Ethnobotany of medicinal plants in Erob and Gulomahda districts, Eastern Zone of Tigray Region, Ethiopia

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Ethnobotany of medicinal plants in Erob and Gulomahda districts, Eastern Zone of Tigray National Region, Ethiopia

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This is to certify that the Dissertation prepared by Tadesse Beyene Wereta, entitled: **Ethnobotany of medicinal plants in Erob and Gulomeheda Districts, Eastern Zone of Tigray National Regional State, Ethiopia** and submitted in fulfillment of the requirements for the degree of Doctor of Philosophy (Biology: Botanical Sciences) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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ABSTRACT

Ethnobotany of medicinal plants in Erob and Gulomahda districts, Eastern Zone of Tigray Region, Ethiopia

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This thesis reports the ethnobotanical study conducted on the medicinal plants, between August 2010 and October 2012, in Erob and Gulomahda districts in Tigray Region of Ethiopia. Ethnobotanical information on plants of local medicinal was gathered through semi-structured interviews involving 382 informants representing different social groups, group discussion, field observation, guided field walk and market survey. A total of 121 medicinal plant species, belonging to 100 genera and 52 families, used to treat 75 human and 27 livestock ailments were documented from both districts. In Erob, 85 plant species in 72 genera and 42 families claimed for treating 58 human and 24 livestock ailments were recorded while 102 medicinal plants in 88 genera and 48 families were documented from Gulomahda, which were claimed to treat 67 human and 18 livestock ailments. The Asteraceae, Solanaceae and Lamiaceae had 11 species each. The herb category was the dominant growth form in the study area. Plant species collected from the wild were the highest in both districts. The most frequently used plant part for preparation of remedies in both districts was the leaf. The local people of the study districts frequently engage their eloquent proverbs to accentuate the importance of plant species for medicinal purposes including the saying "a drug can kill, and a drug can save", which survived for generations. Jaccard's Coefficient of Similarity of Erob and Gulomahda for the reported traditional medicinal plants was 0.55 indicating some trend of using common plants. The insignificant mean number of plant species used to treat human (p (0.17) > 0.05) and those for livestock ailments (p (0.26) > 0.05) between the two districts showing that the local people use similar plant species to cure ailments. The insignificant different of $\chi 2$ test for the relation of gender on conservation of traditional medicinal plants in Erob (p (0.27) > 0.05) and Gulomahda (p (0.23) > 0.05) showing that conservation of medicinal plants was not affected by gender differences. The computed Pearson's Correlation Coefficient for the knowledge among different age levels was 0.84 for Erob and 0.77 for Gulomahda showing a stronger positive (direct) linear relationship between age and knowledge in both districts and this relation was significant in Erob (p (0.00) < 0.05) and Gulomahda (P (0.00) < 0.05). A negative linear relationship for the knowledge among different educational leveles was 0.44 for Erob and 0.47 for Gulomahda indicating modern education affects the knowledge on medicinal plants and the relation was significant in Erob (P (0.00) <0.05) and Gulomahda (P (0.00) < 0.05). The insignificant *difference for mean knowledge of medicinal plant between male and female in Erob (p (0.39) > 0.05) and Gulomahda (p (0.08) > 0.05) indicating that males and females were equally responsible for primary healthcare of the members of their families. The significant difference for mean knowledge between Saho and Tigrigna speakers in Erob (p (0.02) < 0.05) indicating that the mean knowledge of Saho speakers is significantly greater than the mean knowledge of Tigrigna speakers for the reported medicinal plants in this District. The significant difference for the mean knowledge between Catholic and Orthodox followers in Erob (p (0.02) < 0.05) indicating that the mean knowledge for the reported medicinal plants by the Catholic followers) was significantly greater than those of Orthodox followers in this District. There was no widely observed trade on medicinal plants in the markets studied. Threats on medicinal plant species included drought, fuel wood collection, construction material extraction and civil unrest while rehabilitation of degraded areas, replanting, homegardening and provision of alternative energy sources are suggested as plausible actions to protect the medicinal plant resources and the associated indigenous knowledge.*

Key words Ethnobotany, ethnomedicine, ethnovetrinary medicine, Erob, Gulomahda, Tigray, Ethiopia

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This piece of work is dedicated to my wife Tsehay Gebre for bearing in mind the work as her own in all dimensions whilst the work started up to its finishing point and to my daughters Fiyori Tadesse and Kidusan Tadesse who will carry on their knowledge to the next generation.

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Acronyms and Abbreviations

AAU	Addis Ababa University
ANOVA	Analysis of variance
ARDOED	Agricultural and Rural Development Office of Erob District
ARDOGD	Agricultural and Rural Development Office of Erob District
CSA	Central Statistics Agency
CV	Coefficient of variation
FSSE	food security and saftnet of Erob
FSSG	food security and saftnet of Gulomahda
IBC	Institute of Biodiversity Conservation
IBCR	Institute of Biodiversity Conservation and Research
IK	Indigenous knowledge
JCS	Jaccard's coefficient of similarity
MP	Medicinal plant
MPs	Medicinal plants
MPS	Medicinal plant species
NMA	National Meteorological Agency
P.C.	Plant community
R	Pearson's correlation coefficient
r^2	Coefficient of determination
SD	Standard deviation
TH	Traditional healer
TM	Traditional medicine
TMP	Traditional medical plant
WM	Western medicine
χ^2	Chi square

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CHAPTER ONE

1. INTRODUCTION

1.1. Background

Biodiversity refers to the variety and variability among living organisms (Ramesh, 2003); variety of life on earth (Corker, 2003). The level of biodiversity indicates the health of the habitat. If an area has a high variety of life it is said to be very healthy as it is capable of supporting life well. The work of Naeem and Li (1997) indicated that those communities with a greater number of species per functional group were more stable than communities with less species.

