, 2001). Ethnoveterinary medicine provides traditional medicines, which are locally available and usually cheaper than standard treatments. Livestock holders can prepare and use home made remedies with minimum expense. So far, many livestock holders in rural areas where there are relatively few veterinarians and shortages of other facilities, traditional medicinal plants are the only choice to treat many ailments (Mc Corkle, 1995).

2.6. Threats to and Conservation of Traditional Medicinal Plants in Ethiopia

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 species 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 and Zemede Asfaw (1999) and hence this aggravates the rate of loss of species with related indigenous knowledge and loss of widely occurring medicinal plant species. According to Zemede Asfaw (2001), people use many wild species of plants for food, closing, shelter, fuel, fiber, income generation and the fulfilling of cultural and spiritual needs throughout the world in addition to medicinal value. These

threats to medicinal plants can be categorized into anthropogenic and natural causes. Human-induced extinction of species and habitat degradation are the order of the day. Rapid increase in population, the need for fuel, urbanization, timber production, over harvesting, destructive harvesting, invasive species, commercialization, degradation, agricultural expansion and habitat destruction are human caused threats to medicinal plants. Likewise, natural causes include recurrent drought, bush fire, disease and pest outbreaks (Ensermu Kelbessa *et al.,* 1992). Intensive and unrestricted grazing, the presence of large number of livestock could lead to serious decline of medicinal plants in particular and the entire vegetation as a whole. As elsewhere in Ethiopia, Bule Hora Wereda is not exceptional to these problems. Proper management of traditional medicinal plant resources is important, not only because of their value as a potential source of new drugs, but due to reliance on traditional medicinal plants for health.

Cunningham (1993) also pointed out that, demand for fast growing species with a wide distribution, high natural population density and high percentage seed set can be met easily, particularly where leaves, seeds, flowers or fruits are used. The common use of medicinal plant leaves as a source of medicine is therefore highly significant as it differs markedly from the high frequency of roots, bark or bulbs uses. This type of conservation of medicinal plants can also be possible in home gardens, as the home garden is strategic and ideal farming system for the conservation, production and enhancement of medicinal plants. Ethnobotanical studies can indicate management problems of medicinal plants through interviews and market surveys and furthermore, it gives solutions by promoting local traditions and customs that had conservation merits (Gadgil *et al*., 1993; Turner, 2000).

3. MATERIALS AND METHODS

3.1. Description of the Study Area and the People

3.1.1. Geographical location

This study was conducted in Bule Hora District (Formerly called Hageremariam District), Southern Oromia, which is located 467 km away from Addis Ababa to the South and 100 km North of Yabello, the capital of Borana Zone. This District lies between latitudes 5^0 26′ and 5^0 52′ North and longitudes 37^0 56′ and 38^0 31′ East with a total area of about 488,861.3 hectares or 48,886.1 km^2 of which 77.1% is middle land and 22.9% is lowland and the altitudinal range lies between 1465- 2300 m a.s.l.

The neighboring Districts are Kercha to the north east, Kochere to the north, Gelana to the northwest, Burji to the west, and Dugda Dawa District to the south. The District is composed of forty eight kebeles (the smallest community based administrative units in Ethiopia). The administration town is named as Bule Hora (Formerly called Hageremariam). Figure 1 shows the study District.

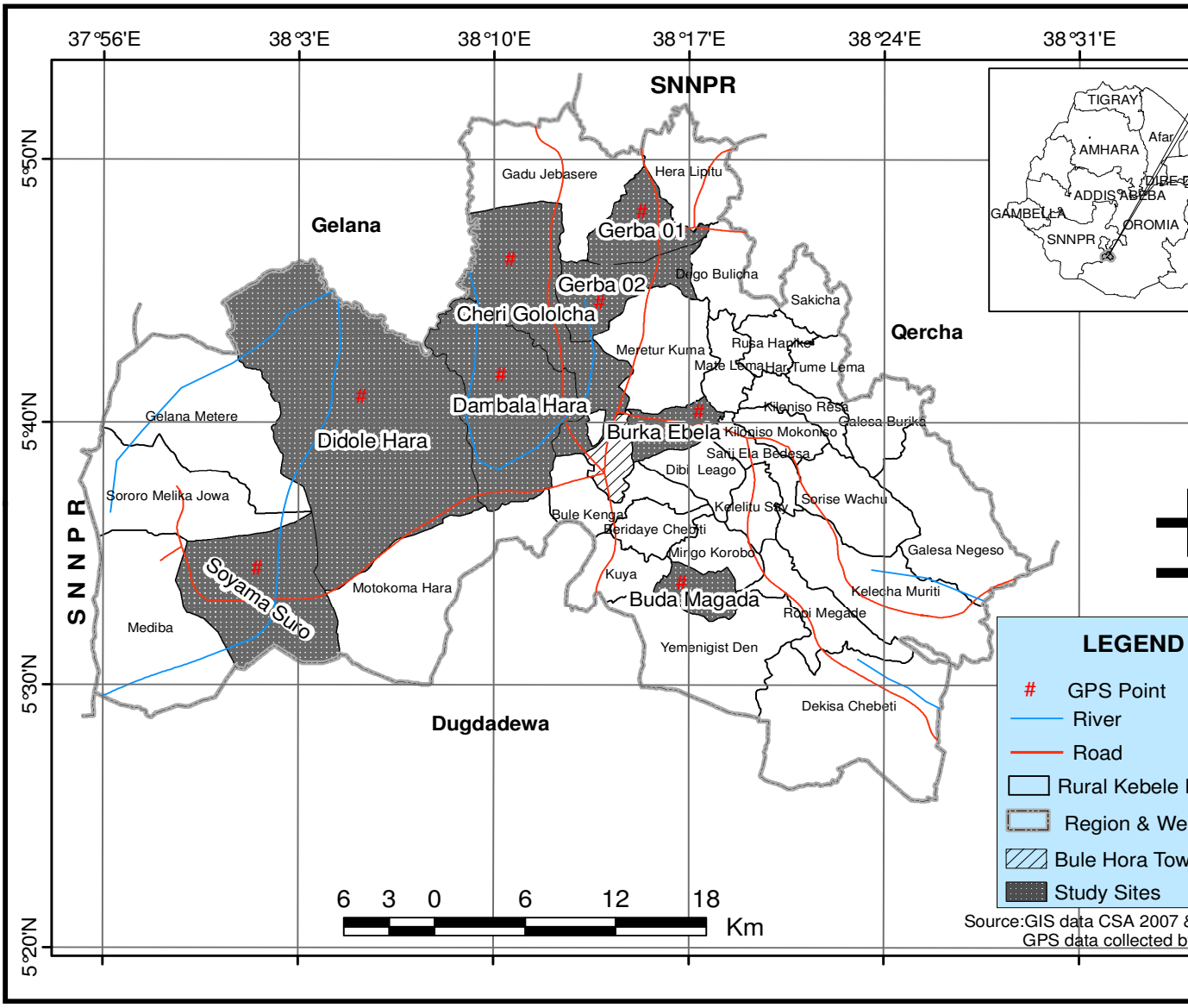

Figure 1. Map of the study District

3.1.2. Agro-ecology and climatic condition

Bule Hora District is divided into two agro-ecological zones, namely the lowlands (<1500 m a.s.l) locally called "gammoojjii; and middle land (1500-2500 m a.s.l) locally known as 'badadaree'. The rainfall pattern is bimodal i.e have two distinct rainy seasons. The analysis of meteorological data of ten years (2001-2010) of Bule Hora District taken from National Metrology Service Agency by using R –Software indicates that Bule Hora Wereda receives high rainfall between March and May as well as relatively good amount from September to November. The dry season extends from December to February and to some extent from June to July. The highest mean annual average rainfall of the study area within ten years was 166.7 mm recorded in May, whereas the lowest mean average was 10.5 mm recorded in February. The lowest mean average temperature over ten years was 10 ^{0}C recorded in December whereas the highest was 28.3 ^{0}C recorded in February. The sum total of average rain fall of ten years was 831 mm whereas the average temperature of ten years was 18.3^{0}C (Figure 2).

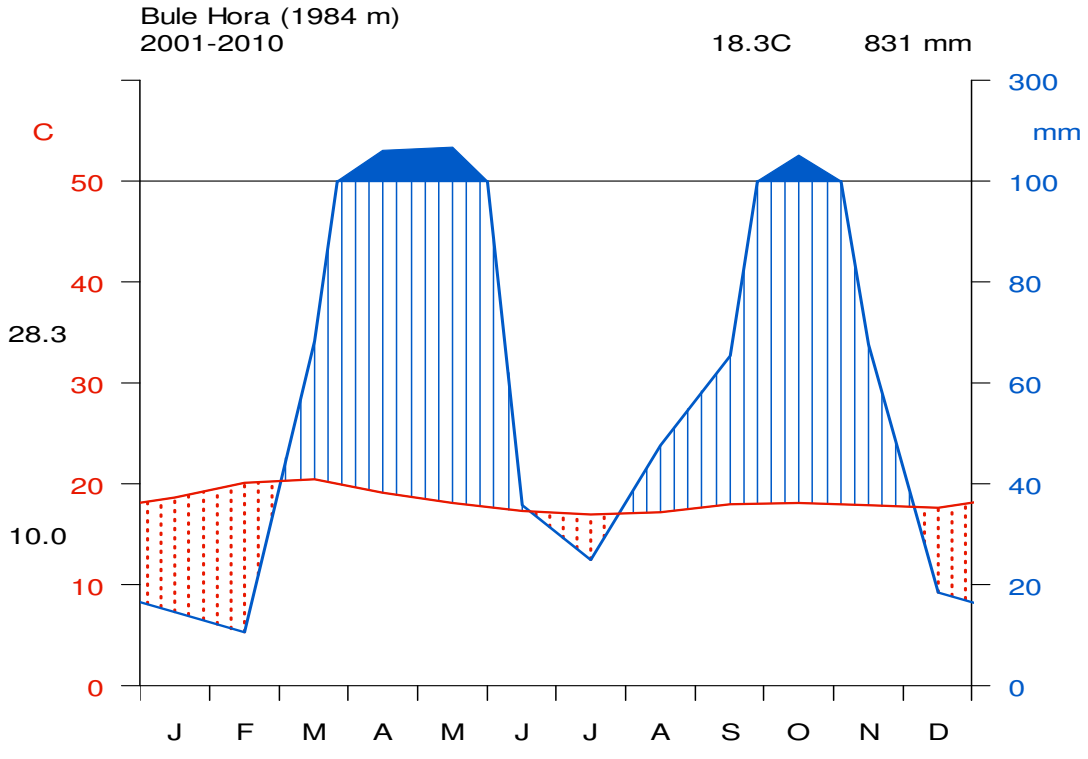

Figure 1. Climadiagram of Bule Hora Station (2001 – 2010).

Source: National Metrology Service Agency of Ethiopia

As the graph depicted, there is high amount of evapotranspiration where the precipitation curve undercuts the temperature curve because the season in between December and February and to some extent June to July (dotted portions) are indicated as dry seasons. On the other hand, where the precipitation curve supersedes the temperature curve (months indicated with vertical lines) indicate the wet seasons especially March to May and September to October are with high amount of rainfall. The line drawn across temperature bar to precipitation bar indicates that the amount of precipitation normally becomes twice of the amount of temperature.

3.1.3. Land management

Bule Hora District Land Management Office's annual report (2009/2010) indicates that the District's total area can be partitioned as 192,743.0 hectares of cultivable land, 68,107.5 hectares of cultivated land, 147,864.3 hectares of land covered with vegetation, 21,242.1 hectares of grazing land and 58,905.1 hectares of land used for other purposes. People in the study area use and classify their land through functional categories as grazing and browsing land, farming land, home gardening area and forest land. Different crop types are cultivated in the District. Agricultural production is based on rain fed cultivation and insignificant scale of irrigation (Soororo Melka Jawe and Habaas areas). The major crops cultivated in the area are maize, wheat, barley, coffee and haricot beans (Table 2).

Table 2. Major crops grown in the study area

Crop category	**Scientific name**	**Vernacular name**	**Local name**
Cereals	*Eragrostis tef (Zuccagni*) Trotter	Teff	Xaafii
	Triticum aestivum L.	Wheat	Qamadii
	Hordeum vulgare L.	Barley	Garbuu
	Zea mays L.	Maize	Badallaa

Pulses	*Pisum sativum* L.	Field pea	Atara
	Phaseolus vulgaris L.	Haricot bean	Halquqa/Hamaraa
	Vicia faba L.	Horse bean	Baaqelaa
Oil Crops	*Linum usitatissimum* L.	Linseed	Talbaa
	Brassica napus var. pabularia L.	Kale seed	Sanyii raafuu
Root crops	*Solanum tuberosum* L.	Potato	Dinicha
	Ipomoea batatas L.	Sweet potato	Maxaaxasha
	Daucus carota L.	Carrot	Kaarotii
	Beta vulgaris L.	Red beet	Hida diimaa
Fruits	*Citrus sinensis* L.	Orange	Burtukaana
	Citrus limon L.	Lemon	Loomii
	Musa x paradsiaca L.	Banana	Muuzii
	Mangifera indica L.	Mango	Mangoo
	Carica papaya L.	Papaya	Paappayaa
	Persea Americana Mill.	Avocado	Abukaatoo
	Prunus persica L.	Peach	Kookii
Vegetables	*Allium cepa* L.	Shallot	Qullubbii diimaa
	Capsicum annuum L.	Pepper	Barbare/Qaaraa

	Lycopersicon esculentum Mill.	Tomato	Timatimii
	Cucurbita maxima Duchesne ex Lam	Pumpkin	Baaqulaa
	Allium sativum L.	Garlic	Qullubbii adii
	Brassica oleracea L.	Cabbage	Shaanaa
Cash crops	*Coffea arabica* L.	Coffee	Buna
	Catha edulis (Vahl) Forssk.ex Endl.	Khat/ Chat	Caatii
	Saccharum officinarum L.	Sugarcane	Shonkoraa
	Nicotiana tabacum L.	Tobacco	Tamboo
	Ensete ventricosum (Welw.) Cheesman.	False banana	Worqicha

Source: Bule Hora District Agricultural and Rural Development Office (2009/ 2010).

3.1.4. Vegetation description

Two approaches were used in describing the vegetation of the study area. On the one hand, information was gathered from informants following the emic categorization technique i.e. categorization by indigenous people based on their own indigenous knowledge. On the other hand, it was described and classified through repeated curious visual observation following the etic classification technique of ethnobotany as described by Martin (1995). In the latter case, morphological characteristics or general appearance of vegetation such as growth and life forms of the dominant plants were focused upon.

The common vegetations in the study area as visualized include mostly remnants of trees in agricultural fields, bushes, shrubs and secondary forests. The common plant species of

the study area include *Podocarpus falcatus, Olea europeae* spp. *cuspidata*, *Cordia africana, Acacia abyssinica*, *Syzygium guineense, Prunus africana* and *Croton macrostachyus*. There is also mixed wood land with patches of *Eucalyptus camaldulensis Grevillea robusta* and *Juniperus procera* plantation. The shrub layer includes *Carissa spinarum, Calpurnia aurea, Euclea divinorum, Vernonia* sp. etc. just to name a few from my visual observation but the study area contains many others. The very feature of the area is that most of the plants are found in and around protected areas, Church compounds and Grave yards. The other areas are highly degraded due to agricultural activities, overgrazing, timber production and high demand of wood for construction, firewood and charcoal, etc. Especially *Podocarpus falcatus, Syzygium guineense, Prunus africana, Hagenia abyssinica* and *Cordia africana* are cut and highly used for construction and other purposes.

3.1.5. Population and medicinal services in the study area

The District is predominantly occupied by the Oromo people who speak Oromo language. The total population of the District is about 266,150 of which 134,603 (50.6 %) are males and 131,547 (49.4%) are females. Urban dwellers are about 37,076 (13.9 %) of which 19,174 (7.2%) are males and 17,902 (6.7%) are females. Rural dwellers are about 229,074 (86.1%) of which 115,429 (43.4%) are males and 113,645 (42.7%) are females (FDREPCC, 2008). The main town is Bule Hora and there are four other small towns called Garba, Qilenso Mokonisa, Qilenso Rasa and Soyama Suro to the north, east and west of the main town respectively. Agriculture is the economic mainstay of the people. The socio-economic activity of the local population is cultivation of cash crops like coffee, khat as well as maize, wheat, barley, teff, haricot beans and in some parts enset (false banana) and rearing livestock. According to the District Agricultural and Rural Development Office report (2009/ 2010), 98% of the populations are farmers, 1.5% merchants and 0.5 % government workers.

As identified and reported by Bule Hora Health Office and Bule Hora Hospital (2009/2010), the most common human health problems are; internal parasitosis (19.4%), pneumonia (14%), all diseases of urinary tract infection 8%, acute bronchitis (4.04%), acute upper respiratory tract infection (4%), acute gastrinteritis (AGI) 3.84%, malaria

(3.71), trauma and all other accidental causes (3%), arthritis and spondilitis (2.58%) and all other diseases of skin (2.3%). Like that of most rural districts of Ethiopia, access to modern health services is poor. According to the District's Health Office report, 119,767 people are assisted by this service, which covers only 45% of the population. In the District one hospital, four health centers, seven clinics, twenty one health posts, and two rural drug venders are found. There are inadequate numbers of health professionals with standard qualifications (Table 3).

Table 3. Profile of health professionals in the modern health facilities of the study area

No.	Specialization	Qualification	No. of professionals
1	Physicians	MD +Specialist	3 +1
2	Health officers	BSc (1st Degree)	8
3	Clinical nurses	BSc + Diploma	1+86
4	Public nurses	BSc + Diploma	3 +5
5	Mid-wives	BSc + Diploma	2 + 7
6	Laboratory technicians	BSc + Diploma	4 +6
7	Pharmacists	BSc + Diploma	1 +8
8	Sanitarian	BSc + Diploma	1+4
9	Health extension workers	Certificate	98
10	Supportive staffs	Various	44

Due to the belief in traditional medicine effectiveness, poor economic status, lack of modern medicines and medication, cost effectiveness and cultural acceptability of the local pharmacopoeia, the majority of the residents of the District are served by traditional health practitioners and traditional means of treatment.

3.1.6. Livestock conditions

Since seven kebeles of the District are semi- pastoralists, livestock population of the area is very high. According to the report of Bule Hora District Livestock Health and Marketing Agency (2009/ 2010), the District consists of 587,711 livestock population of which 228,689 cattle, 154,141 goats, 62,278 sheep,10,869 donkeys,4941 mules, 6225 horses and 120,568 poultry. There are problems in the District associated with irregular climatic condition, inadequate health services and facilities and occurrence of different diseases. Due to poor access to modern medical services and low-income level of most households, the local people use local traditional healers and traditional ethnoveterinary services to treat their livestock ailments. The major livestock diseases reported in the study area were: trypanosomiasis (Gandi*i*), internal and external parasites (Maxantuu qaama keessa fi qaama alaa), mastietis (Naqarsaa Muchaa), C.B. P.P.(Sombiisaa), black leg (Abbaa gorba), anthrax (Abbaa sangaa), L.S.D (Bagaa), babesiosis (Hadhootu) and Foot and Mouth Disease or FMD (Maansaa). Veterinary health care coverage of the District is about 40 %. Four veterinary clinics, three health posts and thirteen animal health workers (assistant animal health physicians) support the livestock of the District.

3.2. Study Methodology

3.2.1. Reconnaissance survey and site selection.

A reconnaissance survey of the study area was conducted from March 26-April 5, 2010 and eight kebeles were selected as study sites by using random sampling. The study area is found within the range of 1465 – 2300 m a.s.l. This variation in altitude resulted in variability in climate, vegetation types, life systems and life constraints. Areas with relatively higher altitude (about 2300 m a.s.l.) Garbaa 01 and 02 are located in the northern part of Bule Hora, lower altitudinal areas (about 1465 m a.s.l.) Soyama Suro, Damballa Haaraa, Didoolee Haaraa and Carii Gollolchaa are to the west of Bule Hora town and medium altitudinal areas (about 1900 m a.s.l.) Eeballa to the east and Buda Megada is almost to the south of Bule Hora town.

3.2.2. Informant selection

Information regarding the indigenous knowledge of traditional practitioners to medicinal plant uses was gathered from local people in the study area and the selection of informants and key informants was carried out with the help of clan leaders, peasant association leaders and other members of the local communities. Hence, sixty informants' seven to nine individuals from each study kebele (Forty four men and sixteen women) from the age of eighteen and above were included. From the eight study kebeles twenty four key informants were selected through preferential sampling techniques (Appendix 2; in* are key informants). Among sixty informants only sixteen (26.7%) have got formal education at different level. An individual is literate when he has " acquired the essential knowledge and skills which enable him to engage in all those activities in which literacy is required for effective functioning in his group and community, and whose attainments in reading, writing and arithmetic make it possible for him to continue to use these skills" (Clammer J.R., 1976). In these social groups there is no religious education like in the northern parts of the country. When recording knowledge held by traditional healers or by certain social groups such as women and elders, the choice of key informants is dictated (Martin, 1995). Accordingly, the selection of key informants was made through preferential methods to drain the necessary information and include three traditional medicinal practitioners in each study site.

3.3. Ethnobotanical Data Collection

Ethnobotanical data was collected between April, 2010 to June, 2010 on three field trips made to the study kebeles following the methods by Martin (1995) and Cotton (1996). By using data collection format given in Appendix 1 and through applying semi- structured interview, guided field walks, observation and group discussion with informants the required information was gathered from the local community on medicinal plants (used

for both humans and livestock), vegetation, landforms and soil of the locality (Figure 3).

Figure 2. Photograph showing ethnobotanical data collection in the study area

3.3.1. Semi-structured interview

Semi-structured interviews were conducted in places where the informants were most comfortable and during the time they have wanted or chosen. During the interview information regarding local name of medicinal plant, parts used, methods of preparation, mode of application, ingredients used in combination, threats and management and other relevant information were recorded from key informants, elders and other knowledgeable informants.

3.3.2. Guided field walk, voucher specimen collection and identification

Guided field walks were performed with informants as they were interviewed during the trip. Based on ethnobotanical information provided by informants, voucher specimens were collected at the spot during guided field walk, numbered, named by using local names (but not all), pressed, dried, deep freezed and identified some in the field and most of them in the National Herbarium, Science Faculty, Addis Ababa University using the available taxonomic keys in the various volumes of the Flora of Ethiopia and Eritrea. At the same time each specimen was also compared with already identified specimens in this Herbarium.

At this time all available information about medicinal plants were recorded on prepared questionnaire in the field at all times. Interviews and discussions were based on a checklist of topics or questions prepared before hand in English and translated to Afaan Oromo (Appendix 1). Most of the interviews and discussions were held in Afaan Oromo by using a translator and information was gathered technically by the researcher from the villagers and accessible informants on an informal basis to maximize the source of information.

3.3.3. Group discussion

Discussion was made with volunteer traditional healers and knowledgeable farmers about the knowledge and use of important medicinal plants. At the time of discussion all informants were allowed to talk freely without interruption. All relevant information such as plant species used to treat different diseases, local names; parts of plants used, ailments treated, method of preparation, degree of management and details of medicine administration were discussed.

3. 4. Ethnobotanical Data Analysis

Ethnobotanical data collected in the field were entered into Excel spreadsheet and summarized. Filter facility was employed to identify the most common ailments in the study area. In addition to this, preference ranking, paired comparisons and direct matrix ranking were made for some selected medicinal plants based on methods given by Martin

(1995) and Cotton (1996). The following methods of data analysis were applied to elaborate the information obtained from the study area.

3. 4.1. Descriptive statistics

A descriptive statistical method such as percentage and frequency were employed to analyze and summarize the data on medicinal plants, associated knowledge as well as use and conservation. The most useful information gathered on medicinal plants reported by local people were medicinal value, methods of preparation, route of application, disease treated, dosage, part(s) and habit used were analyzed through descriptive statistical analysis. Eight categories of plant use- reports and relative frequency of herb, climbers, shrubs and trees species was tabulated and analyzed statistically. In addition to this data on plant species and families were tabulated, bar graphs and pie-charts were drawn and proportions were then determined.

One-way analysis of variance (ANOVA) test was carried out by using software SPSS 15.0 to check whether there were significant differences (at 95% confidence level) among average numbers of medicinal plants reported by youngsters and elders, illiterate (could not read and write) and literate as well as men and women informants. Linear Regression Analysis using SPSS is used when we want to predict the value of a variable based on the value of another variable. It estimates the coefficients of a linear equation, involving one or more independent variables that best predict the value of the dependent variable. In this case, the variable used to predict the other variable's value is called independent variable or sometimes called the predictor variable (here it is the age, sex and education level of informants). The predicted variable is called the dependent variable or sometimes called the outcome variable (here it is the medicinal plants knowledge).

3.4.2. Informant consensus and description of most frequently used medicinal plants in the study area

In order to evaluate the reliability of information recorded during the interview twenty four key informants were contacted at least two times for the same ideas and the validity of the information was proved and recorded. Consequently, if the idea of the informant deviates from the original information, it was rejected since it was considered as

irrelevant information. As a result only the relevant once were taken into account and statistically analyzed. This method was adopted from Alexiades (1996). Similarly, use diversity of medicinal plants gathered from the study area was quantitatively analyzed for eight groups of plant uses reported by informants.

After identification of medicinal plants was carried out by informants, those with informant consensus greater than 60% used for human , livestock , or both for livestock and human were described with respect to local name, scientific name, habit, habitat, distribution and medicinal uses in the study area.

3. 4.3. Preference ranking

Preference ranking was conducted to rank some selected medicinal plants based on degree of their effectiveness in treating rabies. Following the methods of Martin (1995), each informant was asked to think; order and rank the items based on their personal preference, community importance, or any other criteria set by him/her and this helps to indicate the most effective medicinal plants used by the community to treat rabies. In my case, ten randomly selected key informants were allowed for giving the ranks for five medicinal plants that they use to treat rabies. Each rank is given an integer value 1-5 and the most effective one got the highest value or five and while the least important one was assigned a value of one. Finally, all these values were summed up and ranks given to each plant species.

3. 4. 4. Paired comparison

Pair wise comparison can be used for evaluating the degree of preference or levels of importance of certain selected plants/ plant parts. Pair wise comparison exercise was performed on six medicinal plants used to treat cold disease by ten randomly selected informants in their respective localities. A list of pairs of selected items with all possible combinations was made and sequence of the pairs and the order with in each pair was randomized before every pair was presented to selected informants following Martin (1995) and their responses were recorded and total score was summed.

3. 4. 5. Direct matrix ranking

Based on information gathered from informants, eight multipurpose plant species were selected out of the total medicinal plants. Eight use diversities of these plants were listed for eight randomly selected key informants to assign use values to each species in their respective localities. The eight use values include medicinal, fodder, food, firewood, construction, charcoal, fencing and furniture making. Direct matrix ranking is used to compare multipurpose use of a given species and to relate this to the extent of its utilization versus its dominance (Martin, 1995). Each key informant was asked to assign use values (5= best, 4= very good, 3= good, 2= less used, 1= least used and 0= not used). Consequently, each key informant use values for the eight multipurpose medicinal plant species, average value of use diversities for the species was taken and the scores of each species were summed up and ranked.

3. 4. 6. Fidelity level index

Fidelity level index quantify the importance of a given species for a particular purpose in a given cultural group (Friedman *et al*., 1986; cited in Cotton, 1996). The relative healing potential of individual medicinal plants used against human or livestock ailments using an index called Fidelity Level Index (FL) based on the proportion of informants who agreed on the use of a given medicinal plant against a given ailment category. The formula for FL is given as FL% = Ip/Iu X 100, where Ip the number of informants who independently indicated the use of a species for the same major ailments and Iu the total number of informants who mentioned the plant for any major ailment (Friedman *et al*., 1986).

4. RESULTS

4.1. Basic Information about Indigenous Knowledge of the People of the Study Area

4.1.1. Local knowledge on health

A total of 106 Medicinal plant species were collected from the study area. These plants are used to treat thirty seven different types of human and twenty five livestock diseases. Most of the reported medicinal plants are used to treat human ailments. Indigenous people of the study area in general, elders and other knowledgeable community members in particular have well developed knowledge about their environment. They have their own way of classifying land/ land topography, soil, plants and climate. In this study a total of sixty informants were interviewed that includes knowledgeable elders, women and youngsters. Most of the informants were not volunteers to tell their knowledge on traditional medicine due to the belief that the traditional medicine could not work if it is told to everybody. They transfer their knowledge to the youngsters considering their behavior and through hopping good will and preying to them to have the power of healing patient. When these traditional healers cure a patient they will be given a goat or heifer not money as the cultural rule permits. If the cured person can not do this he has to invite the healer and his family overnight in his house. This cultural trend might cause the local healers not to sale traditional medicines in the market which is confirmed by the market survey i.e. market survey was carried out and it was possible to know that the local people in the study area do not sale traditional medicines in the market due to cultural rules.

Traditional healers or practitioners in the study area use very common way of traditional medicine preparation by using different plant parts. They don not have knowledge associated with unclear spiritual words or written materials commonly called “digimt” which is common in the northern part of the country. They serve local people by preparing remedies for different types of diseases. Such types of traditional medicine practices are also common in any other parts of the country. The detail of remedy preparation and disease types are given in Appendix 3.

The Guji Oromo people of Bule Hora District have traditional institution (Gada System) that has conservation merit of ethnomedicinal plants and associated knowledge. This institution (a traditional socio- political institution of Oromo people) includes regulation of plant resources. For example, Odda (Ficus sp.) is highly conserved because the custom prohibits cutting of these species, since they are considered as ancestral sacrifices (a tree under which people carryout ritual ceremonies). The local people of the study area visits traditional healers for different human and livestock ailments such as luxaa (tissue cancer), cacabsaa (bone cancer), birtee (hepatitis), gamtokkee (cold disease), dhukkuba sare (rabies), banqoo (inflammation and pain of mouth and throat), etc. than modern medication. Knowledgeable healers especially elders in the study area treat these ailments by their special remedies with little charge. All of the healers responded that they keep their medicinal plants secrete and said that free transfer could only be possible with family members or close relatives. In the study area medicinal plants are harvested as necessary. Some plants were reported to be harvested when parts (such as seeds, fruits and flowers) were fully matured. The informants also reported that the gathering and processing of remedies are restricted to traditional healers.

The way by which traditional medicinal knowledge has been managed and its mode of transfer among the community is found to be one way of threat to this resource. During field observation it was seen that some healers hesitate to reveal the claimed medicinal plants and others showed interest to be paid for their knowledge. Hence, transfer of knowledge among the community in the study area has mainly been taking place from the father to the trusted eldest son or selected well behaved son. Yet this knowledge could not be transferred freely outside blood relationship of traditional healers. Studies conducted elsewhere (Mirutse Giday *et al*., 2003; Kebede Deribe *et al*., 2006; Endale Amenu, 2007; etc) revealed similar trends in other communities.

There is a need to get information on the cultural and social factors that affect health. In the attempt made to capture information on the indigenous knowledge of the people, it was observed that the indigenous people of study area deserved credit to their health. They call health “fayyaa” which is taken as special wealth offered by God “Waaqaa”. They preserve that ailments are either the cause for health disorders caused by organisms

“ilbisa” or can be sent from God as punishment “dheekkamsa Waaqaa” for wrong doings. The local community in the study area had their own perception of health and illness; they refer to any health disorder (physical/ or mental disorders) as illness and physical and mental wellbeing as healthy condition.

As informed by elders (Jarsaa biyyaa), the local community express the value of their health by using poems, proverbs and songs. Just to mention some:

a). “Fayyaan abbaaf karra! ” – is to say that health is wealth for its owner.

b). “Dhibbi abban hin beekne fayyaadha!” –is to mean that a great wealth and gift is health.

c). “Lubbun abbaan hinkarkaarsinee bara hinbaatu! ” – is to say that life whose owner gives no care cannot stay year after year.

In addition to this in their day-to- day communications and greetings, the people in the study area is appreciating health, for example by saying “Baarra ka’ee? or Babaaroo?“ Is it good to you? “Fafayyoo?” Are you healthy? “Jajjaboo?” Are you strong? “Irrichaa?” Are you well? “Qabbana!” Be well! “Fayyaa ta’aa!” Be healthy! etc. These sayings and proverbs show that, health is viewed as great asset that is vital to accomplish daily life activities in the area.

4.1.2. Age and marital status of the informants

Based on the information obtained from the local people, the interest of younger generation in knowing and using traditional medicine is not that much (Table 4).

Table 4. Age and marital status of the informants

Age gap	**No. of informants**	**%**	**Marital Status**			**%**
18 – 38	11	18.33	Male	Married	34	56.66
39 – 59	15	25.00		Single	10	16.67
60 – 80	34	56.67		Total	44	73.33
Total	60	100.00	Female	Married	10	16.67
				Single	6	10.00
				Total	16	26.67

4.1.3. Educational status of the informants

The majority of the informants (73.3%) were uneducated (illiterate) but knowledgeable agro-pastoralists (Table 5).

Table 5. Educational status of informants

Educational Status	**Male**	**Female**	**Total**	**Percentage**
Modern Education	15	1	16	26.67
Religious Education	----	----	----	---
Illiterate	29	15	44	73.33
Total	44	16	60	100.00

4. 2. Indigenous Botanical and Environmental Knowledge of Local People in the Study Area

4.2.1. Emic classification of plants

People of the study area classify plants into four big categories as muka guddaa (Trees), muka xixiqqaa (Shrubs), marra (Grass) and muka gaalee (Woody climber) based on plant height and strength of the stem as follows (Table 6).

Table 6. Plant classification by local people

Plant habit classification (Emic category)	**Meaning of category**	**Corresponding etic category**
Muka Guddaa	Woody plant with a single main stem (a trunk or a bole) & a distinct upper crown	Tree
Muka Xixiqaa (Miciree)	Woody plants with many stems coming from near the ground	Shrubs
Marra	Plants with no persistent stem above ground	Grass/Herbs
Muka Gaalee	Plants that use other plants or objects as a means for support	Climbers/Liana

4.2.2. Emic classification of soil

Indigenous people of the study area classify soil based on the colors of the soil (Table 7).

Table 7. Local classification of soil

Soil classification (Emic category)	**Meaning of category**	**Corresponding etic gory**
Biyyee Dimmaa	Soil type that can pass water through it & become leeched	Red Soil
cateBiyyee kootichaa	Soil type that cracks when the moisture of the soil decreases	Black Soil
Suphee	Soil type that is used to make pots, etc., & can hold much water	Clay Soil
Biyyee Cirachaa	Soil that has larger and irregular particles that can allow water to pass easily	Sandy Soil
Biyyee Makkaa ykn Ardaa	Soil that contains all types of particles & organic compounds or Soil with high accumulation of decomposing substances especially manure	Loam Soil or Highly fertilized soil

4.2.3. Local classification of land based on its use and location

Indigenous people of the study area are used to classify land based on its use and occupation as follows (Table 8).

Table 8. Local classification of land based on its use and location

Emic land use classification	**Meaning of category**	**Corresponding etic category**
Lafa qonnaa/Fichaa	Cultivated land	Agricultural/Farming land
Gongomaa	Land covered with natural vegetation mostly of trees & shrubs	Forest/ Wild
Lafa tikaa/Lafa dhedumsaa	Area covered with grasses and herbs & not cultivated	Grazing land
Bowwa	Land with overhanging rocky face or gorges	Cliff
Ollaa	Area on which humans are settled	Village
Lafa ciccita	Area which is washed away by wind or running water	Eroded land

4.2.4. Emic categorization of land topography

The local people categorize the area topographically as Tullu, Tarba, Goodaa and Basaa as follows (Table 9).

Table 9. Categorization of topography

Emic land form classification	**Meaning of category**	**Corresponding etic category**
Tullu	An area higher than hill	Mountain
Tarba	Areas less in height than mountain	Hill/Slope
Goodaa ykn Basaa	Area found at the middle of the hill or More or less straight flat or level area	Along the hillsides or Plain

4.2.5. Emic classification of agro - ecology

Indigenous people classify the study area into three main categories based on its climate as Badda, Baddaa Daree and Gammojjii as follows (Table 10).

Table 10. Agro - ecology classification of the study area

Emic agro-ecology classification	**Meaning of category**	**Corresponding etic category**	**Where in the study area it is found**
Baddaa	Areas greater than 2500 m asl	Highland	None
Badda Daree	Areas in b/n 1500 – 2500 m asl	Middle land	Almost in all study cites
Gammojjii	Areas less than 1500 m asl	Lowland	Parts of Sooyyaa Suroo,Didoolee Haaraa & Damballa Haaraa

4.3. Ethnomedicinal Plant Species Used and Ailments Treated by the Traditional Medical System

4.3.1. Medicinal plants used

A sum of 106 species of medicinal plants which are distributed across ninety eight genera and forty six families were gathered and documented from the study area (Appendix 5). In terms of number of species, Asteraceae appeared as the most prominent family having ten species, in eight genera, followed by Rubiaceae which has nine species in eight genera and Lamiaceae seven species in seven genera. Fabaceae and Euphorbiaceae seven species each with six and five genera, respectively, Solanaceae five species, Acanthaceae, Apiaceae,Cucurbitaceae, Poaceae, Rutaceae and Myrtaceae three species each and the remaining families contain two or one species each (Table 11).

Table 11. List of some medicinal plants

No.	Family name	Number of genera	Number of species	Percentage of total species
1	Asteraceae	8	10	9.43
2	Rubiaceae	8	9	8.49
3	Lamiaceae	7	7	6.60
4	Fabaceae	6	7	6.60
5	Euphorbiaceae	5	7	6.60
6	Solanaceae	5	5	4.72
7	Acanthaceae	3	3	2.83
8	Apiaceae	3	3	2.83
9	Cucurbitaceae	3	3	2.83
10	Poaceae	3	3	2.83
11	Rutaceae	3	3	2.83
12	Myrtaceae	2	3	2.83

4.3.2. Growth forms of medicinal plants and their distribution in wild and home garden

Shrub is the dominant growth form among the reported medicinal plants (Table 12).

Table 12. Habit of medicinal plants in the study area

Habit of Plants	**No. of Species**	**Percentage**
Trees	17	16.0
Shrubs	45	42.4
Herbs	29	27.4
Climbers	15	14.2
Total	106	100

Among the collected medicinal plant species of the study area, the majority (85.8%) were wild whereas 14.2% were cultivated in home gardens (Table 13).

Table 13. Number and percentage of medicinal plants collected from wild and home gardens

Wild Plants			**Plants Collected from Home Gardens**	
Habit	No. of sp.	%	No. of species	%
Trees	15	14.2	2	1.9
Shrubs	40	37.7	5	4.7
Herbs	21	19.8	8	7.6
Climbers	15	14.1	-	-
Total	91	85.8	15	14.2

4.3.3. Medicinal plants used to treat human, livestock and both human and livestock ailments

Among 106 medicinal plants reported by the local people in the study area sixty two plant species were used as medicine for human ailments, twenty two species for livestock ailment and the remaining twenty two plants were used for both human and livestock diseases (Table 14).

Table14. Number of medicinal plants used for human, livestock and both human and livestock ailments.

User	No. of Plant species	Percentage
Human	62	58.40
Livestock	22	20.80
Both human & livestock	22	20.80
Total	106	100

4.3.4. Parts of medicinal plants used to treat human and livestock diseases

Widely used plant parts by the local people in the study area to treat human and livestock diseases include leaves, roots, barks and stems. Maximum numbers of species (56.1%) were harvested for their leaves to prepare remedies, followed by roots, barks and stems (14.4%, 9.8%, and 8.3%, respectively) (Table 15). Other parts cover only 11.4%.

Table 15. Plant Parts Used for the Treatment of Human and Livestock Diseases

Plant Parts Used	No. Medicinal Plants Used	Percentage
Barks	13	9.8
Bulb	1	0.8
Fruits	3	2.3
Latex	3	2.3
Leaves	74	56.1
Rhizome	1	0.8
Roots	19	14.3
Seeds	7	5.3
Stems	11	8.3
Total	132	100.0

It was observed that most of the remedies consisted of a single plant part and more than one methods of preparation. However, some of the remedies consisted of different parts of the plant species to treat single or more disease. Moreover, a single plant is used for more than one disease.

4.4. Ailments Treated and Treatment Methods

4.4.1. Human and livestock ailments treated

In the study area thirty seven diseases of humans are treated with a total of eighty four plant species and sixteen preparations, where one species can treat a single disease or a number of diseases (Appendix 6). Similarly, one ailment can be treated with multiple plant species or a single plant species. For example, cold disease is treated with ten

species of plants; tonsillitis and stomach ache with nine species (Appendix 6). Gonorrhea, rabies and wound are treated with six species each. This does not mean that they are necessarily used in combination; they could be used as alternative medicines for the same ailment.

Ailments reported to be handled by traditional medical practitioners of the Wereda are those disorders, which are not prevalent in the area. Although rabies (Dhukkuba Saree) is a common problem in the Wereda, it is not indicated in the 2010/2011 report of the Wereda health office as prevalent. This could be attributed to the preference of herbal drugs over the modern ones by the public to treat the condition.

In this study forty four plant species are used to treat twenty five livestock ailments, in twelve preparations. Diarrhea and body wound (Sumuxee) ranked first with seven species followed by rabies (Dhukkuba Saree) and paralysis (Cuma'a) five species each. Snake bite (Hadhaa Bofaa) and diarrhea of calves (Busootu) ranked third with four species each (Appendix 7). This may indicate the presence of good therapeutic experience of the local people in treating livestock ailments. Perhaps this could be due to the fact that they are agro-pastoralists which help them to follow and treat livestock in their day to day life activities.

4.4.2. Conditions of preparation of traditional medicines

The local communities of the study area employ several methods of preparation of traditional medicines from plants. According to informants 91.5% of herbal preparations are from fresh plant parts whereas 5.7% are from dried parts followed by fresh/dried parts (2.8%) (Figure 4).

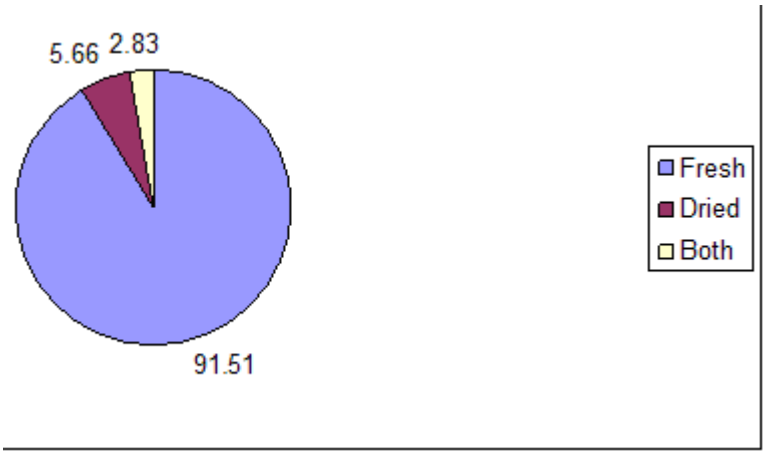

Figure 3. Percentage of condition of medicinal plants used in remedy preparation

Preparation from single species accounted for 85.88% whereas double species 2.82%, triple species 4.70% and quadruple or more species 6.60% (Table 16).

Table 16. Composition Percentage of herbal preparation in the study area

No.	Composition of preparation	Number of species	Percentage
1	Single Species	91	85.9
2	Double Species	3	2.8
3	Triple Species	5	4.7
4	Quadruple or more Species	7	6.6
	Total	106	100.0

The mixture is not changed depending on the patient but the dose may be changed with age, level of the disease, physical appearance of the patient and personal experience of the healer. As far as solvents and additives are concerned, water served as 'solvent' in most of the ethnoformulations, whenever dilution is required. Solution of roasted barley powder or local beer, charcoal powder solution and milk were reported as antidotes for remedies given for ailments such as hepatitis, rabies and gonorrhea respectively.

Different additives are incorporated in 10.61% of the ethnoformulations. These additives included magado salt 3.79%, honey 3.79% and butter 3.03% (Figure 5).

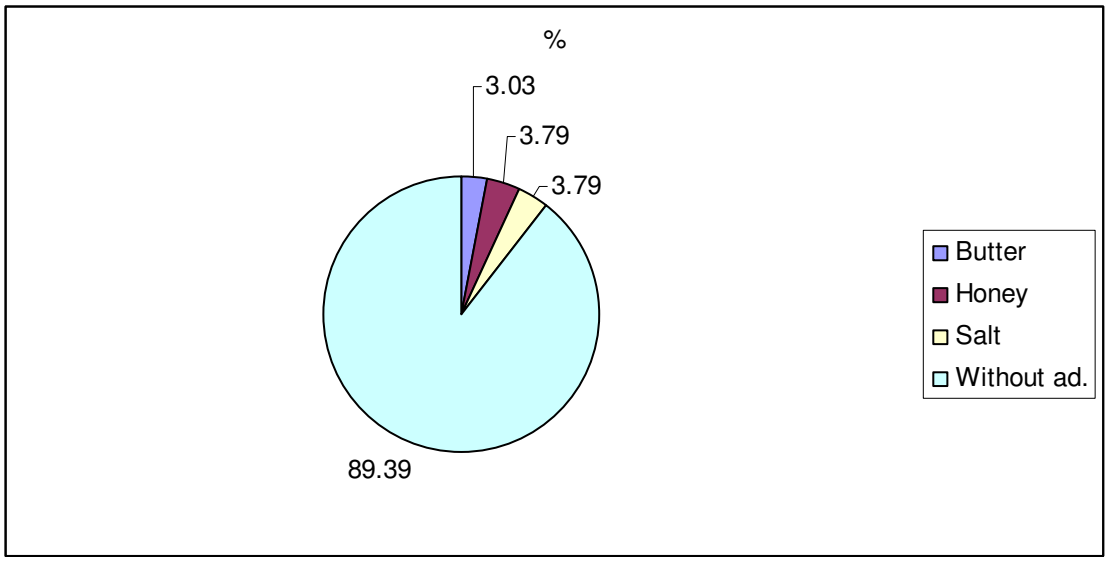

Figure 4. Additives used in plant medicines in the study area.