Local people interact with the natural environment and have ways of categorizing, managing and utilizing part of the environment such as plants existing around them. They use plants for food, medicines, building materials and other purposes. The science that studies these relationships between plants and people is ethnobotany (Farnsworth, 1994; Martin, 1995; Balick 1996). Plants have been closely associated with many social cultures and customs such as personal decoration like cosmetics, entertainment as musical instruments, arts and crafts (Jain, 1986). Endalew Amenu (2007) concluded that plants provide numerous uses for native societies in Chelia Wereda (Ethiopia). Indigenous knowledge has developed as a result of human interaction with their surroundings. Indigenous people have developed their own local specific knowledge on plant use, management and conservation (Cotton, 1996).

As the Earth's population continues to grow, more resources are demanded. Thus, it is understandable that an increase in population is demanding more resources, but with careful management of our natural resources, a sustainable balance can be achieved. Borokini, *et al*., (2010) defined conservation as the management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet needs and aspirations of future generations. According to Cunningham (1993), sustainable 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 medicine for health. Conservation of medicinal plant resource is a critical ecological, cultural and economic issue (Van On, 2001. Such documents on medicinal plants and associated indigenous knowledge are important as a useful source of establishing proper conservation priorities and strategies of medicinal plants. Conservation only has meaning in the context of human intention and it is a social movement working to develop and maintain values in society concerning the human-nature relationship (Jepson, *et al*., 2001).

Biodiversity conservation and sustainable utilization in Ethiopia will held by promting *in-situ* systems as the primary target and *ex-situ* systems in gene banks, farms and botanical gardens as supplementary to *in-situ* conservation (Mesfin Bayou, 1998). Therefore, ethnobotanical studies are useful in documenting, analyzing and communicating knowledge and interaction between plant species and human societies, how they are used and influenced by human activities (Martin, 1995; Balick and Cox, 1996; Cotton, 1996). This helps in giving priority for conservation of vegetation and plant communities those having better medicinal plant species as well as plant species which are rare atleast in the study area,

Plants have significant medicinal values both in developing and developed countries. 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). According to WHO (2002) indigenous or traditional or folk medicine is defined 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). Farnsworth (1994) also defined ethnomedicine as the use of plants by humans for medicines and traditional medicine as the sum total of all non-main stream medicinal practices. The plant-based traditional medical systems continue to provide the primary healthcare to more than three-quarters of the world's population (Choudhary *et al*., 2008). The vast majority, about 70-80% of the people in Africa, consult traditional medicinal practitioners for healthcare (Cunningham, 1993). Many studies have also indicated that many plant species are used to treat livestock ailments. Mathius-Mundy and McCorkle (1989) defined ethnoveterinary medicine as beliefs, knowledge, skills, methods and practices linking to the healthcare of animals.

Different studies have pointed out that there is a real danger of genetic erosion, which in turn calls for collection, investigation and conservation of these resources and the indigenous knowledge on them. The loss of medicinal plant species is a common problem in Ethiopia for sustainable use of the resources (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. Therefore, the knowledge of the community is currently being eroded and lost due to loss of traditional cultural systems and conversion of plant community and forest ecosystems to other purposes such as fuel source, agriculture, construction and others including furniture making.

Various studies suggested a need for urgent documentation of indigenous knowledge related to plant use to make it available to future generations. In Ethiopia, traditional medicine as in other developing countries is faced with problems of sustainability and continuity mainly due to loss of medicinal plants species, loss of habitats of medicinal and other category of plants and cultures (Zemede Asfaw, 2001).

In this context, therefore, the present study conducted a full scale study on the ethnobotany of the traditional medicinal plants in Erob and Gulomahda Districts of Tigray Region. The study particularly focused on the situation with the plants used by the local people for preventing and curing human and livestock ailments including the details of the associated indigenous knowledge and the ethnomedicinal practices of the multi-ethnic community inhabiting the two districts.

1.2. Research Problem, Questions, Hypotheses and Objectives

1.2.1. Research problem

The study area includes Erob and Gulomahda districts of eastern Tigray National Regional State, Ethiopia. The plant communities and the natural vegetation of the area have been affected by various human made and natural factors. Lack of proper conservation and management leads to the shrinking and finally destruction of the plant communities and natural vegetation causing negative impacts on medicinal plants and related knowledge of the local people since most of the traditional medicinal plants are obtained from the plant communities of wild lands, such destruction needs to be controlled.

To alleviate these problems, research about the plants used as medicine and the associated knowledge is mandatory; and this should be carried out in detail. The present research covered Erob and Gulomahda districts that have never been studied like this. Scientific investigation and documentation concerning TMPS and the associated indigenous knowledge on their use and management is considered of paramount importance as it makes useful data available. The study, therefore, targeted this gap in knowledge to fully document the information on TMPS and the wealth of local indigenous ethnobotanical knowledge on the traditional medicinal plants.

1.2.2. Research questions

The main focus of this study was to investigate the traditional medicinal plants along with their uses in healthcare and other purposes, management as understood and applied by the local people of Erob and Gulomahda districts. The work aimed at conducting research about the traditional medicinal plants used to treat both human and livestock ailments in the study districts. Thus, the following key research questions were generated in order to primarily find scientific answers as these would help in crafting appropriate strategies to facilitate their future sustainable use and management.

- What are the common human and livestock ailments in the area?
- What types of plants are used by the community to treat each ailment affecting the people and/or their livestock?

- Which part of the medicinal plants is useful to treat ailments?
- How do the local people or traditional healers prepare the herbal medicine?
- How are the dosages of the plant medicines measured?
- What is the current status of medicinal plants in Erob and Gulomahda districts?
- In what kind of habitats/ plant communities are the medicinal plants found?
- What are the major threats to the medicinal plants in the area?
- What methods are there in use and what methods should be used to conserve the medicinal plants?

1.2.3. Hypotheses

The following working hypotheses were formulated at the onset of the study:

i. There are medicinal plants used by the local people of Erob and Gulomahda districts to treat human and livestock ailments;

ii. There are common medicinal plants that are used by the local people of Erob and Gulomahda districts to treat human and livestock ailments;

iii. Medicinal plant knowledge along socio-demographic differences of the community (age, gender, education, ethnicity, religion) is the same;

   a. The mean knowledge for the reported medicinal plant species of the local people of Erob District is equal with the mean knowledge of the local people of Gulomahda District;

   b. The mean ethnomedicinal knowledge on the reported medicinal plant species of the members of Saho speaking group in Erob Districts is equal with Tigrigna speakers living in the same district;

c. The mean knowledge for the reported medicinal plant species of the members of Orthodox followers is equal with catholic followers in Erob District despite claim by some that people around the church have been more knowledgeable about traditional medicinal plants and the associated IK;
d. The mean ethnomedicinal knowledge on the reported medicinal plant species of married group is equal with those of single in the study districts;
e. Medicinal plant conservation doesn’t depend on gender difference of the community;

iv. The number of medicinal plant species in relation to altitude, growth habit, cultivation status and taxonomic categories are the same.

1.2. 4. Research objectives

1.2.4.1. General objective

The general objective of this research was to document and analyze the traditional medicinal plants used for treating human and livestock ailments along with the associated local indigenous knowledge of the people in Erob and Gulomahda districts of eastern Tigray, Ethiopia.

1.2.4.2. Specific objectives

The specific objectives of this study were to:

i. Collect, make taxonomic determinations and prepare an authentic list of medicinal plants used in the traditional healthcare system of the people of the two districts to treat human ailments;
ii. Collect, make taxonomic determinations and prepare an authentic list of medicinal plants used by the people of the two districts to treat livestock ailments;
iii. Document and analyze the plant parts used for medicinal purposes;
iv. Collect, record and document indigenous knowledge of the people on how the medicinal plants are used;
v. Find out and document the major threats that the traditional medicinal plants are facing;
vi. Find out and document the methods used by the indigenous people to conserve medicinal plants;
vii. Generate plausible suggestions which would contribute to the conservation and sustainable use and management of medicinal plants in the two districts;
viii. Enrich, enhance and scale up the on-going medicinal plant documentation at the National Herbarium (ETH) of AAU with database and voucher specimens.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Traditional Medical Knowledge

According to Alexandrou *et al*. (2015), traditional medical knowledge is defined as practices and knowledge obtained by indigenous people, which is passed on from generation to generation and is conducive towards the development of medicinal research. They also indicated that it is a multidimensional and closely associated to the cultural practices and national identity of many indigenous people.

2.1.1. Types of traditional medical knowledge

According to Payyappallimana (2009), forms of traditional medical knowledge are grouped in to four as follows:

i. ***Codified medical systems/ great traditions***. Codification is defined as the creation of codes, which are collections of written statutes, rules, and regulations that inform the public of acceptable and unacceptable behavior. It includes Ayurveda, Siddha, Unani and Acupuncture medical systems in India and China and has evolved over three to four millennia. The oldest medical text of Ayurveda, Caraka Samhita is estimated to be written and redacted through various versions from 1,500 BC─200 AD. Codified knowledge is easier to distribute, store and recall (Cowan, 2001).

ii. ***Ethnomedicine***. Ethnomedicine, as it is also sometimes called folk medicine or indigenous medicine or bush medicine, is knowledge that is generated over centuries by communities using plants, animals, mineral derivatives and is mostly orally transmitted for treatment purposes. It is the mixture of traditional healing practices (WHO, 2008).

iii. ***Allied forms of health knowledge*** . These are forms of health knowledge such as yoga, judo and others such as massage techniques, which are related to wellbeing. Though these are not purely medical systems they have been adapted as health applications and contribute to community healthcare systems.

iv. ***New forms of alternative health knowledge***. It is a new and relatively recent original knowledge generated in the west and other developed countries with a mix of ancient and contemporary scientific knowledge such as phyto-medicine, health supplements, macrobiotics and reiki or shiatsus which are of 20th century origin. However, some of these are also a blend of one or more of the older medical knowledge systems. Homeopathy and chiropractic systems are not considered traditional medical systems because they were developed in Europe post 18th century after the introduction of modern medicine (WHO, 2002).

2.1.2. Historical development of western medicine

Western medicine (WM) can be traced back to the Greek physician Hippocrates (460-377 BC) who was 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). *Rauvolfia serpentina* (Apocynaceae), used for centuries for its sedative effects. Today, the active component obtained from it is widely used in Western medicine to treat high blood pressure (Jain, 1986).

WM is a modern medicinal practice based on appropriate use of a discrete and well defined chemical entity for the treatment of a given disease (Garodia e*t al.*, 2007); a system in which medical doctors and other healthcare professionals such as nurses, pharmacists, and therapists treat symptoms and diseases using drugs, radiation, or surgery (Brennan, 2007). WM is very new in its origin and is approximately a century old e.g. Aspirin was discovered in 1895 and is firmly integrated with the American culture and economy (Rout *et al*., 2009) and is based on the omen of state-of-the-art technology and drugs (Garodia *et al*., 2007). Today, more analytical method and photochemistry, pharmacognosy researches have been expanding including cell and molecular biology in relation to natural products, ethnobotany and phototherapy (WHO, 2001). Modern pharmacopoeia contains at least 25% drugs derived from plants (Malick *et al*., 2012).

2.1.3. The role of plant species in the development of modern drugs

Human life and continued existence would be impracticable without extensive use of plants and plant products. A large proportion of the population in developing countries continues to depend upon medicinal plants for their primary healthcare needs (Singhal, 2005) and largely plant based (Farnsworth and Soejarto, 1991). Many systems of therapy have been developed primarily based on plants associated with the beginning of human civilization (Choudhary *et al*., 2008).