According to healers, certain additives are frequently used to improve the acceptability of some remedies that are taken orally. This can be salt or honey which is added to decoctions and macerations to reduce the bitterness of the remedies.

The common preparation methods in the study area included decoction (the medicinal plants in the solvent), juice/paste (extracted from fresh plant part), poultice (plant crushed or boiled and applied), unprocessed part (usually fleshy plant part), exudates (sap/latex) and smoke (as dry bath) (Figure 6).

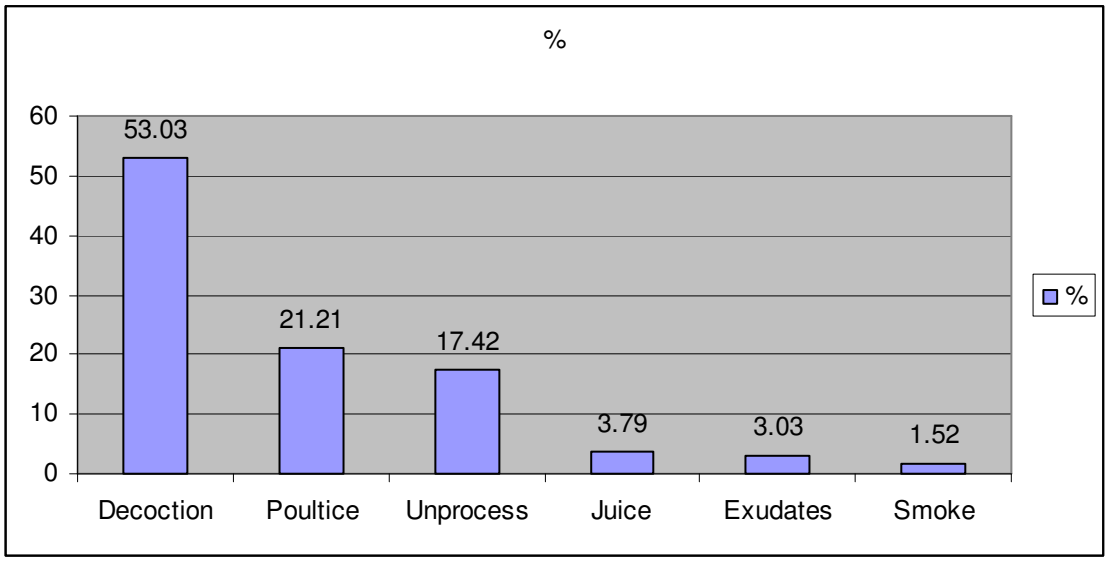

Figure 5. Methods of preparation of remedies in the study area

In the study area, people do not usually store remedies for prolonged period. When needed they go out and collect the plant and prepare the remedy from fresh material. Mostly remedies are prepared by pounding the fresh plant part in a wooden Mortar (Moyee). Latex is sometimes consumed in food such as Qocho bread. External applications (mostly for skin diseases, snake bites and wounds) and internal consumption of the preparations were involved in the treatment of diseases (Appendix 3). The majority of the dosage forms utilized by the people of the study area were liquid preparations (57.45%) and followed by unprocessed plant parts (20.56%) (Table 17).

Table 17. Proportion of dosage forms of remedies used by the people.

Dosage Forms	**Amount and % of Ethnoformulation**	
	Amount	**Percentage**
Liquid Preparation	81	57.45
In the form of ointment	17	12.06
Pounded form	14	9.93
Unprocessed plant part	29	20.56
Total	141	100.00

4.4.3. Route of administration/ application

The most common route of administration of traditional remedies in the study area was oral that cover 67.19%. Most of the remedies prescribed by traditional healers are applied in different ways such as drinking juice, taking drops of squeezed plant part or chewing and swallowing the liquid part only. Dermal application is the second most important route of administration of traditional medicine which covers 21.09%. But there are various ways of dermal application of traditional medicine. For example, they may be applied in the form of paste, coated or tie or crushed the plant part and put the powder on the affected part and so on. Only few medicinal plants were reported to be administered through nasally and optically (Figure 7).

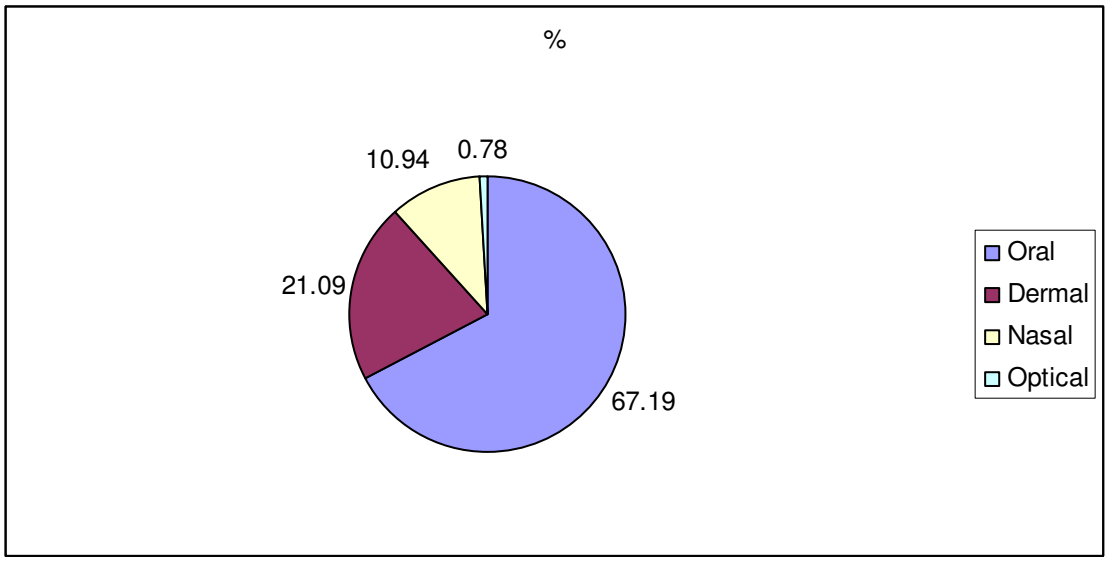

Figure 6. Route of traditional medicine administration

Most of the remedies are taken orally and by external application such as ointment in the case of dermatitis. Some remedies were used for the treatment of bone and tissue cancer. Fumigation is mainly used in the treatment of headache and body pain. Some healers reported that restrictions are imposed when certain types of remedies are taken by patients. For example, food is not given from the morning until midday to a patient who is taking a remedy against intestinal worms. This is the estimated time for getting

diarrhea that expels the worm from the intestine. It is believed that food will reduce the efficacy of the remedy.

4.4.4. Forms of traditional medicines application

The findings of this study showed that all administrations are not standardized. But healers in the study area used almost the same materials to measure the dosage. This may be due to experience sharing among them. According to Dawit Abebe and Ahadu Ayehu (1993), the real drawback in traditional medicine system mostly arises from lack of precision in dosage.

Healers determine the dosages based on age, physical appearance, occupation and duration of the illness, strength of the disease and diagnosis and experience of individual healers. Children are given small doses of medicine than considered in case of adult patients. As a result the local healers simply recommend or prescribe small amount such as drops, hand palms, coffee cups and for larger dosages the water glasses or other local materials that are used for drinking. They use the type of disease and its severity to determine the frequency of treatment. Local healers have special care for pregnant women and physically weak person. For example, pregnant women and physically weak person are not given those medicines that have observable adverse effects such as vomiting and diarrhea.

The frequency of treatment depends on the type of illness and its severity. Most of the remedies were reported to have no serious adverse effects except vomiting, diarrhea and temporary inflammations. According to the healers, these effects are generally due to an overdose of the remedy. Sometimes the expected effect of the remedy is diarrhea, such as in the case of constipation and intestinal worms. For intoxification treatment, the patient is supposed to eliminate the poisons by vomiting. The people of the study area use cow milk as common antidote. Pounding was the common method used for preparing plant medicines before administering to sick people (Table 18).

Table 18. Forms of application of remedies in the study area

Methods	No. of preparation	Percentage
Drinking	76	51.70
Put on	22	14.97
Chewing	16	10.88
Inhaled (Sniffed)	14	9.52
Creamed	9	6.12
Rubbed/Massaged	3	2.05
Eaten	2	1.36
Fumigating	2	1.36
Tooth brush	2	1.36
Washing	1	0.68
Total	147	100

4.4.5. Informant consensuses and description of most frequently used medicinal plants in the study area

This study clarified that some medicinal plants are well known in the study area than others. As a result local informants cited such plants repeatedly as a remedy of various diseases of humans and livestock. For example, *Croton macrostachyus* was cited by fifty two (86.7%) of informants as a source of remedy for black leg & tapeworm, *Cucumis pustulatus* by fifty (83.3%) for TB; *Ocimum urticifolium*, *Rumex abyssinicus, Solanum incanum* and *Vernonia amygdalina* by forty eight (80.0%) informants each to treat 'Mich', gonorrhea, tooth ache and urine retention respectively. These and other most widely used medicinal plants are listed and described as follows (Table 19).

Table 19. Informant Consensus on most commonly used medicinal plants

Botanical Name of Medicinal Plants	No. of Informants	Percentage
Croton macrostachyus	52	86.70
Cucumis pustulatus	50	83.33
Datura stramonium	42	70.00
Hagenia abyssinica	44	73.30
Justicia schimperiana	42	70.00
Ocimum urticifolium	48	80.00
Rumex abyssinicus	48	80.00
Solanum incanum	48	80.00
Vernonia amygdalina	48	80.00
Withania somnifera	42	70.00

These medicinal plants are described as follows:

1. *Croton macrostachyus* Del. (Euphorbiaceae), Mokkoniisaa

Mainly used for firewood and the production of charcoal, but it burns with a rather unpleasant spicy odour. This species produces a dark-ambered honey with strong flavour. The wood is of medium weight, moderately soft, perishable and susceptible to attack by wood borers. It is used for heavy-duty flooring, poles and tool handles. Seeds and resin are poisonous. Boiled leaf decoction is drunk or ashes taken orally as treatment for cough; juice from fresh leaves is applied on wounds to hasten clotting. Root decoction is used as an anthelmintic for tapeworm, as a purgative, and for malaria and venereal

diseases. Bark from the stems and roots is boiled in water and newly born babies are bathed in the mixture as a remedy for skin rash (Agro –Forestry Tree Database, 2010).

2. *Cucumis pustulatus* Naud. Ex Hook.f. (Cucurbitaceae), Haadhatu

Trailing or climbing peremial herb (Jeffrey C., 1995). In the study area its root is used to treat ailments such as TB and Gonorrhea.

3. *Datura stramonium* L. (Solanaceae), Qobboo ardaa

It is known by different common names is a common weed in the *Solanaceae* (the nightshade family). It is a warmth demanding weed and starts to flower between June and October, ripening its seeds in the same period. It can grow big and strong enough to oppress cultivated crops. It can endure summer draughts well; however it is sensitive to low temperatures, and can die on 0°C. Each plant may produce thousands of seeds and they are able to maintain their viability in the soil for a long time. It contains tropane alkaloids that are sometimes used as a hallucinogen. The active ingredients are atropine, hyoscyamine and scopolamine which are classified as deliriants, or anticholinergics (Wikipedia, the free encyclopedia**,** 2009)**.** Leaves of this plant are used to treat diseases such as rabies (Dhukkuba Saree) in the study area.

4. *Hagenia abyssinica* (Bruce) J. F. Gmelin (Rosaceae), Heexo

It is found between the altitudes of 2000-3000 m and mean annual rainfall: 1000-1500 mm. *H. abyssinica* is a good source of firewood and charcoal.Wood is dark red, medium soft but not durable; it is used for furniture, poles, flooring, carving and cabinet making. The roots are cooked with meat and the soup drunk for general illness and malaria, while the dried and pounded female inflorescence is used as an anthelmintic (especially for tapeworm). Bark may be pounded, added to cold water and the liquid drunk as a remedy for diarrhoea and stomach-ache. Generally, this is a strong medicine that must not be taken in large quantities; it is sometimes taken as an abortifacient (Agro –Forestry Tree Database, 2010).

5. *Justicia schimperiana (*Hochst. ex Nees) T. Anders.(Acanthaceae), Ciiggaa

Moist montane forest usually near stream/river, evergreen scrub on hill slopes, forest clearing, coffee plantation, riverine forest, waste ground, village and house hedges and hedgerows (Ensermu Kelbessa, 2006). *Justicia schimperiana* is a plant believed to have several therapeutic effects including anti-asthmatic properties. In the study area this plant is used by traditional healers to treat ailments such as hepatitis (Birtee).

6. *Ocimum urticifolium* Roth. (Lamiaceae), Hancabbii

Shrub or subshrub (Ryding O., 2006). Leaves of this plant were used by traditional practitioners to treat inflammation of oral cavity & fever (Banqoo) in the study area.

7. *Rumex abyssinicus* Jacq. (Polygonaceae), Dhangagoo

A common and tolerated weed in fields and plantations, by paths & in secondary scrub. The tender shoots are edible. The rhizomes are used to refine butter and give it a rich yellow colour. They are also used medicinally and extracts are drunk to control mild forms of diabetes (Hedberg O., 2000). *Rumex abyssinicus* has been used traditionally for treatment of hypertension, inflammatory and painful conditions in Ethiopia People in the study area used its root to treat diseases such as gonorrhea (Dhukkuba Dhiiraa)and others.

8. *Solanum incanum* L. (Solanaceae), Hiiddi

Shrubs, often seasonally deciduous and usually heavily armed with prickles (Friis I., 2006). Traditional healers in the study area used this plant to treat various ailments such as tonsillitis and tooth ache.

9. *Vernonia amygdalina* Del. (Asteraceae), Ebichaa

Small tree or shrub (Fichti and Admasu Adi, 1994). Found in a wide range of bushland, woodland and forest habitats between 500- 2800 m and around houses. Local people in the study area use the juice made from the leaves of this plant to treat abdominal pain, tonsilite, malaria and urinating problem in humans and blotting in cattle.

10. *Withania somnifera* L. (Solanaceae), Lallaafaa

Shrub with broad entire, asymmetric leaves and the fruit is bright red berry. The tuber is used in inflammatory conditions, psoriasis, bronchitis, ulcers, scabies. It grows as a short shrub (35-75 cm) with a central stem from which branch extend radially in a star pattern (Wikipedia, the free encyclopedia**,** 2009**).** Traditional healers in the study area used its root, leaves and fruit to treat different diseases such as snake bite & blotting (Hadhaa boofaa fi Darrabba).

Different healers might give preference to different species for the treatment of the same medical condition. Most species encountered were well known to the healers, even if they themselves did not use the species in question. Many species were often easily recognized by their vernacular names by other members of the population, because most of them were named with only one vernacular name widely used in the study area. Whereas few species don not have vernacular names and this could be attributed to the less popularity. Some medicinal plants are more popular than others in treating different human and livestock ailments.

The result of this study revealed that, 98 species (92.5%) of the total were independently cited by three or more informants for their medicinal uses against human ailments. Moreover, it was observed that some of the medicinal plants were popular and used widely in the study area. In this view, *Croton macrostachyus* with 52 informants (86.7%) resumed the leading position followed by *Cucumis pustulatus* 50 informants (83.3%) Appendix 4. Furthermore, it was observed that most of the medicinal plants were used to treat more than one health problems (Appendix 3). According to the informants in the study area, the reason behind the popularity of these medicinal plants can be attributed to the wide range of diseases that they treat or to the abundance of the plant in the area for easy access.

4.5. Numerical Presentation of Data (Ethnobotanical Data Analysis) for Some Selected Medicinal Plants and Diseases

4.5.1. Preference ranking of plants used to treat rabies

Preference ranking for five medicinal plants to treat rabies (Table 20) made by ten informants showed that *Momordica foetida* ranked first and hence is the most effective medicinal plant to cure rabies. *Datura stramonium, Balanites aegyptiaca, Ricinus communis,* and *Eucalyptus globulus* are the 2nd, 3rd, 4th and 5th , respectively.

Table 20. Preference ranking of five selected medicinal plants based on their degree of treating rabies as perceived by informants

Medicinal Plant Species	**Informant (R_1—R_{10})**										**Total**	**Rank**
	R_1	**R_2**	**R_3**	**R_4**	**R_5**	**R_6**	**R_7**	**R_8**	**R_9**	**R_{10}**		
Balanites aegyptiaca	4	2	3	1	2	3	3	4	5	3	30	3rd
Datura stramonium	4	3	5	3	4	5	3	4	5	3	39	2nd
Eucalyptus globulus	2	1	1	2	3	1	4	2	1	2	19	5th
Momordica foetida	5	4	5	5	4	4	5	5	4	5	46	1st
Ricinus communis	3	4	3	2	1	1	2	2	3	1	22	4th

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

4.5.2. Pair wise comparison of medicinal plants used for cold disease treatment

As it is known pair wise ranking can be used for evaluating the degree of preference or level of importance of certain selected plants or plant parts. In this study, ten informants were selected to conduct the exercise among seven medicinal plants used to treat cold disease (Table 21). *Carissa spinarum*, *Euclea divinorum, Clerodendrum myricoides, Asparagus africanus* and *Dovyalis abyssinica,* were ranked 1st, 2nd, 3rd, 4th and 5th respectively. *Nuxia congesta* and *Flacourtia indica* were less preferred and less efficacious compared to the rest five species.

Table 21. Pair wise ranking of seven medicinal plants used to treat cold

Medicinal Plants	**Informants (R_1—R_{10})**										**Total**	**Rank**
	R_1	**R_2**	**R_3**	**R_4**	**R_5**	**R_6**	**R_7**	**R_8**	**R_9**	**R_{10}**		
Asparagus africanus	4	4	5	6	0	3	1	5	4	7	39	4th
Carissa spinarum	6	0	6	5	6	1	5	6	6	7	48	1st
Clerodendrum myricoides	7	6	4	5	1	4	6	0	6	4	43	3rd
Dovyalis abyssinica	2	3	3	5	1	0	5	2	4	3	28	5th
Euclea divinorum	4	5	4	4	6	6	5	7	4	1	46	2nd
Flacourtia indica	2	7	0	2	2	2	0	1	2	4	22	7th
Nuxia congesta	2	1	2	1	2	4	6	2	1	6	27	6th

4.5.3. Use diversities of medicinal plants collected from the study area

In the study area, some plants were reported to have uses other than their medicinal values. Of the total 106 medicinal plants documented in the study area, eighty six species (87.88%) were reported to have additional uses while twenty species of them (12.12%)

were used as medicinal plants only. The additional use categories include; fuel with fifty one species (30.91%), fodder with thirty one species (18.18%), edible with ten species (6.06%), construction with forty one species (24.85%), spices with three species (1.82%), life fence with six species (3.64%), ornamentals with two species (1.21%) and stimulants with two species (1.21%) according to their importance (Table 22). The complete list of uses of all medicinal plants collected from the study area was also documented (Appendix 4).

Table 22. Use diversity of medicinal plants gathered from the study area

Use Categories	**No.Plant Species Reported**	**Percentage of Total**
Only Medicinal	20	12.1
Medicinal plus Edible	10	6.1
Medicinal plus Fodder	31	18.2
Medicinal plus Fuel	51	30.9
Medicinal plus Spices	3	1.8
Medicinal plus Construction	41	24.9
Medicinal plus Live Fence	6	3.6
Medicinal plus Stimulant	2	1.2
Medicinal plus Ornamental	2	1.2
Total	165	100.0

4.5.4. Direct matrix ranking

Based on information gathered from informants, eight multipurpose plant species were selected out of the total medicinal plants. Eight use diversities of these plants were listed for eight randomly selected key informants to assess their relative importance use in their respective localities (Table 23). The eight use values include medicinal, fodder, food, firewood, construction, charcoal, fencing and furniture making. Each key informant was asked to assign use values (5= best, 4= very good, 3= good, 2= less used, 1= least used

and 0= not used). Consequently, each key informant use values for the eight multipurpose medicinal plant species, average value of use diversities for the species was taken and the scores of each species were summed up and ranked.

Table 23. Average score for direct matrix ranking of eight medicinal plant species based on their general use values (5= best, 4= very good, 3= good, 2= less used, 1= least used and 0= not used).

Plant Species	**Use Categories**									
	Fire wood	**For age**	**Const ructio**	**Fur nitu**	**Fo od**	**Cha rcoa**	**Fenc ing**	**Med icine**	**Tota l**	**Ran k**
Croton macrostachyus	3	0	3	2	0	2	4	5	19	7th
Syzygium guineense	4	1	5	3	5	3	5	3	29	1st
Milletia ferruginea	5	2	4	1	0	3	3	4	22	4th
Prunus africana	5	0	5	3	0	3	5	3	24	3rd
Vernonia amygdalina	3	4	2	0	0	1	2	5	17	8th
Carissa spinarum	5	3	5	0	5	0	2	1	21	5th
Flacourtia indica	4	4	1	0	5	2	2	2	20	6th
Hagenia abyssinica	5	2	5	5	0	3	2	5	27	2nd
Total	34	16	30	14	15	17	25	28	179	
Rank	1st	8th	2nd	6th	7th	5th	4th	3rd		

This investigation showed that, *Syzygium guineense*, *Hagenia abyssinica* and *Prunus africanus* were ranked 1st, 2nd and 3rd and hence are the most preferred medicinal plants by local people for various uses and are the most threatened species as the informants

reported, which is evidently shown by their scarce distribution and time required to collect these species. *Millettia ferruginea, Carisa spinarum* and *Flacourtia indica* were ranked 4th, 5th and 6th respectively. On the other hand, *Croton macrostachyus* and *Vernonia amygdalina* were the least ranked species in multipurpose and are the less threatened species and the dominantly distributed species in the area.

The values for use reports across the selected species were summed up and ranked. The results showed that the local people harvested multipurpose species mainly for firewood, construction, medicine, fencing, charcoal and furniture with the rank of 1st, 2nd, 3rd, 4th, 5th and 6th respectively. Thus, sustainable use of these top-ranked species is under questions, as the pressure on their consumption is intensified, superimposed on lack of propagation techniques in the area. This is evidenced by the high rate of loss of *Hagenia abyssinica* in the area. Generally, the use matrix ranking showed that these medicinal plants are at conservation risk because of overexploitation and additional uses for different activities.

4.5.5 Fidelity level index of healing potential of medicinal plants

Fidelity level (FL) quantifies the importance of a species for a given purpose. Hence, fidelity level values were calculated for commonly used individual medicinal plants against the following ailments: *Croton macrostachyus* (against black leg), *Cucumis pustulatus* (against TB.), *Datura stramonium* (against rabies), *Hagenia abyssinica* (against tapeworm), *Justicia schimperiana* (against hepatitis), *Ocimum urticifolium* (against inflammation of oral cavity), *Rumex abyssinicus* (against gonorrhea), *Solanum incanum* (againt tooth ache), *Vernonia amygdalina* (against urine retention) and *Withania somnifera* (against snake bite). The fact that these medicinal plants had the highest FL values which could be an indication of their good healing potential (Table 24).