Natural product research is often based on ethnobotanical information and many of the drugs used today were developed from medicinal plants employed in indigenous societies (Heinrich, 2003). According to Singhal (2005), 25 to 40% of all modern pharmaceuticals are derived from plants while Hussin (2001) claims that more than 60–70% of modern medicines in the world market are more or less derived from plant products. These plant resources play a great role for a better healthcare and were a central task of modern ethnopharmacological research (Delgado, 1992; WHO, 1999; Heinrich *et al*., 2001). A major part of the ethnopharmaceutical research in recent years has been directed towards a better understanding of the pharmacological effects of individual medicinal plants. Phytochemical studies on medicinal plants are relatively plentiful (Delgado, 1992).

Aklilu Lemma (1972) reported *Phytolacca dodecandra/* Phytolaccaceae is effective as molluscicidal which helps in the control of schistosomosis and fasciolosis in humans and animals in Ethiopia. The efficacy of some species like *Hagenia abyssinica/* Rosaceae and *Glinus lotoides/ Molluginaceae* in the treatment of tapeworm has been verified in Ethiopia based on the lead of the indigenous knowledge of the local people (Endashaw Bekele, 2007).

2.2. Traditional Medicinal Plants

WHO (1991) defined traditional medicines or herbal drugs as remedial practices that have existed for hundreds of years, before the development and spread of modern medicine and are still in use today. It is the sum total of all knowledge and practices, prevention and elimination of ailments relying on practical experience and observation handed down from generation to generation, whether verbally or in writing (WHO, 2002). According to WHO (2003), TM also refers to health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral-based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat or to diagnose and prevent illnesses or maintain wellbeing.

Ethnomedicine is concerned with the cultural interpretations of health, disease and illness and also addresses the healthcare-seeking process and healing practices (Pieroni *et al.*, 2005). The traditional medical practitioner or traditional healer (TH) is described as a person who is recognized by the community in which he/she lives as the competent person to provide healthcare by using vegetable, animal and mineral substances (WHO, 1978). TM helps to meet some of the primary healthcare needs (Ampitan, 2013).

2.2.1. Use and knowledge base on traditional medicinal plant species

Human societies all over the world have built up indigenous knowledge over centuries on plant species and on how to use them for medicinal purposes by depending mostly on locally available plant species. Traditional medicine or indigenous or folk medicine comprises knowledge systems that developed over generations with great contributions made by practitioners to human health (Pei, 2001; WHO, 2003) because it is the most affordable and easily reachable (Bussmann *et al.*, 2007; Maroyi, 2013). TM is the first choice to stop-gap illness by the majority members of the communities (Quinlan and Quinlan, 2007). According to Cotton (1996), WHO has recognized and identified about 4000 plant species which are used in traditional medicinal system.

Herbal medicine is referred to as complementary and alternative medicine (CAM) in the Americas and Western Europe (Bodeker, 2005). Developed and developing countries use some form of traditional medicines. For instance, the proportion of the population that uses TM is given as Chile 71%, Canada70%, India 70%, France 49%, Australia 48%, USA 42%, Colombia 40%, China 40%, Belgium 31% of their healthcare (WHO, 2002; Payyappallimana, 2009). Furthermore, 44% of physicians use alternative healthcare themselves and 23% incorporated them into their practices (Astin, 1998). In 2002, 56% of the German population reported having used a form of complementary medicine during 2001 (Dixon, 2008).

The works of Cunningham (1993) and Hillenbrand (2006) showed that most of the population of the developing countries depends on traditional medicines and the proportion of individuals using traditional medicine also varies from country to country, for instance, 60% of Ugandans and Tanzanians; 65.5% of Ghanians; 70% of Rwandians; 80% of Benians; 80% of Black South Africans and 90% of Ethiopians use traditional medicine (WHO, 2002; Dixon, 2008; Payyappallimana, 2009).

Ingeneral, any community or society has a particular knowledge of how to use plant species for various purposes. Indigenous knowledge (IK) is a distinctive local knowledge to a given community. According to Warren (1991) and Stephen and Justin (2003), IK is defined as the local knowledge that is unique to a given culture or society; the information base for a society, which facilitates communication and decision making (Flavier, 1995); and the accumulated knowledge that resulted from many years of experiences, careful observations, trial and error experiments (Martin, 1995). IK developed through practical experience and skill used to solve problems faced in peoples day-to-day activities. IK encompasses the beliefs, knowledge, practices, innovations, arts, spirituality, and other forms of cultural experience and expression that belong to indigenous communities worldwide and this life long experience is generally known as indigenous knowledge or traditional knowledge (Woyek and Gorjestani, 1998).

2.2.2. The use of plant material as medicine

With the beginning of human civilization, many systems of remedy have been developed primarily based on plants. Peoples of all cultures depend on plants for their primary requirements and learned diverse applications of plants (Idu, 2009). The work of Dery *et al*. (1991) indicated that plants have been crucial sources of preventive and healing traditional medicine preparation for human beings and livestock since ancient times. In 400 BC, Hippocrates (Greek) took a systematic approach to record information about medical treatments. Chinese Materia medica has extensively documented dating from about 1100 BC on uses of over 600 medicinal plants (Karou *et al*., 2007). Ibn Al Baytar (1197-1248 AD), born in Malaga (spain) and studied in Seville, travelled in Spain and North Africa as an herbalist, and later lived in Cairo as Chief Herbalist, listed over 1400 drugs and medicinal plants in Corpus of Simples (Sneden, 2004).

A study also shows that Egyptian medicine dates from about 2900 B.C., with the best known pharmaceutical record "Ebers Papyrus" about 1500 B.C., which includes over 700 drugs. Furthermore, the first records, written on clay tablets in cuneiform are from Mesopotamia which date from about 2600 B.C. Dioscorides, Greek physician attempt to systematize plant knowledge in 77 AD who listed about 600 plants with information on how the Greeks used the plants (Choudhary *et al*., 2008).