Table 24. The relative healing potential of individual medicinal plants used against human or livestock ailments

No.	Medicinal plant	Examples of ailment treated	I_p	I_u	FL	FL %	Rank
1	*Croton macrostachyus*	Black leg	52	52	1	100	1
2	*Hagenia abyssinica*	Tapeworm	44	44	1	100	1
3	*Justicia schimperiana*	Hepatitis	42	42	1	100	1
4	*Datura stramonium*	Rabies	40	42	.95	95	4
5	*Rumex abyssinicus*	Gonorrhea	44	48	.92	92	5
6	*Cucumis pustulatus*	TB	46	50	.92	92	5
7	*Ocimum urticifolium*	Inflammation of oral cavity	43	48	.90	90	7
8	*Solanum incanum*	Tooth ache	42	48	.88	88	8
9	*Withania somnifera*	snake bite	36	42	.86	86	9
10	*Vernonia amygdalina*	Urine retention	40	48	.83	83	10

4.5.6 Comparison of medicinal plants knowledge among different social groups in the community

The statistical significance of the regression was 0.05 and indicates that the model applied is significantly good enough in predicting the outcome variable. The coefficients provide us with information on each predictor variable - Linear Regression Analysis using SPSS (Figures 8, 9 and 10).

Relationship of traditional medicinal knowledge with age level of the informants

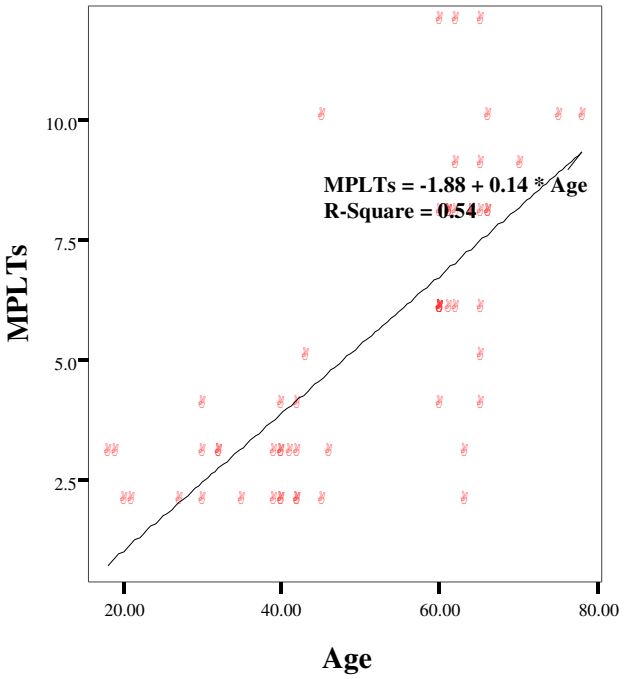

Figure 7. Relationship of traditional medicinal knowledge with age level of the informants (MPLTs= Medicinal Plants knowledge)

The study showed that there were significant differences among average numbers of medicinal plants cited by youngsters and elders as indicated by the above graph. This provides us with information necessary to predict medicinal plants knowledge with respect to age. We can see that both MPLTs knowledge and age contribute to the model. As the age increases medicinal plant knowledge also increases. Hence, we can present the regression equation as: MPLTs= -1.88 + $0.14^{\pm}$ Age. R –square value indicates how much of the dependent variable can be explained by the independent variable. In this case 54% can be explained, which is enough for certain knowledge difference explanation.

Difference of traditional medicinal knowledge in relation to educational level

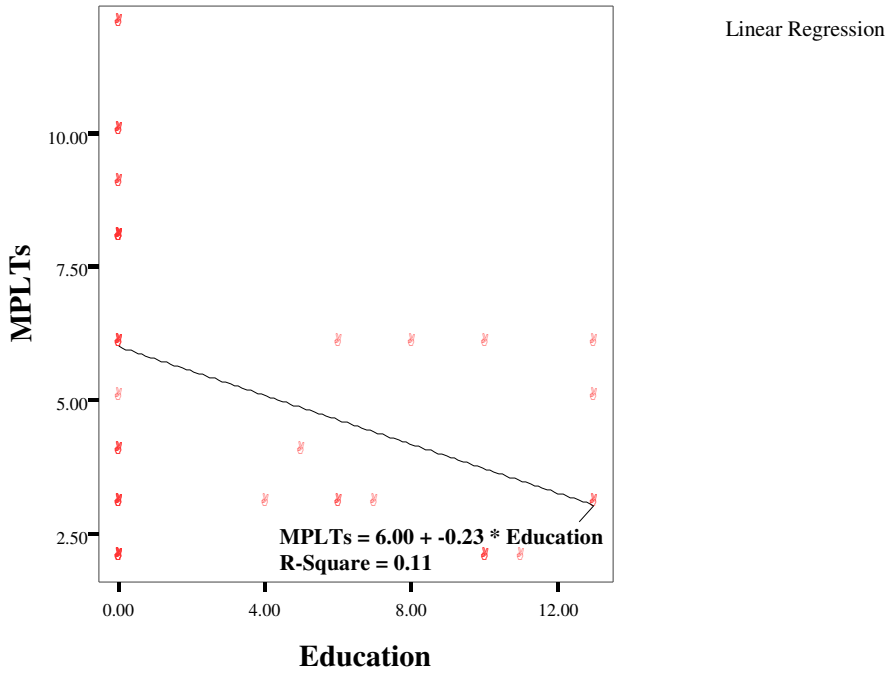

Figure 8. Difference of traditional medicinal knowledge with age level of the informants (MPLTs = Medicinal Plants knowledge)

This analysis depicted the presence of traditional medicinal knowledge difference among literate and illiterate members of the informants as indicated by the above diagram. This again provides us with information necessary to predict medicinal plants knowledge with respect to education level. We can see that both MPLTs knowledge and education level contribute to the model. As the graph indicates being more educated (modernization) minimize traditional medicinal knowledge. Hence, we can present the regression equation as: MPLTs= 6.00 + -0.23$^{\pm}$ Education. As it is mentioned above R –square value indicates how much of the dependent variable can be explained by the independent variable. In this case 11% can be explained, which is enough for certain knowledge difference explanation.

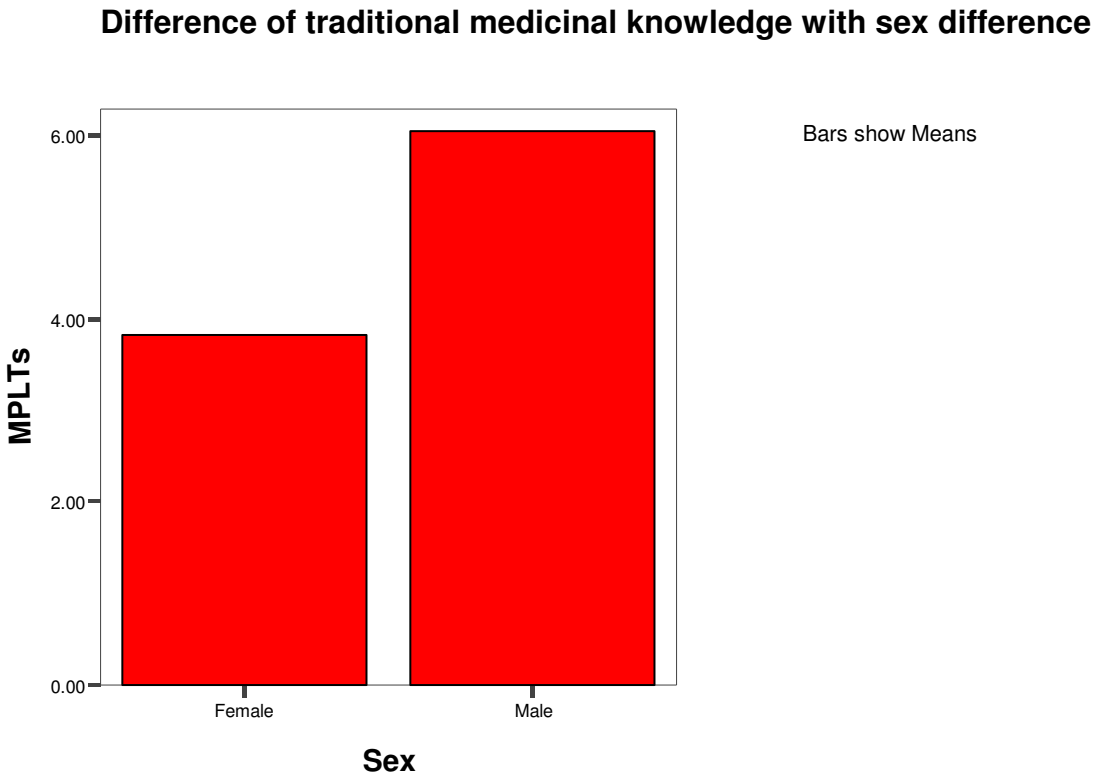

Figure 9. Difference of traditional medicinal knowledge with respect to sex

This analysis also clarifies the presence of traditional medicinal knowledge difference with respect to sex difference. It provides us with information necessary to predict medicinal plants knowledge with respect to sex difference. We can see that both MPLTs knowledge and sex difference contribute to the model in that males are more knowledgeable in traditional medicine practice than females. Hence, it was observed that age, level of education and gender were factors that have influenced knowledge on the use of medicinal plants. Higher averages were calculated for men than women, for older people than younger ones, for illiterate people than literate ones.

4.5.7 Habitats and abundance of medicinal plants in the study area

In this study medicinal plants were collected from various habitats including roadsides, live fence, crop fields, grazing land, forests and home gardens (Table 25).

Table 25. Distribution of medicinal plants in different habitats

Habitat type	No. of medicinal plants	Percent	Degreeof management
Wood land	36	34.0	Uncultivated
Grazing land	32	30.2	Uncultivated
Forest	11	10.4	Uncultivated
Roadside	10	9.4	Uncultivated
Home garden	7	6.6	Cultivated
Crop fields	6	5.7	Both types
Live fence	4	3.7	Uncultivated
Total	106	100	

As the table shows most of the medicinal plants used by the communities were collected from wild (87.7%). They were growing mostly in disturbed habitats, mainly in woodlands and grazing land. About 12.3% were brought under cultivation, most of which are grown for other purposes. Since most of the remedies are being found in the wild a big threat is seen to their existence with the current rate of habitat destruction and conversion. This in turn resulted in rarity of some medicinal plants such as *Hagenia abyssinica*, *Prunus africanus*, *Syzygium guineense, Podocarpus falcatus*, etc. They are becoming highly scarce in the study area, because they are sought for timber, construction, fuel and other uses in the locality. Hence, such pressure calls for urgent measures to be taken to rehabilitate and conserve the remaining vegetation in general and medicinal plants in particular.

5. DISCUSSION

5.1. Indigenous Knowledge of the Local People about Traditional Medicine

Medicinal plant species documented from the study area for the treatment of human and livestock ailments are generally one hundred and six and this could be an indication of significant role of herbal remedies in addressing the primary health care needs of the people. Strong belief in traditional medicine, its better efficacy in treatment of ailments like bone cancer (Cacabsaa), rabies (Dhukkuba Saree), hepatitis (Biirtee) and cold disease (Gamtokkee), as some informants reported as well as limited access to modern health facilities and low socio-economic status of the people could be among the factors that have contributed to the continued reliance on plant based traditional local pharmacopoeia in the study area.

The families Asteraceae, Rubiaceae, Lamiaceae, Fabaceae and Euphorbiaceae were represented by the highest number of medicinal plant species and this could probably be attributed to the overall species richness of these families in the area. Asteraceae, Fabaceae and Rubiaceae are among the largest dicot families in the Flora of Ethiopia and Eritrea containing throughout the world, about 23,000, 18,000 and 10,000 species respectively (Thulin, 1989; Ryding, 2006). Other studies conducted elsewhere in the country (Endalew Amenu, 2007; Mesfin Tadesse *et al*., 2005; Mirutse Giday and Gobena Ameni, 2003; Tesema Tanto *et al*., 2003 and Zemede Asfaw, 1999) also indicated the high contribution of these families to the Ethiopia medical flora.

Out of all medicinal plants collected, the majority were identified with local names. Some species were with names related to their specific medicinal uses (Appendix 3). For example, a medicinal plant called by the name "Qorsaa diriyaa" the word 'Qorsaa' in Afaan Oromoo means "Medicine" and 'diriyaa' means "Evil eye". The fact that most of the medicinal plants had local names could be attributed to their popularity in the study area whereas the absence of local names for few species could reflect their importance is minor, being cited by one informant each.

Most of the collected medicinal plants from this area were in common with plants collected by other researchers from different study areas of the country. This could be

good indication of the widespread utilization of plant medicines over a wide geographical coverage of the country and this in turn indicates the actual therapeutic values of these species in treating various ailments. Out of the total medicinal plants documented from the study area, five species (4.7%) were endemic to the floral area (Appendix 3, plants in asterics are endemic species). These species are *Aloe monticola, Erythrina brucei, Millettia ferruginea, Solanecio gigas* and *Thunbergia ruspolii.*

Indigenous knowledge of traditional medicine among informants with regard to their sex and age was not similar. In terms of sex forty four were male and sixteen were female. This may indicate that there is no equal access in the family to get indigenous knowledge of traditional medicine. In the study area the proper transfer of medicinal plant knowledge takes place through the men line which could have contributed for the women to have less knowledge as compared to men. Similarly, the fact that younger and literate people are more exposed to modernization than older and illiterate ones could have contributed for the former to have less medicinal plants knowledge. This finding may agree with the findings of Tilahun Teklehaymanot *et al*., (2006), Debela Hunde (2001) and Tizazu Gebre (2005). Enough knowledge of medicinal plants is mainly found among the elderly members of indigenous people. Women's knowledge of traditional medicine is largely on medicinal plants found nearby grazing or farmland, live fences and home gardens. Most youngsters (either male or female) did not have knowledge of traditional medicine. Furthermore they did not have interest to learn from their parents, especially those who go to school. The same trend was also reported from Borana lowlands (Gemedo Dalle *et al*., 2005) and in Bosat Wereda (Debela Hunde, 2001). The results of this study showed that knowledge of traditional medicine mainly found in the age group between 60 – 80 years old. The same findings were also recorded by previous studies (Gemedo Dalle *et al*., 2005; Tadesse Beyene, 2008).

In terms of education the majority of the local informants had no formal education (they were knowledgeable agro-pastoralists), few had modern education and none of them had religious education. This condition indicates that less number of educated individuals of the local people was involved in traditional medicinal practices. This finding agrees with

the finding of Debela Hunde (2001) who suggested that use and transfer of knowledge to the young generation can be affected by modernization.

5.2. Comparison of Traditional Knowledge on Medicinal Plants

In most parts of Ethiopia, herbs are the predominant plants for traditional medicine (Tilahun Teklehaymanot and Mirutse Giday, 2007) and this was not seen in the study area. The findings of this study showed that among the collected medicinal plants the majority were shrubs followed by herbs. This clarify that people in the study area depends more on shrubby elements of the vegetation for the preparation of traditional medicine. This is because shrubs are relatively common in the area as compared with other species such as climbers, herbs and trees. This finding did not agree with the finding of Mirutse Giday (1999), Mirutse Giday *et al*., (2003); Gemedo Dalle *et al*., (2005) and Etana Tolosa (2007) in which herbs were mentioned as the dominant groups used for this purpose. It also disagrees with the finding of Tigist Wondimu *et al*., (2007) in which tree provides the highest services for people living in "*DHEERAA"* town, Arsi Zone, Ethiopia. This difference may come from vegetation and traditional knowledge differences of these areas and people. This variation may also be related to the fact that the natural vegetation has been changed so that people rely on the shrubs that remain as remnant species in the area which is converted to agricultural and living quarters.

Most of the medicinal plants utilized by the local people of the study area were collected from wild; only few were collected from crop fields and home gardens. This is also true in different parts of the country. For example, in similar study Tizazu Gebre (2005) found that about of the remedies were reported from wild. The researcher also noted that most of the medicinal plants are under the threat as long as destruction and fragmentation of wild habitat continues. Zemede Asfaw (1997) reported that only of the plants maintained in home gardens in Ethiopia are primarily cultivated for their medicinal value even though many other plants grown for non-medicinal purposes are used for the preparation of medicines.

The fact that some diseases being treated by multiple species is coupled with the frequent occurrence of the diseases and ease of accessibility and/or efficacy (for example, in the

case of cold disease) of plant species for treatment. In turn, these factors widen the popularity of these species among the informants and indigenous knowledge for treating these diseases. This indicates that when there are different plants species prescribed for the same health problem, people show preference of one over the other. They also show preference in searching for treatment either from modern medication or from local healers (traditional medicine practitioners). Some informants reported that in searching treatment for rabies and cold they prefer the local pharmacopoeia than modern medicines. This could be attributed to accessibility and affordability of traditional one, according to the informants. Some other informants had a belief that the traditional herbal remedy is more efficacious than the modern medicine for the treatment of these diseases.

In this study the researcher was not informed as there is specific day of a week or time of a day for ethnomedicinal plants collection as is practiced in other communities elsewhere (Mesfin Tadesse, 1986; Gesseley *et al.,* 1995; Tesfaye Seifu *et al.,* 2006). The practitioners consider the plant as simple physical entity and feel that the action of plants depends on their inherent medicinal properties. In contrary to this finding, study conducted in the country (Tesfaye Seifu *et al*., 2006) indicated that about 93.1% of the herbalists feel that the action of plants depends on the relationship between the collector and the plants. Moreover, the herbalists in other localities of the country make some rituals before collection of medicinal plants (Tesfaye Seifu *et al*., 2006; Abiyot Berhanu *et al*., 2006) which is not common in the study area. There can be herb- modern drug or herb-herb interaction when using remedies but due to the absence of integration of traditional herbal medicine with the conventional system of treatment, the necessary observation could not be made. Some patients may take modern and herbal medicines together. Hence, safety and efficacy of combined herbs with prescription drugs should also be studied well. In addition to this, traditional healers as well as health workers should be trained on the importance of taking the necessary precautions to avoid possible interaction.

The utilization of newly harvested plant parts in the preparation of remedies is a sign of availability of plant material in the vicinity to be harvested any time. Other study conducted elsewhere (Mirutse Giday *et al*., 2003) also indicated the common use of fresh

materials. Fresh materials are also more preferred when remedies contain volatile oils, concentration of which could deteriorate on drying (Mirutse Giday, 2007). Furthermore, it is easier to prepare remedies in the form of juice or paste from newly harvested plant materials.

Concerning parts of the plant used for the preparation of traditional medicine, this study revealed that leaf is the most extensively used plant part followed by roots and bark. The most frequent use of leaves by the local people of the study area in the preparation of their remedies could partly be related to the relative availability of this plant part throughout the year, as leaves were mostly harvested from perennial trees and shrubs. Another factor could be the relatively easy preparation of remedies from this plant part and perhaps the presence of active constituents. Vulnerable flowers, leaves and roots may contain more active chemicals in comparison to fruits, seeds, bark and latex (Bhattarai *et al*., 2006). Leaves, roots, stems and flowers are physically more vulnerable than bark or cone and therefore it is not surprising that they contain more chemical defense in the form of biologically active secondary metabolites.

Moreover, harvesting leaves does not pose a great danger to the survival of an individual plant as compared to collecting roots, stem/bark and whole plant. Studies have shown that removal of up to half of tree leaves does not significantly affect the growth of species studied (Poffenberger *et al*., 1992). Root is the second most frequently sought plant part by the local people at the study area and this could be due to its year round availability. The availability of high concentration of bioactive constituents (Moore, 1994; Bhattarai *et al*., 2006) could also have resulted in frequent use of roots for remedial preparation. The frequent use of roots in a given community, however, is disastrous to the survival of individual plants unless care is taken during the harvesting process (Mirutse Giday, 2007).

The quantity of parts used is measured by the number of leaves, seeds, fruits and length of roots. The use of multiple species in the preparation of remedies could be attributed to perception by many practitioners of synergetic over the other (Dawit Abebe and Ahadu Ayehu, 1993). It could also be due to deliberate prescriptions by healers to mask the potent plant that would, sometimes, lead to unwanted side effects and also as a placebo

(Getachew Addis *et al*., 2001). The frequent usage of leaves and root are also noted in other parts of the country, for example, Endalew Amenu (2007) found that leaves were most extensively used followed by root parts are in people living Ejaji area, West Shoa, Ethiopia; Etana Tolosa (2007) also found that leaves were highly used and follwed by root parts among indigenous people living in Gimbi Werda Western Wellega, Ethiopia. From this evidence one can understand that leaf is a very important part of plants in terms of medicinal value at least in the context of the local people. Usage of the leaf may not have a significant negative impact on the medicinal plant as compared to the root. This is because aerial parts of the plant are highly dependent on underground parts (roots) for physical support and physiological processes.

5.3. Ways of Preparation, Dosage and Route of Application

In this study a significant number of the medicinal plants were cited to be used in fresh forms in remedy preparations. Relatively few medicinal plants were reported to be used in dried form and the remaining very few medicinal plants were reported to be used in fresh or dried forms. This indicate that people in the study area are highly dependent on fresh remedies that may put medicinal plants under serious threat, since there is no habit of preservation or storage of plant parts for latter use. The same results were recorded in other similar studies (Endalew Amenu, 2007; Tadesse Beyene, 2008; Tizazu Gebre, 2005).

The fact that size reduction is the most frequently used method in preparation of remedies could be attributed to its ease of processing and water is the most frequently used 'solvent' in the preparation of remedies could be as a result of availability in search for solvent and other/or universal solvent nature of water in which a wide range of solutes dissolve. The use of water as a solvent may be disadvantage as some active ingredients in the medicinal plants especially non-polar compounds are insoluble in water and hence will not show the desired biological activity (Tesfaye Seifu *et al*., 2006). The reason for the popularity of liquid preparations may be ease of formulation (remedial preparation). The physical availability of water as solvent could also be the reason behind the frequent use of such preparation of remedies by the people in the study area. The common methods of remedy preparation in the study area was reported to be through decoction

followed by poultice and unprocessed part. These people also used some additives such as honey, milk and butter in the preparation of some remedies.

Predominance of oral and dermal routes of herbal drug application in the study area could be because of high prevalence of gastro-intestinal and skin related problems in the area. Intra-cutaneous application of remedial preparation could also be attributed to the fact that it minimizes the chance of intoxification by drugs than when it is administered orally. In addition, both oral and dermal routes permit rapid physiological reaction of prepared medicines with the pathogens and increase its curative power.The most frequent way to administer remedies was drinking followed by put on chewing, inhaled (sniffed), creamed, rubbed and others (Table 18)**.**

5.4. Threats to and Conservation of Medicinal Plants in the Study Area

5.4.1. Threats to medicinal plants and associated knowledge in the study area

Threats of biodiversity are increasing noticeably from time to time. It is beyond the natural rate of regeneration. This is mainly driven by habitat destruction, over harvesting, increase in pollution and introduction of alien species (CBD, 1998). The most serious threat to medicinal plants in the study area is fragmentation and destruction of their habitats due to agricultural expansion and overgrazing. The present finding is also seen elsewhere in the country (Etana Tolosa, 2007 and Mirutse Giday, 2007). Informants in the study area stated that threat due to agricultural expansion and overgrazing is resulted from population growth and subsequent need of farm plot and grazing land which in turn has caused the loss of habitats and species of medicinal plants. During the field study, it was observed that forests have been cleared for agricultural purposes, basic infrastructure activities such as road construction. More seriously than the above is threat that comes due to overexploitation for other uses of medicinal plants such as for timber, fuel, construction and fodder. This overexploitation of medicinal plants for other uses indicate the low socio-economic status in energy and construction material demand of the people, as could also be common in most rural communities in the country as well as in Africa. In turn, this could be a good indication that these valuable resources are at conservation risk in different ways from that of developed countries. These factors could result in loss of

different species of medicinal plants and consequently that of indigenous knowledge associated. According to FAO report, the rate of deforestation in Ethiopia is estimated to be 2000 km^2/year (IUCN, 1993). This situation is even worse in Ethiopia where there are more environmental problems than any other country in the Sahel belt (Ensermu Kelbessa *et al*., 1992).

Introduction of modernization such as schooling and new religion influenced the acculturation and negligence of the present generation to acquire the knowledge and facilitated the threat to medicinal plants and associated knowledge in the study area. Some destructive methods of harvesting such as uprooting, bark peeling and stem cutting are practiced in the locality. Such unsuitable harvesting techniques of these plant parts may lead to disappearance of these valuable resources, if some conservation measures are not taken. But there is no overexploitation of medicinal plants for medicinal purposes. Researches conducted elsewhere (Seyani and Chikuni, 1997; Mirutse Giday, 2007; Odera, 1997; Kebu Balamie *et al*., 2004) revealed similar trend in disappearance of medicinal plants and associated knowledge in other areas. Therefore, a number of combined factors mentioned earlier have resulted in loss of medicinal plant species and associated knowledge in the study area.

5.4.2. Conservation status of medicinal plants and indigenous knowledge in the study area

At this moment natural habitats of medicinal plants in the study area are highly affected by factors mentioned above. The local people in the study area have brought only about thirteen species of the total collected medicinal plants under cultivation (Table 24). As a result many medicinal plants are under serious threats. This cultivation effort is usually due to other uses of these medicinal plants such as for food, fodder, spice, live fence and shade. Some authors clarify that home gardens can be refuge for wild species that are threatened in the wild by deforestation and environmental changes. Concerning this Zemede Asfaw (2001) reported that home gardens are being used as informal experimentation plots for new varieties and exotic species. Medicinal plants are also left as remnants of trees, shrubs and herbs in and around agricultural fields due to their uses as forage, fuel wood, timber, construction, spiritual and ritual needs. Protecting such

multi-purpose plant species by agro-pastoralists in their localities is evidence for the existence of traditional conservation practices in the area. But this has to be strengthened to safeguard these natural resources. Of the species purposely maintained in home gardens in the country, about 6% are primarily cultivated for their medicinal values (Zemede Asfaw, 2001).

6. CONCLUSION AND RECOMMENDATIONS

The findings of this study revealed that several plant species are used as traditional medicine in the study area. About 106 medicinal plant species were collected which have a great value to treat a wide spectrum of human and livestock diseases. These plants were distributed across 98 genera and 46 families growing over an extended area and used by the local traditional healers living in different kebeles of the study area. Out of the total collected plant species, 62 were used to treat 37 human ailments, 22 species to treat 25 livestock ailments and the rest to treat ailments of both. Traditional medicine preparation mostly involves single plant and the mode of administration is mainly internal in which oral administration is the common route. This enables the traditional health care system to cover more than 54% of human and 59% of livestock health services in the study area. This in turn gives hint to believe that the traditional medicinal practices using native medicinal plants exist well functioning in the study area.

The local people use traditional medicines for primary health care due to the belief in its effectiveness, lack of modern medicines and medication as well as poor economic status of the people. The Guji Oromo people of Bule Hora Wereda are rich with indigenous knowledge in using, conserving and managing plant resources in general and medicinal plants in particular. They have a wide knowledge in using plants for various purposes such as for medicine, food, household utensils, fodder, fuel, construction, etc. This knowledge is transferred from elders to youngsters entirely through oral traditions and personal experiences. But this way of knowledge transmission will lead to distortion of the original knowledge or total disappearance of the practice.

Human induced and natural factors are the major threats to plant species in general and to the medicinal plants in particular in the study area. As suggested by informants, the human induced threats include agricultural expansion, overgrazing, deforestation, uncontrolled burning and multipurpose usage of plant species and natural factors such as extended dry time are cited to be major threats for reduction of medicinal plants. The main threats to indigenous knowledge are caused by modernization, introduction of new religion, increased business work and negligence of the young generation to have the knowledge in the study area. Hence, based on the results of the study the researcher

recommends the following to conserve the natural resources as well as indigenous knowledge of the locality:

- Attention should be given to the usage of traditional medicine and indigenous knowledge of traditional practitioners.
- Awareness raising activities should be undertaken so that traditional healers get organized in managing and controlling different human and livestock ailments and in ensuring the sustainable utilization of medicinal plant resources in the study area. This could be achieved through;
    - Establishment of healers association at least at the kebele and if possible at the Wereda level.
    - Protecting, advising, licensing and encouraging their association and indigenous skills to use this traditional practice properly in controlling and managing both human and livestock diseases of the study area.
    - Adjusting conditions for close discussion and cooperation of traditional healers and modern health care system officials about the preparation and applications of remedies properly and effectively. This can be carried out through providing basic training to the healers with the objective of adding values to their traditional skills, especially related to dosage and sanitation.
- The concerned bodies should give emphasis to the proper management and conservation activities of the area through involving the local people. Initiation to conserve the natural resources in general and medicinal plants in particular could be developed by providing formal and non- formal education to the society. If this is not done the existing heavy pressure on natural vegetation due to human induced and natural pressures will eradicate the remaining natural resources in the near future.
- For the benefit of the existing and coming generation, governmental and non-governmental organizations (NGOs) should participate in conserving the natural resources through:
    - Encouraging in-situ and ex-situ conservation.

- Conceptualizing people to grow medicinal plants in the home gardens, mixing with crops in the farm lands and live fences.
- Educating people to protect and enclose ritual and spiritual areas with higher distribution of medicinal plants in the locality.
- Promoting dissemination and application of research results in the study area to raise awareness and to save the existing medicinal plants and associated knowledge.
- Supporting the activities of plantations of medicinal plants in degraded and degrading areas through forming youth association in the countryside to make them beneficial from the product of the plantations.

❖

❖ Based on the information provided by the researcher further researches especially to identify and isolate bioactive constituents of different medicinal plants that can be developed to modern medicines enabling to control various human and livestock diseases should be carried out in the future through giving recognition to the local health practitioners and their knowledge.

7. REFERENCES

Abbink, J. (1993). Me'en ritual, medcinal and other plants: A contribution to southwest Ethiopia Ethnobotany. *Journal of Ethiopian studies*, **26** (2): 1-21.

Abbink, J. (1995). Medicinal and Ritual Plants of Southwest Ethiopian. An Account of Recent Research. *Indigenous Knowledge and Development Monitor* **3**:6-8.

Abbiw, O.K. (1996). Misuses and Abuses in self-medication with Medicinal plants. The case of Erythrophelum in Ghana. **In**: Biodiversity of African plants, pp. 700-720. (Masen, G., Burger, X. M. and Rooy, J. M., eds.).Kluwer Academic Publisher, Netherlands.

Abiyot Berhanu, Zemede Asfaw and Ensermu Kelbessa (2006). Ethnobotany of plants used as insecticides; repellants and anti-malarial agents in Jabitehnan District, West Gojam. *SINET: Ethiopian Journal of Science* **29**: 230: 87-92.

Agro –Forestry Tree Database, (2010). Species Information. Accessed from internet: *http://www.worldagroforestrycentre.org.*

Alcorn, B.J. (1984). *Huastec Mayan Ethnobiotany.* University of Texas Press, Austin, USA.

Alexiades, M. (1996). 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

Amare Getahun (1976). *Some Common Medicinal and Poisonous Plants Used in Ethiopia folk Medicine*. Pp. 63. Addis Ababa University, Ethiopia.

Antench Belayneh (2006). *Floristic Description and Ethnobotanical Study of the Natural Vegetation in the Babile Elephant Sanctuary, Ethiopia.* M.SC. Thesis, AAU. 123 pp.

Asfaw Debela, Dawit Abebe and Kelbessa Urga (1999). 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.

Balick, M.J. and Cox, P.A. (1996). *Plant, People and Culture: The Science of Ethnobotany.* Scientific American Library, New York. p.220.

Balick, M.J. and Cox, P.A. (1997). Ethnobotanical research and Traditional Health Care in Developing Countires. **In**: Bodeker, G. and Vantomme,(P. eds.), *Medicinal Plants for forest Conservation and Health Care.* FAO, Rome. Non- Wood Forest Products no. 11.

Bayafers Tamene (2000). *A Floristic Analysis and Ethnobotanical Study of the Semi- Wet Land of Cheffa Area,* Soth Welo, Ethiopia, M.SC. Thesis, AAU. PP. 139.

Bhattarai, S., Chaudhary, RP, Tayler, RSL, (2006). Ethnobotanical Plans used by the People of Manang District, Central Nepal. *Journal of Ethnobiology and Ethnomedicine* **2**:41.

Brigdle J., (2003). *Study of Indigenous Plants and Non- Timber Products as Related to Traditional Medicine in the Nuba Mountains and Southern Blue Nile Region of South Sudan*. Report to USAID.

CBD (1998). Convention on Biological Diversity, Agenda 21, Habitat Information. Retrieved from http://www.digital. Engine. Net in November, 2010.

Clammer J. R. (1976). Literacy and social changes; a case study of Fiji. Retrieved from *http://books. google.com.et/ books?* in November, 2010.

Cotton, C.M. (1996). *Ethnobotany: Principles and Applications*. John Willey and Sons Ltd., Chichester, p.242.

Cunningham, A.B.(1993). African medicinal plants: Setting properties at the interface between conservation and primary health care. *People and plants* working page 1. Paris.UNESCO.

Dawit Abebe (1986). Traditional Medicine in Ethiopia: the Attempt Bering Made to Promote it for Effective and Better utilization. *SINET: Ethiopian Journal of Science 9:* 61-69.

Dawit Abebe (2001). The Role of Medicinal Plants in Health care Coverage of Ethiopia, the Possible Integration. In: Medhin Zewdu and Abebe Demise, (eds.). Proceeding of the National Workshop on *Biodiversity Conservation and Sustainable use of Medicinal Plants in Ethiopia*, 28 April- 1 May 1999. IBCR, Addis Ababa. PP.6-21.

Dawit Abebe and Ahadu Ayehu (1993). Medicinal Plants and Enigmatic Health Practice of North Ethiopia. Berhanina Selam Printing Enterprise, Addis Ababa. p. 341.

Debela Hunde (2001). Use and Management of Traditional Plants by Indiigenous People of Bosat Wereda, Wolenchiti area: An ethnobotanical approach. M.Sc. Thesis, Addis Ababa, Ethiopia.

Dery, B. B., Ofsynia, R. and Ngatigwa, C. (1991). Indigenous Knowledge of Medicimal Trees and Setting Priorities for their Domestication in Shinyanga Region, Tanzania. International Center for Research in Agro Forestry, Nairobi, Kenya. 87 pp.

Endalew Amenu (2007). *Use and Management of Medicinal Plants by Indigenous People of Ejaji Area (Chelya Wereda) West Shoa, Ethiopia:* An Ethnobotanical Approach. M.SC. Thesis, AAU, pp.102.

Ensermu Kelbessa (2006). Acanthaceae. **In**: *Flora of Ethiopia and Eritrea,* Volume 5. Gentianaceae to Cyclocheilaceae; Hedberg I., Ensermu Kelbessa, Edwards S., Sebsebe Demissew and Persson E. (eds). The National Herbarium, Addis Ababa, Ethiopia and Uppsala, Sweden pp. 459 – 468.

Ensermu Kelbessa, Sebsebe Demissew, Zerihun Woldu and Edwardds, S. (1992). 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 CentralAfrica.

Etana Tolosa (2007). Use, Treat and Conservation of Traditional Medicinal Plants by Indigenous people in Gimbi Wereda, Western Wellega, Ethiopia. M.Sc. Thesis, Addis Ababa University.

Fabricant, J.N. and Farnsworth, G.D. (2001). The Value of Plants Used in Traditional Medicine for Drug Discovery: Program for Collaborative Research in the Pharmaceutical Sciences, College of Pharmacy, University of linois-Chicago, USA.

FAO (1983). Some medicinal forest plants of Africa and Latin America. FAO, UN, Rome.

Farnsworth, N.R. (1985). Plants and Modern Medicine: Where Science and Folklore Meets. *World Health Forum* **6**:76-80.

Farnsworth, N.R. (1994). Ethnopharmacology and Drug Development. **In**: Wiley Chichester (Ciba Foundation eds.), *Ethnobiology and the Search for new Drugs.* Pp 42-59. Chicago, USA.

Farnsworth, N.R. and Soejarto, D.D. (1991).Global Importance of Medicinal Plants. **In**: *Conservation of Medicinal Plants*. (Akerel, O., Heywood, N. and Synge, H.eds.), Cambridge University Press. Cambridge, UK.

Fasssil Kibebew (2001). The status and availability of oral 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 May1998, pp. 107-119. IBCR, Addis Ababa.

FDREPCC (Federal Democratic Republic of Ethiopian Population Census Commission) (2008). Summary and Statistical Report of the 2007 Population and Housing Census: Population size by age and sex.

Fekadu Fullas (2001). *Ethiopian Traditional Medicine:* Common Medicinal Plants in Perspective, Sioux City.

Feleke Woldeyes (2000*). A Study on Biodiversity Management in Daaddegoyo (Traditional Home Gardens) by Keficho People of Bonga area (South-Western Ethiopia).* An Ethnobotanic Approach. M.SC. Thesis, AAU. p.89.

Fichti, R. and Admasu Adi (1994). *Honeybee Flora of Ethiopia*. Margrave Verlag, Wikersheim, Germany.

Frankel, O.H., Brown, A.H.D. and Burdon, J.J. (1995). *The Conservation of Plant Biodiversity*. Cambridge University Press. Cambridge p.299.

Friedman, J. Yaniu, Z., Dafni, A. and Palewitch, D. (1986). A Preliminary Classification of the Haling Potential of Medicinal Plants, Based on the Rational Analysis of an Ethnopharmacolgical Survey Among Bedouins in Negue Desert, Israel. *Journal of Ethnophamacology* **16**:275-287.

Friis, I. (2006). Solanaceae.**In**: *Flora of Ethiopia and Eritrea,* Volume 5. Gentianaceae to Cyclocheilaceae; Hedberg I., Ensermu Kelbessa, Edwards S., Sebsebe Demissew and Persson E. (eds). The National Herbarium, Addis Ababa, Ethiopia and Uppsala,Sweden pp. 111- 155.

Gadgil, M., Bekes, F., and Folke, C.(1993). Indigenous knowledge for biodiversity conservation. *Ambio* **22**: 151 – 156.

Gemedo Dalle, Brigitte L.M. and Isselstein, J.(2005). Plant Biodiversity and Ethnobotany of Borana Pastoralists in Southern Oromia, Ethiopia.

Gesseley Mc., Msuya DC, Nkunya, MHH, Scher A., Henrich M, Tnaner M (1995). Traditional healers in Tanzania: Socio-cultural profile and the short portraits. *Journal of Ethnopharmacology* **48**: 145-160.

Getachew Addis, Dawit Abebe and Kelbessa Urga (2001). A survey of traditional medicinal plants In Shirka District,Arsi Zone, Ethiopia. *Ethiopian pharmaceutical Journal*, **19**: 30 –

Gilbert, M.G. (1995). Euphorbiaceae. **In**: *Flora of Ethiopia and Eritrea,* Volume 2 part 2. Canellaceae to Euphorbiaceae; Edwards S., Mesfin Tadesse and Hedburg, I. (eds.). The National Herbarium, Addis Ababa, Ethiopia and Uppsala, Sweden Pp.265- 380.

Haile Yineger (2005). *A Study of Ethnobotany of Medicinal Plants and Floristic Composition of the Dry Afromantane Forest at Bale Mountains National Park.* M.SC. thesis. Addis Ababa, Ethiopia.

Hamilton, A. C. (2003). Medicinal Plants and Conservation: issues and approaches. International plant conservation unit, WWF-UK, Pandahouse, Catteshall Lane, UK.

Hassan, O.K. (2007). *Promotion of Public Health Care Using African Indigenous Knowledge Systems and Implications for IPRs; experiences from Southern and Eastern Africa*. African Technology Policy studies Network (ATPS). Special Paper Series No. 30. Nairobi, Kenya.

Hedberg, O. (2000). Polygonaceae. **In**: *Flora of Ethiopia and Eritrea,* Volume 2:1. Magnoliaceae to Flacourtiaceae; Edwards, S., Mesfin Tadesse, Sebsebe Demissew and Hedberg, I. (eds). The National Herbarium, Addis Ababa Univesity, Addis Ababa, Ethiopia pp.338 – 339.

Hedberg, O. (2000). Rosaceae. **In**: *Flora of Ethiopia and Eritrea,*Volume 3. Pittosporaceae to Araliaceae; Hedberg, I. and Edwards, S. (eds). The National Herbarium, Addis Ababa,Ethiopia; Asmara, Eritrea and Uppsala, Sweden pp. 43 – 44.

IBCR (2000). Biodiversity Conservation and Strategic Action Plan for Ethiopia, Volume II, United Version. Institute of Biodiversity Conservation, Addis Ababa, Ethiopia.

IBCR, (1999). *Biodiversity Conservation and Sustainable use of Medicinal Plants : Project proposal*. Addis Ababa, Institute of Biodiversity Conservation and Research (IBCR), Addis Ababa.

IUCN (1993). Guidelines on Conservation of Medicinal Plants. Castlecary Press, UK.

IWU, M.M. (1993). *Handbook of African Traditional Medicinal Plants*. Boca Raton.Ann Arbor.London.p.43.CRC*Press,Inc*.

Jain,S.K. (1986). Ethnobotany. Natronal Botanical research Institute, Lucknow, India. *Interdisciplinary Science Reviews* **11**(3):285-292.

Jansen, P.C.M. (1981*). Species, Condiments and Medicinal Plants in Ethiopia, their Taxonomy and Agricultural Significance.* Centeral for Agricultural Publishing and Documentation, Wageningen, Netherlands. p. 327.

Jeffrey, C. (1995). Cucurbitaceae. ***In****: Flora of Ethiopia and Eritrea,* Volume 2:2. Canellaceae to Euphorbiaceae; Edwards S., Mesfin Tadesse and Hedberg I. (eds). The National Herbarium, Addis Ababa, Ethiopia and Uppsala, Sweden pp. 31 – 34.

Kebede Deribe, Alemayehu Amberbir, Binyam Getachew, and Yunis Mussema (2006). A Historical Overview of Traditional Medicine Practices and Policy in Ethiopia. *Journal of Health development* **20**:127-134.

Kebu Balemie, Ensermu Kelbesa and Zemede Asfaw (2004). Indigenous medicinal plant utilization, management and threats in Fentale area, Eastern Shewa, Ethiopia. *Ethiopian Journal of Biological Sciences* **3**: 37 – 58.

Khasbagan, S. (2008). Indigenous knowledge for plant species diversity : A case study of wild plants folk names used by the Mongolian in Ejina Desert, Inner

Mongolia, P. R., China. Journal of Ethnobiology and Ethnomedicine 4 : 13

Kloos, H. (1976). Preliminary studies of medicinal plants and plant products in markets of Central Ethiopia. *Ethnomedicine* **4**: 63 – 102.

Kong, J.M., GOH, N.K., CHIA, L.S., CHIA, T.F. (2003). Recent advances in traditional plant drugs and Orchids. Pharmacology Sin. **24**: 7-21.

Lans, C. Turner, N., Khan T., Brauer G. and Boepple (2007). Ethnoveterinary medicines used for ruminants in British Columbia, Canada. Journal of Ethnobiology and Ethnomedicine **3**: 11

Letchamo,W, and Craker, L.E. (1996). Cultivating and Breeding of Medicinal and Aromatic Plants (editorial.) .*Journal of Herbs, Spices and Medicinal Plants* **4**:12.

Martin, G.J. (1995). *Ethnobotany:* A Method Manual. Chapman and Hall, London.

McCorkle and Mathias (1996). Animal Health Biotechnology: Building on Farmers Knowledge. Bunders, J. Haverkort, B. and Heiemstra, W. (eds). Pp. 22 – 55. Macmillan Education Ltd., London.

McCorkle, C. M. (1995). Back to the futurelessons from ethnoveterinary research, development extension for studying and applying knowledge. Journal of the Agricultural, Food and Human values society **22** : 52-80

Mekonnen Bishaw (1990). Attitudes of Modern and Traditional Medical Parishioners towards Cooperation. *Ethiopian Medicinal Journal* **28**:63-72.

Mesfin Tadesse (1986). Some Medicinal Plants of central Shewa and South Western Ethiopia. *SINET. Ethiopian Journal of Science* **9** (SUPPL.)1986.

Mesfin Tadesse and Sebesebe Demissew (1992). Medicinal Ethiopian plants. Inventory, Identification and Classification. **In**: Edwards, S. and Zemede Asfaw (eds.). PP. 1-19. NAPRECA. Botany 2000: Monograph Series No. 5.

Mesfin Tadesse, Debella Hunde and Yehenew Getachew (2005). Survey of medicinal plants used to treat human diseases in Seka Cherkosa, Jimma Zone, Ethiopia. *Ethiopian Journal of Health Sciences* **15**: 89 – 106.

Mirgissa Kaba (1998). Utilization of Plant Medicine for the Treatment of Health Problems. The case of Oromo of Chora District Illubabor Zone, Western Ethiopia. *The Ethiopia Journal of Health Development* **10**:161-166.

Mirutse Giday (1999). An Ethnobotanical Study of Medicinal Plants Used by the Zay People in Ethiopia. M.SC. Thesis. Uppsala, Sweden .

Mirutse Giday (2007). Medicinal Plants of the Bench, Meinit and Sheko Socio- Cultural Groups in Ethiopia with Emphasis on use Diversity, Distribution and Abundance. Doctoral Thesis (Unpublished). Addis Ababa University, Addis Ababa, Ethiopia.

Mirutse Giday and Gobena Ameni (2003). An ethnobotanical survey on plants of veterinary importance in two Woredas of Southern Tigray, Northern Ethiopia. *SINET : Ethiopian Journal of Science* **26**: 123 – 136.

Moore, P.D. (1994). Trials in bad taste. *Nature* **370**: 410 – 411.

Mwambazi WC. (1996). WHO Partnership in the Development and Utilization of Herbal Remedies in Ethiopia. In: Abebe Dawit. (ed). Proceedings of Workshop on *Development of Herbal Remedies in Ethiopia,* 1996 June 4-6; Addis Ababa. EWHNRI: 26-27.