According to Cotton (1996), ethnobotanical work seems to have started with Christopher Columbus in 1492, at a time when he brought tobacco, maize, spices and other useful plants to Europe from Cuba. William Withering (1775-1785) used extraction of Foxglove, *Digitalis purpurea* (Scrophulariaceae) for the treatment of heart disease (Mans, 2013). In

1803, Sertürner, German pharmacist extracted the active ingredient *morphine* from the medicinal plant opium poppy, *Papaver somniferum* (Papaveraceae) (Mans, 2013). The 19th century was the peak of botanical investigation. The practice of traditional medicine is now widespread in many countries (Hoareau and Dasilva, 1999).

2.2.3. Advantages of herbal medicine

Medical herbalists believe that plants should be used in their full, original form and not synthesized to form chemical drugs (Elumalai and Eswariah, 2012). There are several reasons why some people prefer medical herbalism over western healthcare. These include:

I. ***Regulation.*** The instruction of modern drugs is extremely rigorous and the activity of bringing new medicines to the market is expensive and time consuming compared to herbal medicine (Brennan, 2007). The instruction how to use traditional medicine is simple comparing to western medicine.

II. ***Protection.*** Not strict intellectual property law in herbalism. Strict intellectual property law on modern medicine ensures that scientific knowledge and research is highly protected but herbalism is built around the sharing of knowledge between generations and cultures (Aburjai *et al*., 2007). Openness and honest mentality are the most important values rather than money in herbalism (Garoida *et al*., 2007).

III. ***Consultation.*** Herbalist treatment is mostly specific, more personal and needs short time to brief a patient's particular symptoms than western healthcare (Elumalai and Eswariah, 2012).

IV. ***Formulation*****.** Herbal medicines are mostly prepared during the consultation and can be judgementally modified to their personal needs. On the other hand, western drugs are manufactured in a standardized way using standard ingredients and standard processes (Obosmsawin, 2008).

V. ***Cheap and accessible***. Traditional medicine has remained as the most affordable and easily accessible source of treatment in the primary healthcare system of resource for poor communities. According to Dawit Abebe (2001), there is a large magnitude of use and interest in medicinal plants in Ethiopia due to accessibility and biomedical benefits of the traditional medicinal plants.

2.3. Study of Medicinal Plants

Harshberger (1896) first defined ethnobotany as the study of plants used by primitive and indigenous people. Since then, the term has been broadened by experts in the field. Though Alcom (1984) argued that it is difficult to provide a single unified definition for ethnobotany because of its multidisciplinary nature, many authors have attempted to define it by associating it toward plant and human relationship including Jones (1941) who defined ethnobotany as 'the study of the interrelationships of primitive men and plants'; the study of plants in relation to the inhabitants of an area and deals with folk concepts of classification by habit, habitat and usage (Berlin *et al*., 1973); the study of the use of plants by aboriginal people (Cotton, 1996); indigenous knowledge of local community on utilization and management of plants (Cotton, 1996; Balick and Cox , 1996).

The rapid development of ethnobotany is due to the expansion of ethnobotanical methodology and research undertaking which increased awareness and social value of traditional knowledge. The field ethnobotany has moved from the natural history of plant uses by primitive peoples to a wide range of interests on plants in cultural and ecological contexts (Ford, 1994).

The scope of ethnobotany expanded to include studies of modern cultures, has become interdisciplinary and more recently, with greater attention to its application, conservation and sustainable development. Hence, ethnobotanical knowledge and practices are essential for the conservation of biodiversity. As it was reported by Balick *et al.* (1996), some of the steps followed in ethnobotanical research involve documenting how people classify, identify and relate to plants, examining the reciprocal interactions between plants and people, taxonomic identification of selected plants and biological as well as chemical evaluation of their constituents. Ethnobotanical studies are now growing and in fast progress throughout the world. Ethnobotany is multidisciplinary (Khan *et al*., 2008), standing at the interface of several disciplines and relies on knowledge, research methods of different disciplines and various analytical tools and statistical analyses leading to more sophisticated ways of collecting data and more profound interpretations of research results.

Today, the field of ethnobotany requires a variety of skills such as botanical training, anthropological training, linguistic training and has matured over the past century from rather shallow rooting in the documentation of useful plants of primitive peoples for potential economic application and the betterment of mankind, to addressing a more complex web of applied and theoretical issues of human and plant interactions from cognition to biodiversity conservation (Ford, 1994). Nowadays, plant' chemical and genetic characters are increasingly explored for human benefits due to ethnobotanical studies that have provided us a plenty of information data about plants and has been moving to the popularization of ethnobotany as a field of study in biological science.

In general, ethnobotany has become a more diversified and multidisciplinary subject that requires experts in various fields of academics such as botany, anthropology, agriculture, linguistics, archeology and economics (Martin, 1995; Alexiades, 1996; Balick, 1996) and rapidly growing science, attracting people with widely varying academic backgrounds and interests (Hamilton, 2003; Idu, 2009).

2.3.1. Emergence of ethnobotany as a science

Ethnobotany is a fast growing, interdisciplinary and multidisciplinary science, which focuses on documenting, analyzing of indigenous knowledge on plants and the interaction between humans and plants as well. The multidisciplinary nature of ethnobotany allows a wide array of approaches and applications for many scientists to study the uses of plants in different ways (Alexiades, 1996).

Throughout human history, people used various materials from nature to cure their illnesses and improved their health (Ghorbani *et al*., 2006). Christopher Columbus discovered tobacco that was being used by local people, during his voyage to Cuba in 1492 which was the landmark and there has been an ever increasing interest of anthropologists, botanists and explorers of the world to document the potential uses of plants used by indigenous society (Cotton, 1996). The British explorer, Richard Spruce around 1858, noted the phychoactive properties of the South American Vine, *Banisteriopsis caapi* (Malpighiaceae) for the first time (Cotton, 1996). As the number of expeditions and scholarly communication widened, there has been an intensified and continuous search by researchers of different fields to make known the traditional use of plants in different parts of the world by indigenous society (Balick, 1996; Cotton, 1996).