Njau, E.A. (2001). An Ethnobotanical Study of Medicinal Plants Used by the Massai People of Manayara Arusha, Tanzania. M.SC. Thesis, AAU. Pp.95.

Odera, J. A. (1997). Traditional beliefs, sacred groves and home garden technologies: Adapting old practices for conservation of medicinal plants. **In**: *Conservation and utilization of indigenous medicinal plants and wild relatives of food crops*. Pp. 19-28. UNESCO, Nairobi,Kenya. Orchids, the Royal Botanic Gardens, Kew.

Pankhurst, R. (1965). A historical Examination of Traditional Medicine and Surger. *Ethiopian Medicinal Journal* **3**: 160.

Pankhurst, R. (1990). An Introduction to Medicinal History of Ethiopia PP. 250-261. The Red Sea Press, Inc. New Jersey.

Pankhurst, R. (2001). The status and availability of oral and written knowledge on traditional health care. **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.92- 106. IBCR, Addis Ababa.

Poffenberger, M., McGean, B., Khare, A. and Campbell, J. (1992). Field Method Manual, volume II. Community Forest Economy and use Pattern: Participatory and Rural Appraisal (PRA) Methods in South Gujarat, India. Society for Promotion of Waste Lands Development, New Delhi.

Quanash, N. (1998). Bicultural Diversity and Integrated Health Care in Madagascar. *Nature and Resource* **30**:18-22.

Ryding, O. (2006). Lamiaceae. **In**: *Flora of Ethiopia and Eritrea*, Volume 5. Genitianaceae *to* Cyclocheilaceae; Hedberg, I., Ensermu Kelbessa, Edwards, S., Sebsebe Demissew and Persson, E. (eds).The National Herbarium, Addis Ababa University, Addis Ababa, Ethiopia. pp. 515 – 604.

Seyani, J.H. and Chikuni, A.C. (1997*). Botanic Gardens of Malawi and their Role in Conservation and Sustainable Utilization of Indigenous Medicinal and Agricultural Plants and Wild Relatives of Food Crops.* Pp 36-40. UNESC, Nairobi, Kenya.

Slikkerveer, L.J., (1990). *Plural Medical Systems in the Horn of Africa: the Legacy of 'Sheileh' Hippocrates.* KPI, London.

Sofowara, A. (1982). *Medicinal Plants and Traditional Medicine in Africa.* John Wiley and Sons. New york. Pp. 255-256.

Stephen A.H. and Justin W.V. (2003). *Traditional Knowledge and Intellectual Property: A Handbook on Issues and Options or Traditional Knowledge Holders in Protecting their Intellectural Property and Maintaining Biological Diversity.* American Association for the Advancement of Science (AAAS) and Human Rights Program. Washington, DC.

Tabuti, J. S. (2004). The traditional medicine practitioners (TMPs) and attitudes of rural community of Bulamogi Country (Uganda) towards traditional medicine : Preliminary findings. African Journal of Ecology **42** : 40-41

Tadesse Beyene (2008). Ethnobotanical study of medicinal plants in Adigrat Wereda and Adjacent Kebeles in Ganta- Afeshum Wereda, Eastern Tigray, Ethiopia. An Ethnobotanical Approach, M.Sc. Thesis, Addis Ababa, Ethiopia.

Tafesse Mesfin and Mekonen Lemma (2001). The role of traditional veterinary herbal medicine and its constraints in animal health care system in Ethiopia. **In**: (Medhin Zewdu and Abebe Demissie eds.). Proceeding of the National Workshop on Biodiverssity Consevation and Sustainable use of medicinal plants in Ethiopia, 28 April- o1 May 1998, pp 23-33. IBCR, Addis Ababa.

Temperly, D.H. (2002). Finding the Link: Medicinal Plants, Modern Drugs and Conservation of Tropical Resources: Costa Rica Ecology Research Papers.

Tesema Tanto, Mirutse Giday, Negesu Aklilu, Teshome Hunduma (2003). *Medicinal Plants Biodiversity.* National Bioldiveristy Strategy and Action Plan (NBSAP) Project (Unpublished). Institute of Biodiversity Conservation and Research (IBCR), Addis Ababa, Ethiopia.

Tesfaye Awas and Zemede Asfaw (1999). Report on Ethnobotanical study Nations of Nationalities and People in Gambella and Benishangul Gumuz Regional

States. Progressive Report to Research and Publication office, Addis Ababa University, Addis Ababa.

Tesfaye Hailemariam (2007). An Ethnobotanical Study of Medicinal Plants Used by Local People in the Low Lands of Konta Special Wereda, SNNPRS, Ethiopia, M.SC. Thesis, AAU, p.111.

Tesfaye Seifu, Kaleab Asress and Tsige Gebre-Mariam (2006). Ethnobotanical and ethnopharmacological studies on medicinal plants of Chifra District, Afar Region, North Eastern Ethiopia. *Ethiopian Pharmaceutical Journal* **24**: 41-58.

Teshale Sori, Merga Bekana, Girma Adugna and Ensermu Kelbessa (2004). Medicinal plants in Ethnoveterinary practices of Borana Pastoralists, South Western Ethiopia. *Appl. Res. Vet. Med. 2:4*

Thomas, H. (1995). Indigenous Knowledge, Emancipation and Alienation. *Journal of Knowledge Transfer and Utilization* **8**:63-73.

Thulin, M. (1989). *Fabaceae*. **In**: Flora of Ethiopia, Volume 3: Pittosporaceae to Araliaceae, Hedberg,I. and Edwards, (eds.). The National Herbarium, Addis Ababa,University, Addis Ababa, Ethiopia. Pp. 49- 251.

Tigist Wondimu, Zemede Asfaw and Ensermu Kelbessa (2007). Ethnobotanical Study of Medicinal Plants Around "Dheeraa" town, Arsi Zone, Ethiopia. *Journal of Ethnopharmacology.* **112**: 152- 161.

Tilahun Tekelehaymanot, Mirutse Giday, Girmay Medhin and Yelemtsehay Mekonnen (2006). Knowledge and Use of Medicinal Plants by People around Debre Libanos Monastery in Ethiopia. *Journal of Ethnopharmacology*. **111**: 271-283.

Tilahun Teklehaymanot and Mirutse Giday, (2007). Ethnobotanical Study of Medicinal Plants Used by People in Zegie Peninsula, North Western Ethiopia. *Journal of Ethnobiology and Ethnomedicine* **3**:12.

Tizazu Gebre (2005). Ethnobotanical Study of Medicinal Plants in the Konso Special Woreda (SNNPR), Ethiopia, M.SC. Thesis. (Unpublished). Addis Ababa University.

Trotter, R.T. and Logan, M.H. (1998). Informant Consensus: a new approach for identifying potentially effective medicinal plants. **In**: *Plants in Indigenous Medicinal and Diet*, N.L. Etrin (eds), Red grave publishing company, Bedford Hill,NY,pp. 91-112.

Turner, N.J. (2000). Ethnobotany: Future direction for the new millennium. *Manitoba Anthropology Student's Journal* **16**: 15 – 18.

WCMC (1992). Global Biodiversity Status of the Earth's Living Resources. World Conservation WHO, (1991). *Traditional Medicine and Modern Health Care:* Progress Report by the Director- General paper Presented to the Forty-fourth World Health Assembly. Monitoring Centre. Chapman and Hall.

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

WHO (2001). Planning for cost effective traditional health services in the new century a discussion paper. *http:// www.who.or.jp/tm/research/bkg/ index.html*.

WHO (2002). *Traditional Medicines Strategy 2002-2005*. World Health Organization, Geneva WHO.

WHO (2003). Fact Sheet. Geneva. Family,body, sexuality and health. Pp. 205 – 219. Accessed from internet: *http://books.google.com.et/books?*

Wikipedia, (the free encyclopedia) (2009). Datura stramonium**.** Accessed from internet: *http://www.cocaricky.com.*

Wondwosen Teshome (1999). Indigenous Medicinal Plants Used in Ethiopia*. Viennese Ethnomedicine News Letter **II**:28-32.*

Wondwosen Teshome (2004). Concept of health, Disease, Illness and Therapy among people of Addis Ababa, Anuals of African Medicine **3**: 28 – 31.

Worku Abebe (1984). Traditional Pharmaceutical Practice in Gondar Region, North Western Ethiopia. *Journal of Ethiopia Pharmacy Association 2:34-35.*

World Bank (1998). Indigenous Knowledge for Development: A Framework for Action Knowledge and Learning Centre, Africa Region, The World Bank.

Woyek, R. and Gorjestani, N. (1998). Indigenous knowledge for Development: A Framework for Action World Bank. National Institute of Education, Nanyang Technological University, 1 Nanyang Walk, Singapore 637616, Republic of Singapore.

Zemede Asfaw (1997). Survey of Indigenous food plants, their preparations and homegardens in Ethiopia. **In**: *Indigenous African food Crops and useful Plants*. UNU/IRNA Assessment series No. B6.N. Okigbo (series editor).

Zemede Asfaw (1999). Ethnobotany of Nations, Nationalities and People in Gambella, Benishangul-Gumuz and Southern Regions of Ethiopia (unpublished). Addis Ababa, Ethiopia.

Zemede Asfaw (2001). The Role of Home Garden in Production and Conservation of Medicinal Plants. 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. 76-91. IBCR, Addis Ababa.

Zhang, X. (2000). Traditional Medicine and its knowledge. WHO, UNCTAD Expert Meeting on Systems and National Experiences for protecting Traditional Knowledge, Innovations and Practices, 30 October- 01 November 2000, Geneva.

APPENDICES

Appendix1. Semi-structured interviews scheduled to be employed in the research area.

Date _____ village (Kebele) _____

Name of respondent (informant) _____

Sex: Male _____; Female _____ ; Age _____; Occupation _____ ; Religion ____

Level of education: High _____; Middle _____ ; Low _____

1. What are the main human health problems in your locality or kebele?
2. What are the main livestock health problems or diseases?
3. How do you diagnose each disease/health problem?
4. How do you control/prevent disease in your locality?
5. How do you treat human and livestock diseases in your locality?
6. Which plant do you use to treat that particular health problem/disease?
    A. Local name(s) of the plant(s)
    B. Morphological description of the plant(s)
    C. Habit of the plant: cultivated/wild? Specify the habitat?
    D. Part(s) of the plant(s) used
    E. How is the part(s) gathered? (Including the amount collected at a time)
    F. Season/time of collection
    G. Preferred maturity level
    H. Any taboo/ restrictions in plant collections
    I. Detailed methods of remedy preparation
    J. Mode of remedy administration
    K. Amount used(dose) of remedy used
    L. Does the dose differ among men, women, children, and elders?
    M. Any noticeable side effect(s)?
    N. Any restrictions in taking remedies (pregnancy, age, etc.)?
    O. Do you store the medicine? If yes, how and for how long?

7. Is the medicinal plant marketable?
8. What type of habitat does the medicinal plant prefer?
9. How abundant is the plant in the area?
10. Season of the plant availability ?
11. How much time does it take to collect the plant? Or how far you go to collect it?
12. Trend in the abundance of the plant, where it is increasing or decreasing?
13. Is the plant cultivated in the area? If yes, for what purpose?
14. What do you think are the main conservation threats to the plant?
15. Any traditional medicinal plants conservation practice?
16. For what other purposes do you use the medicinal plants?
17. How is the traditional knowledge and traditional medicinal plants transferred?
18. How about the issue of secrecy of this knowledge?
19. What seems the issue of botanical and ecological knowledge ?
20. Cultural significance of some plants or preference of one over the other for a given purpose (to treat ailments).
21. Any other comment

Identification:

Date of interview _____

Name of interview site _____

-

Appendix2. List of informants consulted during the study.

Key: In * are key informants. Level of education is identified as NO=Illitrate (couldn't read and write); numbers (1,2, 3…) indicate grade completed; M= Married; S= Single).

No.	Name of informants	Sex	Age	Education	Marital status	Residence Kebele	No. of MPT
1	Abraahaam Dhugoo*	M	60	10	M	Garbaa 02	6
2	Arbaa Boruu	M	30	No	S	Diidoollee	3
3	Arerii Eedema	M	39	10	M	Carii	2
4	Baallii Hirbaayyee	M	61	No	M	Garbaa 01	8
5	Badhasoo Arerii	M	65	5	M	Eeballaa	4
6	Baleela Safaayii	F	21	No	S	Garbaa 01	2
7	Banachaa Dubee	M	62	No	M	Sooyaamaa	8
8	Bokkoo Areerii*	M	62	No	M	Carii	9
9	Bokkoo Boruu*	M	75	No	M	Diidoollee	10
10	Boru Galgee*	M	60	8	M	Carii	6
11	Bunoo Qilxaa*	M	64	No	M	Dambala	8
12	Caaltuu Bokkoo	F	46	No	M	Diidollee	3
13	Caaltuu Buno	F	42	No	M	Eeballaa	4
14	Dambaaree Neenkoo	F	27	No	S	Garbaa 01	2
15	Damboobii Bokkoo	M	43	No	M	Dambala	5
16	Dashu Hagala *	M	60	No	M	Dambala	12
17	Dastaa Arerii	M	63	6	M	Eeballaa	3
18	Dastaa Sorsaa	M	40	No	S	Sooyaamaa	4

19	Diiramu Baleela	F	42	No	M	Eeballaa	2
20	Dukkanee Goobanaa*	F	62	No	M	Garbaa 02	6
21	Dureetii Salii	F	18	No	S	Garbaa 01	3
22	Eedoo Dubee	M	66	No	M	Sooyaamaa	8
23	Galchu Safaayii	M	63	10	M	Diidollee	2
24	Galgaloo Areerii*	M	70	No	M	Dambala	9
25	Gammachuu Sallii	M	39	No	M	Bu. Magada	3
26	Goobanaa Dubee*	M	66	No	M	Sooyaamaa	10
27	Gudduree Moromaa*	F	60	No	M	Sooyaamaa	6
28	Guyee Nuxaa	M	61	No	M	Bu.Magadaa	8
29	Guyoo Goobanaa	M	41	10+3	S	Sooyaamaa	3
30	Haalakee Dubee	M	40	No	M	Bu.Magadaa	2
31	Halloo Burqaa*	M	75	No	M	Garbaa 02	10
32	Hullufoo Eedemaa*	F	60	No	M	Sooyaamaa	6
33	Jurruu Woddeessaa	M	60	No	M	Dambala	8
34	Kabada Halake*	M	65	12+1	M	Eeballaa	6
35	Lelloo Bunoo	M	30	No	S	Carii	4
36	Lelloo Safaayii	F	19	No	S	Garbaa 01	3
37	Lencaa Bunoo	F	42	7	S	Dambala	3
38	Lollee Dhakko	M	40	No	S	Bu.Magadaa	2
39	Martaa Duubee*	F	60	No	M	Garbaa 02	6
40	Monaa Jaarsoo	M	65	No	M	Eeballaa	8
41	Nageellee Gannaalee	F	42	No	M	Bu.Magadaa	2
42	Nageellee Saamuel*	F	61	No	M	Eeballaa	6

43	Nigaatuu Abraahaam	M	32	10+2	S	Bu.Magadaa	3
44	Qaasiim Baatii*	M	62	10+3	M	Bu.Magadaa	5
45	Quree Guyyee*	F	60	No	M	Carii	4
46	Roobee Qaasiim	M	3O	No	S	Eeballaa	2
47	Safaayii Jirmaa*	M	62	No	M	Garbaa 01	12
48	Safaayii Shonee	M	64	No	M	Dambala	8
49	Safaayii Waacuu	M	40	4	M	Garbaa 02	3
50	Sallii Kamee	M	45	No	M	Garbaa 01	2
51	Sorsaa Dulachaa*	M	61	No	M	Sooyaamaa	8
52	Tadassaa Biree*	M	60	6	M	Garbaa 02	6
53	Tamasgan Halloo	M	20	10	S	Garbaa 02	2
54	Turee Bunoo	M	32	6	S	Dambala	3
55	Uddeessaa Dullachaa*	M	65	No	M	Garbaa 02	12
56	Utura Baatii	M	35	10+1	M	Carii	2
57	Waaccu Muudaa*	M	78	No	M	Garbaa 02	10
58	Waaqoo Galgalloo*	M	65	No	M	Diidollee	9
59	Waaqoo Safaayii*	M	66	No	M	Garbaa 02	8
60	Yuubboo Bokkoo	F	40	No	S	Diidollee	3

Appendix 3: Lists of medicinal plants used to treat human and livestock ailments in the study area

Key: (Hb=Habit, Pu=Parts used, Ut=Used to treat, Cp=Condition of preparation, Ra= Route of application, T=Tree, H=Herb, Sh=Shrub, Cl=Climber, Hu= Human, Ls=Livestock, B=Both, F=Fresh, D=Dried, F/D=Fresh/Dried, O=Oral, Dm=Dermal, Na=Nasal, Op=Optical, Er=Ear, L=Leaf, Rt=Root, St=Stem, Ba=Bark, Fl=Flower, Fr=Fruit, S=Seed, Bu=Bulb, Rh= Rhizome, La=Latex, Ds=Distribution, C=Common, R=Rare, *=Endemic).

Scintific name	**Family**	**Local name**	**Hb**	**Pu**	**Ut**	**Cp**	**Ra**	**Disease tr.**	**Preparation and Application**	**Ds**	**Coll No.**
Acacia dolichocephala Harms	Fabaceae	Waaccu	T	Rt	Hu	D	Na Dm	Evil eye (Driyaa)	Taking dried root parts & fumigating the patient.	C	MA 105
Acacia lahi Steud.& Hochst.ex Benth.	Fabaceae	Jirmee	Sh	L	Hu Ls	F	Na	Coughing & sneezing of donkey Human wound (Quffa haree fi madda	Pounding the leaves, making s/n & dropping one coffee cup through the nostrils of the animal. Pounding the leaves & put on the wound	R	MA 093

							Dm	namaa)	for humans.		
Acanthospermum hispidum DC.	Asteraceae	Harmaagussaa	H	L	Hu	F	O	Pain around the shoulder & back head (Danfaa dhiigaa)	Crushing the leaves ,boiling it & drinking one tea cup with in 12 hrs difference.	R	MA 091
Acmella caulirhiza Del.	Asteraceae	Jiloo qaldhaa	H	L	Hu Ls	F	O Dm	Swelling & forming wound on the body (Luxaa)		C	MA 012
Acokanthera schimperi (A.D.C.) Schweinf	Apocyanaceae	Qarraruu	Sh	L	Hu Ls	F	Dm	Scabies (Qanxoo ykn ciittoo)	Chopping the leaves, making s/n & applying on the infected part of the body.	R	MA 062
Albizia schimperiana Oliv.	Fabaceae	Garbii	T	L	Hu	F	O	Inflammation of children's mouth (Banqoo).	Chewing some young leaves & spiting it in the mouth of suffering child.	C	MA 023
Allium sativum L.	Alliaceae	Qullubi	H	B	Hu	F	O	Stomach ache	Peeling the bulb & eating one or two	C	MA

		adii						(Dhukkubaa garaa)	splits before meal when there is pain.		009
*Aloe monticola** Reynolds	Aloaceae	Hargiissa	H	La	Hu	F	O Dm	Liver disease both in humans & livestock (Biirtee / Bekkekkoo)	Taking the latex & drinking one coffee cup for humans & one and half water glass for livestock daily. Polishing on the infected part of the skin.	R	MA 021
Asparagus africanus Lam.	Asparagaceae	Sariitii	C	L	Hu	F	O	Cold disease (Gamtokke)	Crushing the lives, making solution ,adding honey & drinking one water glass.	R	MA 065
Balanites aegyptiaca (L.) Del.	Balanitaceae	Baddana	Sh	Ba	Hu Ls	F	O	Rabies (Dhukkuba Saree)	Chopping the bark, making s/n & giving a coffee cup for humans & 1-2 littres for livestock 2 times a day for a total of 5 days to cure 40 days passed rabies infection.	R	MA 027

Bersama abyssinica Fresen.	Melianthaceae	Xibiirroo	Sh	L	Hu	F	O	Inflammation of children's mouth (Waan Afaanii)	Crushing the leaves with the flower of *Solanum incanum*, young leaves of *Ehretia cymosa* & *Zingiber officinale* & spiting into the mouth of the child.	R	MA 084
Buddleja davidii Franch.	Loganiaceae	Adiitii	Sh	L	Hu	F	O	Tonsillitis (Waan Afaani)	Pounding the leaves, making s/n & giving half a coffee cup at once.	R	MA 096
Calpurnia aurea (Aiti) Benth.	Fabaceae	Ceekataa	Sh	L	Ls	F	Na	Early maturity of the udder (Saadhessa)	Rubbing the leaves with hands & smelling it to the animal or crushing the leaves, making s/n & dropping some droplets through the nostrils.	C	MA 002
Capparis tomentosa Lam.	Capparidaceae	Gooraa gaalaa	C	Ba	Hu	F	O	Tooth ache (Dhukkuba ilkaa)	Chewing the root bark with the infected teeth.	R	MA 026

Carissa spinarum L.	Apocynaceae	Agansa	C	Rt	Hu	F	O	Cold disease (Gamtokke)	Chewing the root or crushing the root, boiling it & drinking one water glass once.	C	MA 007
Clematis hirsuta Perr.& Guill.	Ranunculaceae	Fiitii	C	L	Hu	F	O Dm	Bone cancer, gland TB & swelling which forms deep wound (caccassaa, xanachaa & luxaa)	Pounding the leaves, making s/n & drinking half of small glass & applying certain amount of the solution into the whole of the wound by using syringe or other domestic material. The residue should put on the opening of the wound.	R	MA 015
Clerodendrum myricoides (Hochst.) Vatke	Lamiaceae	Mardhisiisaa	Sh	Rt	Ls	F	Dm	Breast cancer of cattle (Naqarsaa muchaa looni)	Crushing the roots, mixing it with butter and applying it on the infected part.	C	MA 087
Clutia lanceolata	Euphorbiaceae	Mukka	H	Rt	Ls	F	O	Hepatitis of cattle	Crushing the root, boiling it & giving	R	MA

Forssk.		dhigaa		L	Hu		Dm	(Biirtee) Eczema (Cacca)	one water glass. Pounding the leaves, if necessary adding butter & applying on the infected part.		043
Coffea arabica L.	Rubiaceae	Buna	Sh	S L	Hu	F & D	O Dm	Dizzy ness & headache. Wound	Roasting the seeds & leaves, crushing, boiling & drinking it as necessary. Put on the seed powder on the wound	C	MA 032
Combretum molle R.Br. ex G.Don.	Combretaceae	Rukkensaa	T	Rt	Hu	D	Na Dm	Evil eye (Driyaa)	Fumigating the patient.	C	MA 103
Crabbea velutina S.Moore	Acanthaceae	Laafaa	H	L Rt	Ls	F	Na	Dropping saliva (Dhukkuba addu)	Chopping the leaves & roots together , making solution & dropping one coffee cup through the nostrils	R	MA 003
Crinum abyssinicum Hochst. ex A. Rich.	Amaryllidacea e	Butte woraabessa	H	L	Ls	F	O	Swelling of the skin	Pounding the leaves, making s/n & giving	R	MA

								around the stomach (Darrabbaa)	one water glass 2 times a day until the animal is cured.		095
Crotalaria albicaulis Franch.	Fabaceae	Qorsa direyaa	Sh	Rt	Hu	F	Dm	Evil eye (pain of all parts of the body) - Driyaa	Crushing the root, boiling it & washing part of the body where pain is feeling without touching the ground with legs.	R	MA 053
Croton macrostachyus Del.	Euphorbiaceae	Mokkoniisaa	T	Ba L	Hu Ls	F	O Dm	Black leg, ring worm & tapeworm (Abbagorbaa, ciirtii & mini)	Crushing the bark, making s/n & giving one liter for Black leg. Crushing the bark, boiling it & giving one coffee cup for humans & one water glass for livestock to eradicate tapeworm. Applying the latex of the petiole on the infected skin for ringworm.	C	MA 006