2.3.2. Significance of ethnobotanical studies

People depend on plants for various needs such as food, construction, fire wood, charcoal, medicines, shade, fodder, forage, living and non-living fence, tooth brush and others including cloth and provide information for priority of conservation. Plant species provide valuable uses (Dangol, 2008). Ethnobotanical studies are important strategy to the conservation of biodiversity, the discovery of new medicines and increasing of the quality of life of poor rural communities (Almeida *et al*., 2006). Many drugs that are being used today have originated from indigenous knowledge (Subramoniam *et al*., 1997). Ethnobotanical studies have taken a great role on use of plants having significant medicinal properties which were unknown to the scientific world (Koul, 1941; Subramoniam *et al*., 1999). The exploration of the cultural values of plant species plays a considerable role in discovering new medicine, farming, pharmaceutical and nutraceutical industrial sectors (Pei, 1995). Ethnobotanical studies also play a great role to find nutraceutical and dietary potential of plant species (Shad *et al*., 2013). Traditional healers can provide a lead to scientific breakthrough in modern medicine (Baker *et al.* (1995); Garodia *et al.* (2007).

Ethnobotany is a vital key to learn the diverse approaches to the use of plants by different human cultures in the past and present to preserve the diversity of plants species, to understand and interpret the ethnobotanical knowledge and sustainable use of the plant species. The search for new medicines by the pharmaceutical industry has turned to plant natural products and to ethnobotanical studies as a first step in bioprospecting, making a valuable contribution to the cataloguing of biological diversity and hence to the conservation of threatened ecosystems (Cotton, 1996).

A severe challenge, especially in the developing countries, is the ever growing gap between human population and food supply. Ethnobotanical studies on wild, semi-wild and lesser known edible plants could assist in narrowing the gap between population growth and food deficiency (Getachew Addis *et al*., 2013). Applied Ethnobotany is oriented toward sustainable use and conservation of plant species through ethnobotanical investigation.

In general, TM has preserved its esteem in all regions of the developing countries and its use is fastly spreading. The role of this healthcare system will not shrink in the future, because it is culturally feasible and expected to remain affordable, while the modern healthcare service is limited and expensive (WHO, 1998). Nowadays ethnobotany has tended to become more analytical, quantitative, cross disciplinary, and multi institutional (Hamilton, 2003).

2.3.3. Ethnobotanical study and drug discovery

Indigenous people discovered and developed the medicinal uses of native plant species. Ethnobotanical studies give a clue for the discovery of many modern drugs or western medicine. Medicinal folklore have provided guide in screening of many important modern drugs (Ghorbani *et al*., 2006). A number of present day drugs still come from natural products, specifically from medicinal plants (Aikman, 1974 as cited in Abbiw, 1996). The use of plant extracts for medicinal purposes is known (Rout *et al*., 2009). However, crude plant preparations require modern standards of safety and efficacy (Obosmsawin, 2008).

According to Elumalai and Eswariah (2012), at least 7,000 medical compounds in the modern pharmacopoeia such as Atropine, Caffeine, Camphor, Cocaine; Aspirin, Ajmaline, Reserpine, D-Tubocurarine, Digitoxin, Tubocurarine, Ephedrine, Ergometrine, Vinblastine, Adoniside, Aescin, Gossypol and Glaucaroubin are derived from plant species (Anyinam, 1995; Sheldon and Balick, 1995; Balick and Cox, 1996; Vasisht, 2002; Kong *et al*., 2003). Since 1986, chemicals obtained from *Calophyllum lanigerum* and *C. teysmannii* (Clusiaceae), *Ancistrocladus korupensis* (Ancistrocladaceae) and *Camptotheca acuminata* (Nyssaceae) showed significant activity against AIDS among more than 40,000 screened plant species and are under research for cancer and AIDS (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. Plant species used as medicines in traditional systems of healing have been the source of several pharmaceutical drugs (Cragg *et al*., 1999).

2.4. Medicinal Plant Species Use in Ethiopia

2.4.1. Plant species as traditional medicine

The various climatic and topographic conditions of the country have contributed to a rich biological diversity. Ethiopia is believed to be home for about 6,000 species of higher plants with approximately 10% endemism (Vivero *et al*., 2006). Like all other parts of the world, plants are used as a source of medicine in Ethiopia. Ethiopia is also a country with many languages, beliefs and highly diversified cultures. This diversification contributes for the people living in different localities of the country to develop their own specific knowledge of plant resource uses, management and conservation (Pankhurst, 1990). Ethiopia has a long history of using traditional medicines from plants and has developed ways to combat diseases through it (Asfaw Debela *et al.,* 1999).

The majority of Ethiopians depend on medicinal plants as their only source of healthcare, especially in rural areas where access to modern medicine is low. According to Dawit Abebe (1986; 2001), 95% of traditional medicinal preparations in Ethiopia are of plant origin and about 80% of the population continue to use traditional plant-derived medicines for their primary healthcare needs (IBCR, 1999; Berhane Kidane *et a*l., 2014). The work of Dawit Abebe and Ahadu Ayehu (1993) in northern Ethiopia elucidated that 87% of the traditional medicines come from plant source. According to the work of Asfaw Deblea *et al*. (1999) and Kebede Deribe *et al*. (2006), plants have been used as a source of traditional medicine from antiquity to solve different health problems and human sufferings in Ethiopia. In addition, the work of Mirgissa Keba (1998) confirms that traditional medicine has become an integral part of the culture of Ethiopian people due to its long period of practice and existence. The work of Dawit Abebe (2001) also confirmed that there is a large magnitude of use and interest in traditional medicine in Ethiopia due to its acceptability, accessibility and biomedical benefits. In general, Ethiopians started to use traditional medicinal plants to treat human and livestock ailments from ancient times. Even today, it is common for people living in rural and urban areas to treat some common ailments using plants available around them such as *Hagenia abyssinica* (Rosaceae) to expel tapeworm and *Ruta chalepensis* (Rutaceae) for various health problems (Abbink, 1995). 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). Using plants by humans as traditional medicine is one of the indigenous knowledge noticed in the history of human being (Fikadu Fullas, 2001)