Cucumis pustulatus Naud. Ex Hook.f.	Cucurbitaceae	Haadhatu	C	Rt	Hu	F	O	TB & sharp pain on sides of the body (Dhukkuba sombaa fi warrana)	Chewing the root or crushing the root, making s/n & drinking one coffee cup daily until cured.	C	MA 090
Cymbopogon caesius (Hook.& Arn.) Stapf	Poaceae	Marra garra	H	L	Hu	F	O	Stomach ache (Gara ciininu ykn dhukkubu)	Chewing the leaves & swallowing the juice.	R	MA 069
Datura stramonium L.	Solanaceae	Qobboo arddaa	H	L	Hu Ls	F	O	Rabies (Dhukkuba Saree)	Pounding the leaves, making s/n & giving 1-2 coffee cup for adult human and livestock and half of it for children and calves.	C	MA 025
Discopodium penninervium Hochst	Solanaceae	Maraaroo	Sh	L	Hu	F	Dm	Eczema (Caccaa)	Crushing or burning the leaves & applying the crushed form or the ash on the infected part of the body.	R	MA 071

Dodonea angustifolia L.f.	Sapindaceae	Dhitachaa	Sh	L	Ls	F	O Na	Diarrhea of calves (Busootu)	Pounding the leaves, making s/n if possible adding *Megado* salt & giving small amt through the nostrils & one coffee cup orally once for all.	C	MA 046
Dombeya torrida (J.F. Gmel.) P. Bamps	Sterculiaceae	Daannisa	Sh	Ba	Ls	F	Na	Donkey cough (Gororsaa Harree)	Crushing internal part of stem bark, making s/n & giving quarter of coffee cup through the nose.	R	MA 049
Dovyalis abyssinica (A.Rich.) Warb	Flacourtiaceae	Dhugo	Sh	L	Hu	F	O	Cold disease (Gamtokkee)	Pounding the leaves, making s/n & drinking one coffee cup.	R	MA 079
Ehretia cymosa Thonn.	Boraginaceae	Uraaga	Sh	L	Hu	F	O	Gonorrhea & amoeboid (Dhukkuba dhirra fi mageana)	Crushing its leaves with the leaves of *Fagaropsis angolensis, Acmella caulirhiza* & internal part of stem bark of *Croton macrostachyus*, making s/n &	C	MA 082

									drinking one water glass at once.		
Ehretia obtusifolia Hochst. ex DC.	Boraginaceae	Me'ee	Sh	L Ba	Hu Ls	F		Pain of stomach in newly born child (Dhukkuba raqaa & cumma)	Crushing its leaves with the leaves of *Clematis hirsuta,Prunus Africana,Croton macrostachyus* & *Calpurnia aurea*, making s/n, adding *megado* salt & giving half of coffee cup for newly born child orally & a liter for cattle.		MA O48
Embelia schimperi Vatke	Myrsinaceae	Haanquu	C	S	Hu Ls	F	O	Tapeworm infection (Mini)	Crushing the seeds, making s/n & drinking/ giving one water glass.	R	MA 077
*Erythrina brucei** Schweinf	Fabaceae	Waleenaa	T	Ba	Hu	F	O	Tooth ache (Dhukkuba ilkaa)	Chewing internal part of stem bark if possible with *magado* salt.	C	MA 072

Erythroselinum atropurpureum (Hochst. ex A. Rich.) Chiov.	Apiaceae	Batti	H	L	Hu Ls	F	O	Rabies (Dhukkuba saree)	Pounding the leaves, making s/n & drinking or giving one water glass at once.	R	MA 067
Eucalyptus camaldulensis Dehnh.	Myrtaceae	Baargamoo diima	T	L	Hu	F	O	Stomach ache (Dhukkuba garra)	Chewing the young leaves & swallowing it.	C	MA 028
Eucalyptus globulus Labill	Myrtaceae	Baargamoo adii	T	L	Hu	F	O Na	Rabies & common cold (Dhukkuba saree fi quufaa)	Crushing the leaves, making s/n & dinking two coffee cup three times a day for rabies & taking the leaves, boiling them & smelling & fumigating with vapor for common cold.	R	MA 057
Euclea divinorum Hiern	Ebenaceae	Mi'eessa	Sh	L	Hu	F	O	Cold disease	Pounding the leaves, making s/n &	C	MA

								(Gamtokke)	drinking one coffee cup at once.		083
Euphorbia ampliphylla Pax.	Euphorbiaceae	Hadaama	T	La	Hu	F	O	Gonorrhea (Dhukkuba dhiiraa)	Taking some amount of the latex ,cooking it with *Qocho* bread & eating it once for all.	C	MA 056
Euphorbia depauperata A. Rich.	Euphorbiaceae	Gurii	H	La	Hu	F	Dm	Skin rash & ring worm (Kormommaan fi Roobbii)	Taking the latex & applying on the infected part.	C	MA 023
Euphorbia cryptospinosa Bally	Euphorbiaceae	Aananno	C	Rt	Hu	F	O	TB (Dhukkuba Soombaa)	Crushing internal part of the root with the roots of *Solanum incanum* & *Osyris quadripartita*, making s/n & adding honey then drinking as necessary when the patient becomes thirsty.	C	MA 035
Fagaropsis angolensis (Engl.)	Rutaceae	Sisaa	T	L	Ls	F	O	Diarrhea & wound on	Pounding the leaves & internal part of	R	MA

Dale				Ba				all parts of the body until cutting the tail (Sumuxee)	stem bark with the leaves of *Protea gaguedi* & fruits of *Solanum incanum*, making s/n and giving one liter orally		076
Flacourtia indica (Burm. f.) Merr.	Flacourtiaceae	Hagalaa	Sh	Ba	Hu	F	O	Swelling of part of the body due to cold disease (Gamtokke)	Chopping bark of the stem, making s/n driking one coffee cup 2 times a day until the patient is cured.	C	MA 019
Foeniculum vulgare Miller	Apiaceae	Insilaala or kalkala	H	Rt	Hu Ls	F	O	Stomach ache in humans & to remove plastic materials from livestock stomach (Dhukkuba garra)	Pounding the roots, making s/n & giving a coffee cup for humans and a liter for livestock.	R	MA 100
Fuerstia africana	Lamiaceae	Qayaa	H	L	Hu	F	Dm	Ring worm	Crushing the leaves, making s/n &	C	MA

T.C.E.Fr.		duraa						(Roobbii)	applying on the infected part.		031
Gardenia ternifolia Schumach.& Thonn.	Rubiaceae	Gambello	Sh	Rt	Hu	F	O	Increased bile production due to malarial infection (Haadhootuu)	Crushing the roots, making s/n & drinking half of coffee cup once for all.	C	MA 089
Gnidia involucrata Stend. ex A. Rich	Thymelaeaceae	Bortoo	H	Rt	Hu	F	O	Gonorrhea &ascaris (Dhukkuba dhiiraa fi Maagaa)	Crushing the root, making s/n & drinking one water glass at once.	R	MA 010
Guizotia scabra (Vis.) Chiov.	Asteraceae	Hadaa butti	H	L	Ls	F	O	Black leg (Abagorba)	Chopping the leaves, making s/n & giving one water glass.	C	MA 073
Hagenia abyssinica (Bruce) J. F. Gmelin	Rosaceae	Heexo	T	L S	Ls Hu	F D	O	Swelling of stomach & tapeworm (Furfuraa fi mini)	Pounding the leaves & seeds together, making s/n & giving one water glass orally for cattle.	R	MA 058

									Crushing the seeds, making s/n & giving one water glass for adult humans.		
Haplocoelum foliolosum (Hiern) Bullock	Sapindaceae	Canaa	Sh	S	Hu	F	O	Ascaris (Maagaa)	Chewing a handful of ripened seeds and swallowing it.	R	MA 101
Heteromorpha arborescens var. *abyssinica (*A.Rich) Wolff.	Apiaceae	Al-Hanqaa	Sh	L	Ls	F	O	Shivering and abnormal breathing (Cuma'a)	Crushing its leaves with the leaves of *Ozoroa insignis, Croton macrostachyus, Calpurnia aurea* and *Senecio hadiensis*, making s/n & giving one liter orally at once.	R	MA 060
Hordeum vulgare L.	Poaceae	Garbuu	H	S	Hu Ls	D	O	Broken bones & worn out tissues (Lafee cabaa)	Slightly toasting and grinding the seeds, preparing soup and drinking it as necessary for humans. Giving some amount	C	MA 098

									of grains daily for sick Donkey, Muel or Horse.		
Hymenodictyon floribundum (Hochst. & Steud.) Robinson	Rubiaceae	Takkidha'a a	Sh	L	Hu	F	Op	Eye disease (Dhukkuba ija'a)	Chopping the leaves, squeezing it to get droplets of saps & put one droplet in each eye.	R	MA 013
Justicia schimperiana (Hochst. ex Nees) T. Anders.	Acanthaceae	Ciiggaa	Sh	L	Hu	F	O	Hepatitis (Bekekko ykn Birtee)	Chopping the leaves, making s/n & drinking half of water glass at once.	R	MA 054
Kalanchoe densiflora Rolfe	Crassulaceae	Hancullee	H	L	Hu	F	Dm	Rheumatic pain (Nafaa bocu)	Heating the leaves on fire & put on where pain is feeling	C	MA 078
Lagenaria abyssinica (Hook.f.) C.Jeffrey	Cucurbitaceae	Buqee Fardoo	C	Fr	Ls	F	Dm	Swelling of the hooves of Horse, Muel & Donkey-FMD (Dhukkuba korraa).	Splitting the fruit, heating it on fire & put on the infected hooves.	R	MA 074

Laggera crassifolia (Sch.Bip. ex A. Rich) Oliv. & Hiern	Asteraceae	Seesiqoo	H	L	Hu	F	Dm	Blood clotting (Dhiigaa dhaabuuf)	Chopping the leaves & put on the cut.	C	MA 024
Leonotis ocymifolia (Burm.f.) Iwarsson	Lamiaceae	---	Sh	L	Hu	F	O Dm	Feverile illness & hepatitis (Michii fi birtee)	Pounding the leaves, making s/n & drinking half a coffee cup and applying certain amnt on the body	R	MA 099
Lepidium sativum L.	Brassicaceae	Feecoo	H	S	Hu	D	O Dm	Stomach ache & febrile illness (Garaa ciininu fi michii)	Chewing the seeds & swallowing it. Applying its s/n on the body.	R	MA 092
Leucas discolor Sebald	Lamiaceae	Xuxiyee	Sh	L	Ls	F	Na	Coughing & sneezing of calves (Bussotu)	Pounding the leaves, making s/n & applying half of a coffee cup through the nose.	R	MA 042
Maesa lanceolata	Myrsinaceae	Abaayii	Sh	L	Ls	F	Na	Leech	Chopping the leaves,	C	MA

Forssk.								infection (Ulaula)	making s/n & applying through the nostrils.		041
*Microglossa pyrifolia (*Lam.) O. Kuntze	Asteraceae	--------	C	L	Ls	F	Dm	Dermal wound of Muel,Horse & Donkey (Booccoqaa)	Pounding the leaves, making thick s/n & applying on the wound daily until healed.	C	MA 088
*Millettia ferruginea** (Hochst.) Back	Fabaceae	Dhaadhatu	T	L S	Hu	F D	O Dm	Cold & flee infection (Gamtokke fi mujalee)	Chopping the leaves, making s/n, adding honey and drinking one water glass at once for cold. Crushing the seeds, making thick s/n and applying on the infected toes & fingers for flee infection.	C	MA 037
Momordica foetida Schumach.	Cucurbitaceae	Suruphaa bofaa	C	Rt	Hu	F	O	Rabies &Gonorrhea (Dhukkuba Saree fi	Pounding the roots, making s/n drinking one coffee cup at	C	MA 005

								dhukkuba dhiiraa)	once.		
Nicotiana tabacum L.	Solanaceae	Tamboo	H	L	Hu Ls	D	O Na	Tooth ache & Leech (Dhukkuba illkaa fi Ulaulaa)	Chewing partly crushed leaves with *magado* salt for tooth ache. Crushing dried leaves, making s/n and applying through the nose or mouth of the animal.	C	MA 085
Nuxia congesta R. Br. ex Fresen	Loganiaceae	Uddessa	T	L	Hu	F	O	Cold disease (Gamtokke)	Pounding the leaves with the leaves of *Asparagus africanus*, making s/n & drinking one water glass at once.	R	MA 064
Ocimum urticifolium Roth. S.Lat.	Lamiaceae	Hancabbii	Sh	L	Hu	F	O Dm	Inflammation of oral cavity & fever (Banqoo)	Chopping the leaves, making s/n, dinking small amount and rubbing the body with the residue.	C	MA 014

Osyris quadripartita Decn.	Santalaceae	Waatoo	Sh	L Rt	Hu	F	O	TB (Dhukkuba Sombaa)	Pounding these parts, making s/n & drinking one water glass daily for a month.	R	MA 008
Ozoroa insignis Del.	Anacardiaceae	Biiqaa	Sh	Ba	Hu	F	O	Cold disease (Gamtokke)	Chopping the inner part of the bark, boiling it, if possible adding milk or butter and drinking one water glass 2 times a day for 5 days.	R	MA 034
Pavetta gardeniifolia A. Rich.	Rubiaceae	Qadiidaa	Sh	Rt	Hu Ls	F	O Dm	Tooth ache & wounded cancer (Dhukkuba illkani fi cacassaa)	Chewing the root for tooth ache. Pounding the root & put on the infected part.	R	MA 039
Pavetta oliveriana Hiern	Rubiaceae	Buururrii	Sh	L	Hu Ls	F	O Na	Urine retention (Dhidiinsa fincaanii)	Chopping the leaves, making s/n & drinking one coffee cup at once or smelling the chopped leaves.	R	MA 080

Pentas lanceolata (Forssk.) Defl.	Rubiaceae	Cunfaa	H	L	Hu	F	O	Gonorrhea & amoebiasis (Dhukkuba dhiiraa fi mageana)	Pounding the leaves with the leaves of *Fagaropsis angolensis, Acmella caulirhiza* and internal stem bark of *Croton macrostachyus*, making s/n , if possible adding honey and drinking one water glass once.	R	MA 075
Phytolacca dodecandra L`He`rit	Phytolaccaceae	Haraanja	C	L	Ls	F	O	Horse coughing disease (Gamojii)	Chopping the leaves, making s/n & giving one water glass twice per week.	R	MA 055
Pittosporum viridiflorm Sims	Pittosporaceae	Irbaa	Sh	L	Ls	F	Na	Paralysis (Sumuxee)	Pounding the leaves, making s/n and dropping one coffee cup through the nostrils 3 times a day	R	MA 001
Podocarpus falcatus (Thumb.) Mirb.	Podocarpaceae	Birbirsa	T	L	Hu	F	O	Diarrhea, fever and joint pain	Chopping the leaves, making s/n and drinking one coffee	C	MA 040

								(Laafaa).	cup.		
Polysphaeria parvifolia Hiern	Rubiaceae	---------	Sh	L	Hu Ls	F	Dm	Wound (Madaa)	Pounding the leaves and put on the wound	R	MA 102
Polyscias fulva (Hiern) Harms	Araliaceae	Gudduba	T	L	Hu	F	O	Amoebiasis (Mageana)	Chopping the leaves, making s/n and drinking one coffee cup.	R	MA 050
Premna schimperi Engl.	Lamiaceae	Xullangee	Sh	L	Hu	F	O Dm	Cancer (Swelling and forming deep opening) - Luxaa	Pounding the leaves and making s/n to take it orally and applying through the opening. The residue should be closed on the opening.	C	MA 029
Protea gaguedi J. F. Gmel.	Proteaceae	Daansee	Sh	L	Ls	F	O	Diarrhea and wound (Sumuxee)	Chopping the leaves with the leaves of *Fagaropsis angolensis* and fruits of *Solanum incanum*, making s/n and giving one liter orally.	R	MA 081

Prunus africana (Hook. f.) Kalkm.	Rosaceae	Sukkee	T	L	Ls	F	O	Diarrhea, wound and coughing in cattle (Sumuxee)	Pounding the leaves with the leaves of *Clematis hirsuta, Calpurnia aurea, Ehretia obtusifolia, Croton macrostachyus* and *Teclea simplicifolia*, making s/n and giving one water glass orally at once.	R	MA 051
Rhamnus prinoides L`He`rit	Rhamnaceae	Geeshoo	Sh	L	Hu	F	O	Tonsilitis (Waan afaani)	Chopping the leaves, making s/n and giving half a coffee cup at once	C	MA 097
Rhus natalensis Krauss.	Anacardiaceae	Daboobessaa	Sh	L	Hu	F	O	Snake bite or venom (Iddansaa Bofaa)	Chewing a handful of its leaves	R	MA 036
Ricinus communis L.	Euphorbiaceae	Qoobboo	H	L	Hu Ls	F	O	Rabies (Dhukkuba Saree)	Pounding its leaves with the leaves of *Croton macrostachyus*, making s/n and giving one water	C	MA 070

									glass orally at once.		
Rubia cordifolia L.S.l	Rubiaceae	Maxanee	C	L Rt	Hu	F	O Dm	Snake venom (Iddansaa Bofaa)	Chopping the leaves and roots together, making s/n and drinking one liter at once. Applying the residue on the infected area .	R	MA 038
Rumex abyssinicus Jacq.	Polygonaceae	Dhangagoo	H	Rt	Hu	F	O	Gonorrhea (Dhukkuba dhiiraa)	Pounding the roots, boiling, adding butter and drinking one water glass daily until cured.	R	MA 045
Ruta chalepensis L.	Rutaceae	Xeenaada mii	Sh	L	Hu Ls	F	O	Stomach ache & cold disease (Dhukkuba garaa fi Gamtokke)	Chopping the leaves, making s/n, adding honey and drinking or giving one water glass.	C	MA 068
Salvia nilotica Jacq.	Lamiaceae	----------	H	L	Hu	F	O	Cold disease (Gamtokke)	Pounding the leaves, making s/n, adding honey and drinking	C	MA 044

									one water glass daily until cured.		
Schrebera alata (Hochst) Welw	Oleaceae	Dhamee	T	Ba	Hu	F	O	Tooth ache and throat pain (Naqarsaa ilkaa fi Qalxaa)	Chewing internal part of stem bark and not swallowing the juice for tooth ache but swallowing for throat pain.	R	MA 086
Senecio hadiensis Forssk.	Asteraceae	Walgabbissa	C	L	Ls	F	O	Shivering and unable to breath normally (Cuma'a)	Chopping the leaves with the leaves of *Heteromorpha arborenscens, Croton macrostachyus,Calpurnia aurea* and *Lagenaria abyssinica*, making s/n and giving one liter orally at once.	R	MA 061
*Solanecio gigas** (Vatke) C. Jeffrey	Asteraceae	Gimboodha	Sh	L	Hu	F	O	Paralysis (Cuma'a)	Pounding the leaves with the leaves of *Clematis hirsute* and *Teclea simplicifolia*, making s/n and drinking one water	R	MA 059

									glass.		
Solanum incanum L.	Solanaceae	Hiiddi	Sh	Fr	Hu	F	Na	Tonsilitis and tooth ache (Waan afaanii fi dhukkuba ilkaa)	Applying 1-2 droplets of the fruit juice through the nostrils for tonsillitis and 1 -2 drops for infected tooth.	C	MA 004
Syzygium guineense var. (Wild.) DC.	Myrtaceae	Baddessa	T	Ba	Ls	F	Na	Leech infection (Ulaulaa)	Chopping internal part of stem bark, making s/n and giving half of a coffee cup through the nostrils.	R	MA 047
Teclea simplicifolia (Engl.) Verdoorn	Rutaceae	Haadheessa	Sh	L	Hu Ls	F	O	Inflammation of children's mouth and black leg (Waan afaanii fi Abagorba)	Pounding the leaves, making s/n and giving a quarter of water glass for cattle and adult humans while very small amnt for children and calves.	R	MA 016
*Thunbergia ruspolii**	Acanthaceae	----------	H	L	Ls	F	Na	Diarrhea in	Chopping the leaves,	R	MA

Lindau								calves (Busootuu)	making s/n and applying one coffee cup through the nose two times a day.		020
Tragia cinerea (Pax) Gilbert & Radcl.-Smith	Euphorbiaceae	Laalessaa	C	L	Ls	F	O Na	Diarrhea in cattle (Busootuu)	Pounding the leaves, making s/n and giving one liter orally and some droplets through the nose.	C	MA 063
Triticum aestivum L.	Poaceae	Qamadii	H	S	Hu	D	Dm	Swelling of part of the body due to infection (Dhulla=Bu gunge)	Chewing the seeds and placing the bolus on the swelling	C	MA 018
Urera hypselodendron (A. Rich.) Wedd	Urticaceae	Hajijaa	C	L	Ls	F	O	Placenta retention (Jiila akka bussu)	Chopping the leaves, making solution, adding *magado* salt & giving one lite orally at once.	R	MA 066
Vangueria madagascariensis Gmel.	Rubiaceae	----------	Sh	L	Hu	F	Dm	Wound (Madaa)	Pounding the leaves & applying on the wound.	R	MA 106

Vernonia amygdalina Del.	Asteraceae	Eebichaa	Sh	L	Hu Ls	F	O	Blotting and urine retention (Bokkoksaa fi dhiibiinsaa fiincaanii)	Chopping the leaves, making s/n drinking one coffee cup for humans & giving a liter for livestock at once.	C	MA 033
Vernonia auriculifera Hiern	Asteraceae	Reejii	Sh	St	Hu	F	O	Amoebiasis (Mageana)	Peeling the young stem near the meristem and chewing it	C	MA 017
Vernonia smithiana Less	Asteraceae	----------	H	L	Hu	F	O	Stomach ache during birth (Garaa ciininu)	Pounding the leaves, making s/n and drinking one coffee cup daily.	R	030
Viscum turberculatum A. Rich.	Viscaceae	Dhertoo	H	L	Hu Ls	F	O	Paralysis and Donkey cough (Dhukkuba Cuma'a fi quffaa Harree)	Chopping the leaves, making s/n & giving one water glass for humans & two water glass for Donkey.	C	MA 052
Withania somnifera	Solanaceae	Lallaafaa	Sh	Rt	Hu	F	O	Snake bite and blotting	Chewing small amount of the root	C	MA

(L.) Dunal				L Fr	Ls			(Hadhaa boofaa fi Darrabba)	and swallowing it for snake venom and crushing the leaves and fruits together, making s/n & giving one water glass for blotting.		011
Zingiber officinale Roscoe	Zingiberaceae	Gaanjiibillo	H	Rh	Hu	F	O	Tonsilitis (Waan afaani)	Pounding the rhizome with the leaves of *Ehretia cymosa* and flowers of *Solanum incanum* and spiting into the mouth of infected baby.	R	MA 094
Ziziphus mucronata Willd.	Rhamnaceae	----------	Sh	L	Hu	F	Dm	Wound (Madaa)	Chopping the leaves and applying on the wound.	R	MA 104

Appendix 4: List of medicinal plant species in the study area showing their habitat, location (altitude, latitude & longitude) and the corresponding informants citation as well as their use diversity.

Key: Habitat is mentioned as W= Wild, Hg=Home garden (Cultivated); Use diversity: M= Only medicinal, E= Edible, Fo= Fodder, Fu= Fuel, Sp= Spices, Cn= Construction, L.Fn= Life Fence, St= Stimulant and O= Ornamental

No	Scientific name	Habitat	Altitude (masl)	Latitude (North)	Longitude (East)	Uses of plant sp.	Informant citation	%
1	*Acacia dolichocephala*	W	1944	$05^0$38′39.1″	$38^0$11′14.9″	M, Fu, Cn, Fo	4	6.7
2	*Acacia lahai*	W	1465	$05^0$39′02.3″	$38^0$11′10.2″	M, Fu, Fo	7	11.7
3	*Acanthospermum hispidum*	W	1821	$05^0$39′04.7″	$38^0$13′38.2″	M	6	10.0
4	*Acmella caulirhiza*	W	1943	$05^0$38′37.7″	$38^0$11′17.8″	M, Fo	38	63.3
5	*Acokanthera schimperi*	W	2014	$05^0$47′39.1″	$38^0$14′10.0″	M, Fu, Cn	28	46.7
6	*Albizia schimperiana*	W	1817	$05^0$39′22.4″	$38^0$13′09.7″	M, Fu, Fo	8	13.3
7	*Allium sativum*	Hg	1875	$05^0$38′41.5″	$38^0$14′08.2″	M, E	42	70.0
8	*Aloe monticola**	W	1825	$05^0$39′00.9″	$38^0$11′04.5″	M	6	10.0

9	*Asparagus africanus*	W	2166	$05^0$47′20.7″	$38^0$14′39.7″	M	42	70.0
10	*Balanites aegyptiaca*	W	1748	$05^0$39′03.0″	$38^0$12′15.1″	M, Cn, Fu	24	40.0
11	*Bersama abyssinica*	W	1894	$05^0$32′28.9″	$38^0$15′12.2″	M, Fu	5	8.3
12	*Buddleja davidii*	W	2207	$05^0$46′25.8″	$38^0$16′59.7″	M, Fu	10	16.7
13	*Calpurnia aurea*	W	1924	$05^0$39′08.1″	$38^0$11′00.1″	M, Cn, Fu	30	50.0
14	*Capparis tomentosa*	W	1792	$05^0$39′03.6″	$38^0$13′36.5″	M, Fo	9	15.0
15	*Carissa spinarum*	W	1800	$05^0$39′23.2″	$38^0$11′54.5″	M, Fo, E	36	60.0
16	*Clematis hirsuta*	W	1767	$05^0$39′35.7″	$38^0$12′02.9″	M, Fo	22	36.7
17	*Clerodendrum myricoides*	W	1880	$05^0$33′32.2″	$38^0$01′27.9″	M, Fo, Fu	11	18.3
18	*Clutia lanceolata*	W	2296	$05^0$47′41.4″	$38^0$16′09.4″	M	15	25.0
19	*Coffea arabica* L.	W	1877	$05^0$38′41.6″	$38^0$14′08.2″	M, E, Fu	42	70.0
20	*Combretum molle*	W	1924	$05^0$39′14.2″	$38^0$11′07.3″	M, Fu	8	13.3
21	*Crabbea velutina*	W	1886	$05^0$39′21.7″	$38^0$11′15.5″	M	6	10.0

22	*Crinum abyssinicum*	W	1465	$05^0$39′02.5″	$38^0$01′8.3″	M	4	6.7
23	*Crotalaria albicaulis*	W	2207	$05^0$46′24.8″	$38^0$16′59.3″	M	4	6.7
24	*Croton macrostachyus*	W	1832	$05^0$38′57.0″	$38^0$11′36.8″	M, Cn, Fu	52	86.7
25	*Cucumis pustulatus*	W	1942	$05^0$33′59.6″	$38^0$01′47.3″	M	50	83.3
26	*Cymbopogon caesius*	Hg	1875	$05^0$38′41.5″	$38^0$14′08.2″	M, O	18	30.0
27	*Datura stramonium*	W	1796	$05^0$39′15.5″	$38^0$13′23.2″	M	42	70.0
28	*Discopodium penninervium*	W	2250	$05^0$46′25.7″	$38^0$16′05.7″	M	5	8.3
29	*Dodonea angustifolia*	W	2296	$05^0$47′41.4″	$38^0$16′09.4″	M, Fu, Cn	14	23.3
30	*Dombeya torrida*	W	2296	$05^0$47′41.4″	$38^0$16′09.4″	M, Fu	13	21.7
31	*Dovyalis abyssinica*	W	2261	$05^0$46′24.5″	$38^0$15′42.3″	M, Fn	8	13.3

32	*Ehretia cymosa*	W	1817	$05^0$39′22.4″	$38^0$13′09.7″	M, Fu, Cn	16	26.7
33	*Ehretia obtusifolia*	W	2296	$05^0$47′41.4″	$38^0$16′09.4″	M, Fu	7	11.7
34	*Embelia schimperi*	W	2261	$05^0$46′24.5″	$38^0$15′42.3″	M, Fo	42	70.0
35	*Erythrina brucei**	W	2250	$05^0$46′25.7″	$38^0$16′05.7″	M, Fn, Cn	19	31.7
36	*Erythroselinum atropurpureum*	W	2229	$05^0$46′46.8″	$38^0$15′48.0″	M, Fo	8	13.3
37	*Eucalyptus camaldulensis*	W	1925	$05^0$38′17.6″	$38^0$14′39.2″	M, Cn, Fu	6	10.0
38	*Eucalyptus globulus*	W	2258	$05^0$47′07.7″	$38^0$16′05.9″	M, Cn, Fu	42	70.0
39	*Euclea divinorum*	W	1976	$05^0$47′47.5″	$38^0$14′11.0″	M, Fu, Cn	22	36.7
40	*Euphorbia ampliphylla*	W	2212	$05^0$46′24.8″	$38^0$16′59.3″	M, Fn	4	6.7
41	*Euphorbia depauperata*	W	1796	$05^0$39′15.5″	$38^0$13′23.2″	M	42	70.0
42	*Euphorbia cryptospinosa*	W	1794	$05^0$35′36.1″	$38^0$06′39.7″	M	5	8.3

43	*Fagaropsis angolensis*	W	2230	$05^0$46′21.6″	$38^0$15′30.1″	M, Cn, Fu	7	11.7
44	*Flacourtia indica*	W	1825	$05^0$39′13.5″	$38^0$13′07.7″	M, E, Cn	5	8.3
45	*Foeniculum vulgare*	Hg	1875	$05^0$38′41.5″	$38^0$14′08.2″	M, O	4	6.7
46	*Fuerstia africana*	W	1908	$05^0$38′19.7″	$38^0$14′36.2″	M	10	16.7
47	*Gardenia ternifolia*	W	1919	$05^0$33′52.1″	$38^0$01′43.9″	M, Fu, Fo	6	10
48	*Gnidia involucrata*	W	1922	$05^0$39′12.9″	$38^0$11′07.5″	M, Fo	4	6.7
49	*Guizotia scabra*	W	2250	$05^0$46′25.7″	$38^0$16′05.7″	M, Fo	7	11.7
50	*Hagenia abyssinica*	W	2264	$05^0$47′05.3″	$38^0$16′04.2″	M, Cn, Fu	44	73.3
51	*Haplocoelum foliolosum*	W	2230	$05^0$46′21.8″	$38^0$15′32.5″	M	5	8.3
52	*Heteromorpha arborescens* var. *abyssinica*	W	1976	$05^0$47′47.1″	$38^0$14′11.0″	M, Fu	17	28.3
53	*Hordeum vulgare*	Hg	2236	$05^0$46′44.7″	$38^0$15′27.8″	M, E, Fo	42	70.0

54	*Hymenodictyon floribundum*	W	1944	$05^{0}38'39.1''$	$38^{0}11'14.9''$	M	12	20.0
55	*Justicia schimperiana*	Hg	2212	$05^{0}47'05.3''$	$38^{0}16'05.7''$	M, Fn	42	70.0
56	*Kalanchoe densiflora*	W	2260	$05^{0}46'24.5''$	$38^{0}15'42.3''$	M	5	8.3
57	*Lagenaria abyssinica*	W	2250	$05^{0}46'25.7''$	$38^{0}16'05.7''$	M	4	6.7
58	*Laggera crassifolia*	W	1796	$05^{0}39'15.5''$	$38^{0}13'23.2''$	M, Fu	9	15.0
59	*Leonotis ocymifolia*	W	2250	$05^{0}46'25.9''$	$38^{0}16'05.9''$	M, Fu	2	3.3
60	*Lepidium sativum*	Hg	1877	$05^{0}38'41.5''$	$38^{0}14'08.2''$	M	36	60.0
61	*Leucas discolor*	W	2236	$05^{0}46'44.6''$	$38^{0}15'27.5''$	M, Fo	8	13.3
62	*Maesa lanceolata*	W	2236	$05^{0}46'44.6''$	$38^{0}15'27.5''$	M, Fu	20	33.3
63	*Microglossa pyrifolia*	W	1875	$05^{0}33'32.3''$	$38^{0}01'28.0''$	M, Fu	2	3.3
64	*Millettia ferruginea*	W	1878	$05^{0}38'46.0''$	$38^{0}14'13.9''$	M, Fu, Cn	30	50.0

65	*Momordica foetida*	W	1840	$05^{0}39'57.6''$	$38^{0}11'35.3''$	M, Fo	42	70.0
66	*Nicotiana tabacum*	Hg	1894	$05^{0}32'28.9''$	$38^{0}15'12.2''$	M, St	42	70.0
67	*Nuxia congesta*	W	2157	$05^{0}47'20.9''$	$38^{0}14'39.2''$	M, Cn, Fu	21	35.0
68	*Ocimum urticifolium*	W	1912	$05^{0}38'43.8''$	$38^{0}11'15.7''$	M, Fu	48	80.0
69	*Osyris quadripartita*	W	1794	$05^{0}39'22.9''$	$38^{0}11'57.0''$	M, Fu	26	43.3
70	*Ozoroa insignis*	W	1772	$05^{0}35'33.7''$	$38^{0}06'42.8''$	M, Fu	14	23.3
71	*Pavetta gardeniifolia*	W	2236	$05^{0}46'44.6''$	$38^{0}15'27.5''$	M, Fu	10	16.7
72	*Pavetta oliveriana*	W	2270	$05^{0}46'27.3''$	$38^{0}15'55.9''$	M, Fu	8	13.3
73	*Pentas lanceolata*	W	2230	$05^{0}46'21.6''$	$38^{0}15'30.1''$	M, Fo	17	28.3
74	*Phytolacca dodecandra*	W	2212	$05^{0}46'24.8''$	$38^{0}16'59.3''$	M	33	55.0
75	*Pittosporum viridiflorm*	W	1924	$05^{0}39'08.1''$	$38^{0}11'00.2''$	M, Fu	12	20.0

76	*Podocarpus falcatus*	W	2198	$05^0$46′44.9″	$38^0$15′26.0″	M, Cn, Fu	8	13.3
77	*Polysphaeria parvifolia*	W	2075	$05^0$38′46.8″	$38^0$10′55.7″	M, Fu	2	3.3
78	*Polyscias fulva*	W	2296	$05^0$47′41.4″	$38^0$16′09.4″	M, Cn, Fu	5	8.3
79	*Premna schimperi*	W	1793	$05^0$39′11.1″	$38^0$13′07.5″	M, Fu	23	38.3
80	*Protea gaguedi*	W	2075	$05^0$38′46.6″	$38^0$10′52.5″	M, Fu	4	6.7
81	*Prunus africana*	W	2296	$05^0$47′41.4″	$38^0$16′09.4″	M, Cn, Fu	18	30.0
82	*Rhamnus prinoides*	Hg	1976	$05^0$47′47.6″	$38^0$14′11.5″	M, E	28	46.7
83	*Rhus natalensis*	W	1768	$05^0$35′35.7″	$38^0$06′39.5″	M, Fu	7	11.7
84	*Ricinus communis*	W	2240	$05^0$46′23.3″	$38^0$16′10.1″	M, Fu	19	31.7
85	*Rubia cordifolia**	W	2236	$05^0$46′44.6″	$38^0$15′27.5″	M, Fu	24	40.0
86	*Rumex abyssinicus*	W	2296	$05^0$47′41.4″	$38^0$16′09.4″	M, Fo	48	80.0
87	*Ruta chalepensis*	Hg	1875	$05^0$38′41.5″	$38^0$14′08.2″	M, Sp	42	70.0
88	*Salvia nilotica*	W	1832	$05^0$38′51.8″	$38^0$13′52.6″	M, Fo	2	3.3

89	*Schrebera alata*	W	1916	$05^{0}33'39.1''$	$38^{0}00'49.6''$	M, Fu	7	11.7
90	*Senecio hadiensis*	W	1976	$05^{0}47'47.1''$	$38^{0}14'11.0''$	M, Fo	6	10
91	*Solanecio gigas*	W	2212	$05^{0}46'24.8''$	$38^{0}16'59.3''$	M, Fu	7	11.7
92	*Solanum incanum*	W	1868	$05^{0}39'22.7''$	$38^{0}11'18.1''$	M, Fo	48	80
93	*Syzygium guineense*	W	2296	$05^{0}47'41.4''$	$38^{0}16'09.4''$	M, Cn, Fu, E	27	45.0
94	*Teclea simplicifolia*	W	1908	$05^{0}38'52.6''$	$38^{0}11'13.0''$	M, Fu, Cn	31	51.7
95	*Thunbergia ruspolii*	W	1875	$05^{0}39'23.5''$	$38^{0}11'17.2''$	M, Fo	2	3.3
96	*Tragia cinerea*	W	2097	$05^{0}47'33.3''$	$38^{0}14'22.2''$	M, Fo	10	16.7
97	*Triticum aestivum*	Hg	1798	$05^{0}39'16.4''$	$38^{0}13'22.1''$	M, E, Fo	29	48.3
98	*Urera hypselodendron*	W	2237	$05^{0}46'47.0''$	$38^{0}15'24.4''$	M, Fu	18	30
99	*Vangueria madagascariensis*	W	1793	$05^{0}39'11.3''$	$38^{0}13'07.9''$	M, Fu	2	3.3
100	*Vernonia amygdalina*	W	1832	$05^{0}38'51.6''$	$38^{0}13'52.8''$	M, Fu, Fo	48	80.0

101	*Vernonia auriculifera*	W	1937	$05^{0}39'10.3''$	$38^{0}11'13.9''$	M, Fu	11	18.3
102	*Vernonia smithiana*	W	1793	$05^{0}39'11.1''$	$38^{0}13'07.5''$	M, Fo	2	3.3
103	*Viscum turberculatum*	W	2296	$05^{0}47'41.4''$	$38^{0}16'09.4''$	M	24	40.0
104	*Withania somnifera*	W	1940	$05^{0}38'40.8''$	$38^{0}11'16.6''$	M	42	70.0
105	*Zingiber officinale*	Hg	1875	$05^{0}38'41.5''$	$38^{0}14'$ $08.2''$	M, Sp	42	70.0
106	*Ziziphus mucronata*	W	1832	$05^{0}38'51.9''$	$38^{0}13'52.5''$	M, Fu	2	3.3

Appedix 5. List of families, genera and species with human and livestock ailments treated by these plants.

No.	Family name	No. of genera	No. of species	% of total species	No. of species used to treat			Total
					Human ailments	Livestock ailments	Both	
1	Asteraceae	8	10	9.43	5	3	2	10
2	Rubiaceae	8	9	8.49	7	_	2	9
3	Lamiaceae	7	7	6.60	5	2	_	7
4	Fabaceae	6	7	6.60	5	1	1	7
5	Euphorbiaceae	5	7	6.60	3	1	3	7
6	Solaceae	5	5	4.72	2	_	3	5
7	Acanthaceae	3	3	2.83	1	2	_	3
8	Apiaceae	3	3	2.83	_	1	2	3
9	Cucurbitaceae	3	3	2.83	2	1	_	3
10	Poaceae	3	3	2.83	2	_	1	3
11	Rutaceae	3	3	2.83	1	1	1	3
12	Myrtaceae	2	3	2.83	2	1	_	3
13	Anacardiaceae				2	_	_	2

		2	2	1.90				
14	Apocyanaceae	2	2	1.90	1	_	1	2
15	Flacourtiaceae	2	2	1.90	2	_	_	2
16	Loganiaceae	2	2	1.90	2	_	_	2
17	Myrsinaceae	2	2	1.90	_	1	1	2
18	Rhamnaceae	2	2	1.90	2	_	_	2
19	Rosaceae	2	2	1.90	_	1	1	2
20	Sapindaceae	2	2	1.90	1	1	_	2
21	Boraginaceae	1	2	1.90	1	_	1	2
22	Alliaceae	1	1	0.94	1	_	_	1
23	Aloaceae	1	1	0.94	_	_	1	1
24	Amaryllidaceae	1	1	0.94	_	1	_	1
25	Araliaceae	1	1	0.94	1	_	_	1
26	Asparagaceae	1	1	0.94	1	_	_	1
27	Balanitaceae	1	1	0.94	_	_	1	1
28	Brassicaceae				1	_	_	1

		1	1	0.94				
29	Capparidaceae	1	1	0.94	1	_	_	1
30	Combretaceae	1	1	0.94	1	_	_	1
31	Crassulaceae	1	1	0.94	1	_	_	1
32	Ebenaceae	1	1	0.94	1	_	_	1
33	Melianthaceae	1	1	0.94	1	_	_	1
34	Oleaceae	1	1	0.94	1	_	_	1
35	Phytolaccaceae	1	1	0.94	_	1	_	1
36	Pittosporaceae	1	1	0.94	_	1	_	1
37	Podocarpaceae	1	1	0.94	1	_	_	1
38	Polygonaceae	1	1	0.94	1	_	_	1
39	Proteaceae	1	1	0.94	_	1	_	1
40	Ranunculaceae	1	1	0.94	1	_	_	1
41	Santalaceae	1	1	0.94	1	_	_	1
42	Sterculiaceae	1	1	0.94	_	1	_	1
43	Thymelaeaceae				1	_	_	1

		1	1	0.94				
44	Urticaceae	1	1	0.94	_	1	_	1
45	Viscaceae	1	1	0.94	_	_	1	1
46	Zingiberaceae	1	1	0.94	1	_	_	1
				Total	62	22	22	106

Appendix 6: Human health problems and the number of medicinal plant species used to treat those ailments

No.	**Types of ailments treated**	**Local name of the ailments**	**No. of plant Species used**	**Percentage**
1	Evil eye	Driyaa	3	2.6
2	Wound	Madda	6	5.4
3	Blood pressure	Danfaa dhiigaa	1	0.9
4.	Tissue cancer	Luxaa	4	3.6
5	Tonsillitis and fever	Banqoo	9	8.0
6	Scabies	Ciittoo/ Qanxoo	1	0.9
7	Stomach ache	Dhukkuba garaa	9	8.0
8	Hepatitis	Biirtee	4	3.6
9.	Cold disease	Gamtokke	10	8.9
10	Rabies	Dhukkuba Saree	6	5.4
11	Tooth ache	Dhukkuba ilkaa	5	4.4

12	Bone cancer	Caccassa	2	1.8
13	Gland TB	Xanachaa	1	0.9
14	Tapeworm	Mini	3	2.6
15	Eczema	Cacca	2	1.8
16	Dizzy ness	Araadee	1	0.9
17	Head ache	Bowwoo mataa	1	0.9
18	Ring worm	Roobi	3	2.6
19	TB (Tuberculosis)	Dhukkuba Somba	3	2.6
20	Gonorrhea	DhukkubaDhiirra	6	5.4
21	Amoebiasis	Mageana	5	4.4
22	Common cold	Quffa	1	0.9
23	Skin rash	Komomman	1	0.9
24	Ascaris	Maagaa	2	1.8
25	Increased bile production due malarial infection	Haadhootu	1	0.9
26	Broken bones	Lafee cabaa	1	0.9
27	Eye disease	Dhukkuba ijaa	1	0.9
28	Rheumatic pain	Nafaa bocu	1	0.9
29	Blood clotting	Dhiigaa dhaabuuf	1	0.9
30	Febrile illness	Michii	2	1.8
31	Flee infection	Mujalee	1	0.9
32	Urine retention	Dhidiinsa fincaani	2	1.8
33	Diarrhea, fever & joint pain	Laafaa	2	1.8
34	Snake bite (Venom)	Iddansaa or hadhaa	5	4.4

		bofaa		
35	Throat pain	Qalxaa	1	0.9
36	Swelling	Dhulla	1	0.9
37	Paralysis	Dhukkuba Cuma'a	4	3.6

Appendix 7: List of livestock ailments and number of medicinal plants used to treat those diseases

No.	**Types of ailments treated**	**Local name of the ailments**	**No. of plant species**	**%**
1	Coughing & sneezing of donkey	Gororsaa Haree	3	5.6
2	Tissue cancer	Luxaa	1	1.9
3	Scabies	Ciittoo /Qanxoo	1	1.9
4	Hepatitis	Bekkekko	2	3.7
5	Rabies	Dhukkuba Saree	5	9.3
6	Early maturity of udder	Saadhessa	1	1.9
7	Breast cancer of cattle	Naqarsaa muchaa looni	1	1.9
8	Dropping saliva	Dhukkuba addu	1	1.9
9	Swelling of the skin around the stomach	Darrabbaa	1	1.9
10	Black leg	Abaa gorbaa	3	5.6
11	Diarrhea of calves	Busootu	4	7.4
12	Wound	Madda	1	1.9
13	Paralysis	Cuma'a	5	9.3
14	Tapeworm	Mini	1	1.9

15	Diarrhea & body wound	Sumuxee	7	13.0
16	To remove plastics eaten by an animal	Rakko laastica	1	1.9
17	Blotting	Furfuraa	2	3.7
18	Broken bones	Lafee cabaa	1	1.9
19	Swelling of hooves in Horse Mule & Donkey(FMD)	Dhukkuba korra	1	1.9
20	Leech infection	Ulaulaa	3	5.6
21	Dermal wound of Mule, Horse & Donkey	Booccoqaa	1	1.9
22	Urine retention	Dhidiinsaa fincaani	2	3.7
23	Horse coughing	Gamojii	1	1.9
24	Placenta retention	Jila akka busuu	1	1.9
25	Snake bite	Hadhaa bofaa	4	7.4