Study conducted in various parts of Ethiopia also confirmed that the people have a wealth of knowledge about herbal medicine that are used for the treatment of sick animals. Plants comprise the largest component of the diverse therapeutic elements of traditional livestock health care practices in Ethiopia (Teshale Sori *et al*., 2004). The work of Endalew Amenu (2007) showed that 41 plant species were used to treat various livestock ailments including *Albizia schimperiana* against blackleg and swelling, *Calpurnia aurea/* both Fabaceae against scabies and Lumpy skin, *Aloe pubescens*/Aloaceae and *Crateva adansonii/* Capparidaceae againat anthrax by the peoples of Ejaji area (Chelya Woreda) West Shoa, Ethiopia. Furthermore, *Snowdenia polystachya* /Poaceae was used to treat pasteurellosis by the people of Sheko ethnic group of Southwest Ethiopia (Mirutse Giday *et al*., 2010). The report of Teshale Sori (2004) also showed 77 different plants were used to treat or prevent a wide range of livestock disease including *Alium sativum*/ Alliaceae as is as expectorant, *Solanum incanum /* Solanaceae to treat cowdriasis and dermatophilosis by the local people of Borana Pastoralists, Southern Ethiopia.

2.4.2. Sources of medicinal plants

Plants have significant medicinal value in Ethiopia, which are obtained from different sources such as wild areas, homegardens and cultivated crop fields with varying extent. In Ethiopia, most of the medicinal plants are collected from the wild and some are cultivated and grown in homegardens either purposely for medicinal use or non medicinal purpose (Zemede Asfaw and Ayele Nigatu, 1995; Etana Tolassa, 2007; Fisseha Mesfin *et al*., 2009; Tesfaye Awas and Sebsebe Demissew, 2009). This indicates a few medicinal plant species that are used by the herbalists are collected from homegardens whilst the larger number is obtained from the natural vegetation. The natural ecosystems of the forests, grass lands, woodlands, wetlands and field margin, contain a significant number of MPs where traditional healers and other members of the community collect medicinal plant species and use it (Frankel *et al*., 1995; Black and Cox, 1996).

2.4.3. Transfer of ethnomedicinal knowledge

Traditional medicinal plant knowledge in Ethiopia is transmitted from generation to generation in the form of songs, proverbs, stories, folklore and other practices. IK on remedies in many countries 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). The traditional healers want their knowledge to be held secrete and the knowledge of plant remedies remained in their hands (Mirutse Giday *et al*., 2003).

When the knowledge of healing by traditional medicinal plants is passed from generation to generation, the original and valuable information is passed in an incomplete fashion or the medical healer may die even without passing his knowledge of healing (Jansen, 1981; Pankhurst, 1990; Fikadu Fullas, 2001). Hence, there is a need for systematic documentation of such useful knowledge through enthobotanical research.

2.4.4. Uses of medicinal plants other than their medicinal uses

Plant species that are used for herbal medicine are also used by the local people for various purposes other than their medicinal uses. For example, *Agave sisalana* (Agavaceae) and *Hypericum revolutum* (Hypericaceae) are used as chewing sticks due to their antibacterial activity against *Staphylococcus aureus* and *Bacillus cereus* (Ermias Dagne *et al*., 1999); *Eucalyptus globulus* (Myrtaceae) which is used against common cold, meningitis and as insect repellant is also used as fuelwood and construction material; *Tamarindus indica* (Fabaceae) which is used against diarrhea is also used for charcoal making; *Trigonella foenum-graecum* (Fabaceae) is used against leprosy, muscular distrophy and rheumatism and is also considered good food and spice; *Coccinia abyssinica* (Cucurbitaceae) is used as medicinal and dietary item; *Zingiber officinale* (Zingiberaceae) is used against stomach cramps and cultivated as a spice (Amare Getahun, 1976).

In general, different studies conducted in Ethiopia indicated that plant species used by the local people for traditional medicinal purpose are also used by them for other purposes than medicinal use. These include tooth brush sticks, fire wood and charcoal, food, construction, fodder, spices, forage, shade and many others such as ornamental and furnituremaking . For instance, plants like *Allium sativum* (Alliaceae), *Capsicum annuum* (Solanaceae), *Carissa spinarum* (Apocynaceae), *Citrus aurantifolia* (Rutaceae), *Coffea arabica* (Rubiaceae), *Cordia africana* (Boraginaceae), *Dovyalis abyssinica* (Flacourtiaceae), *Embelia schimperi* (Myrsinaceae), *Ensete ventricosum* (Musaceae), *Ficus sur* (Moraceae), *Linum usitatissimum* (linaceae), *Trigonella foenum-graecum* (Fabaceae), *Urtica simensis* (Urticaceae) and *Ximenia americana* (Olacaceae) are used for other purposes (Zemede Asfaw and Ayele Nigatu, 1995; Zemede Asfaw, 2001; Tigist Wondimu *et al*., 2007).

2.4.5. Ethnobotanical research of medicinal plants in Ethiopia

Although the contribution of medicinal plant species to modern health system and the poor society who live mainly in the rural area is very high, lack of detailed descriptions of the medicinal plants has made it difficult for the researchers to decide the identity of these plants with the only reference being the local names of the plants and there is very little attention in modern research and development and the effort made to upgrade is not satisfactory. One of the reasons is that the traditional medicinal plant species are not well described (Mesfin Tadesse and Sebsebe Demissew, 1992). 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).

On the other hand, in the recent time, there is an effort of training PhD and MSc students in Ethnobotany in Ethiopia, especially at Addis Ababa University (College of Natural and Computationa Sciences). In addition, many ethnobotanical studies have been conducted in many parts of Ethiopia. Therefore, it is possible to say that ethnobotanical studies are flourishing in the country and showing some steps forward. Some of the many ethnobotanical studies conducted in Ethiopia in the recent past in different parts of the country include those by Amare Getahun (1976); Jansen (1981); Dawit abebe (1986); Dawit Abebe and Estifanos Hagos (1991); Mesfin Tadesse and Sebsebe Demissew (1992); Dawit Abebe and Ahadu Ayehu (1993); Abbink (1995); Zemede Asfaw (2001);

Feleke Woldeyes (2000); Abebe Demisse (2001); Teferi Gedif and Hahn (2002); Tesema Tanto *et al*. (2003); Debela Hunde *et al*. (2004); Kebu Balemie *et al*. (2004); Aberra Geyid *et al*. (2005); Tigist Wondimu *et al*. (2007); Tilahun Teklehaimanot and Miruste Giday (2007); Fisseha Mesfin *et al*. (2009); Teferi Flatie *et al*. (2009); Tesfaye Hailemariam *et al*. (2009); Mirutse Giday *et al*. (2010); Anteneh Belayneh *et al*. (2012); Firaol Tamiru *et al*. (2013), Berhane Kidane *et a*l.(2014).

2.4.6. Traditional medicinal plants and use in Tigray National Regional State

As the majority of Ethiopians depend on medicinal plants as their source of healthcare, especially in rural areas, members of local communities of Tigray Regional State also continue to use traditional medicinal plants for their primary healthcare needs. Studies conducted by different authors in the Regional State confirmed traditional medicine obtained from plants has become an integral part of the society of the Region. For instance, the work of Gidey Yirga *et al*. (2012) in Seharti-Samre District Northern Ethiopia confirmed that 22 traditional medicinal plants are used to treat 18 different livestock ailments. Similarly, Abrha Tesfay (2008) documented 82 plant species used to treat 26 human and nine livestock ailments in Dess'a Forest and its surroundings while 114 medicinal plant species used to treat 47 human and 19 livestock diseases in Kilte Awulaelo District of Tigray Regional State were recorded by Abraha Teklay *et al*. (2013). Another study conducted by Kalayu Mesfin *et al*. (2013) in Gemad area of Tigray Regional State documented 31 medicinal plant species used to treat 32 human ailments. Gidey Yirga (2010) reported 25 medicinal plant species used as a cure for 18 ailments in Alamta District while Mirutse Giday and Gobena Ameni (2003) reported 83 medicinal plant species used for the treatment of 37 livestock ailments in Ofla and Raya-

Azebo districts. Similar study conducted by Nurya Abdurhman (2010) also showed that the use of 113 MPs to treat 69 ailments in Ofla District of Tigray Regional State. Furthermore, 68 medicinal plant species used to treat 50 different ailments were recorded in Asgede Tsimbila District of Tigray Regional State, by Girmay Zenebe *et al*. (2012).

2.5. Ethnoveterinary Medicine

The term “Veterinary anthropology” was coined in the 1980s to animal healthcare (Rollefson and Juliane, 1998). McCorkle (1986) defined ethnoveterinary medicine as people’s beliefs, knowledge, skills and practices relating to care of their animals. Mathius-Mundy and McCorkle (1989) also defined ethnoveterinary medicine as the medicines that livestock keepers used to cure their livestock using other than the modern synthetic drugs. According to McCorkle (1995), ethnoveterinary research is defined as “the holistic, interdisciplinary study of local knowledge and its associated skills, practices, beliefs, practitioners, and social structures pertaining to the healthcare and healthful husbandry of food, work and other income-producing animals, always with an eye to practical development applications with livestock production and livelihood systems, and with the ultimate goal of increasing human well-being via increased benefits from stock raising”. Livestock raisers, both farmers and herders have developed their own ways of keeping their animal health and productivity. Ethnoveterinary medicine involves the use of medicinal plants, surgical techniques and livestock management practices to prevent a range of animal diseases (McCorkle and Mathias, 1996).

Ethnoveterinary medicinal practice and skills are built up by empirical observation over time, mainly through trial and error and sometimes through deliberate or even desperate experimentation and innovation (McCorkle and Mathias, 1996; Lans *et al*., 2007).

Traditional veterinary practice is based on indigenous knowledge passed on from generation to generation. Many livestock holders in rural areas where there are relatively few veterinarians and shortages of other facilities, traditional medicinal plants are the only choice to treat many ailments (McCorkle, 1995). According to Tafese Mesfin and Mekonen Lemma (2001), the ever-declining provision of animal health services in Ethiopia has resulted due to a number of epizootic diseases reducing the economic efficiency of livestock production.

2.5.1. Ethnoveterinary medicine in Ethiopia

Ethnoveterinary medicine provides traditional medicines, which are locally available and usually cheaper than standard treatments. Livestock holders can prepare and use homemade remedies with minimum expense. In general, Ethiopia is one of the top ranking in African countries and among the first ten in the world in livestock resources which directly constitutes important sources of livelihood, in addition to contribution to crop production (Tafesse Mesfin and Mekonnen Lemma, 2001; Iqubal, 2013). There is insufficient number of veterinary drugs, high cost of most drugs and far and out of the reach of the Ethiopian farmers and pastoralists (Mirutse Giday and Gobena Ameni, 2003). To overcome these problems, many people use traditional herbal medicines to treat their livestock ailments; for instance, the report of Firaol Tamiru *et al*. (2013) showed that 48 medicinal plant species were used to treat 22 livestock ailments in Dabo Hana District, West Ethiopia. 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 healthcare practices because of inadequate human 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).

Hence, raising awareness on ethnoveterinary medicine by emphasizing on plants used for the treatment of livestock has vital importance to livestock management. In addition, proper documentation and understanding of farmers' knowledge, attitude and practices about the occurrence, cause, treatment, prevention and control of various ailments is important in designing and implementing successful livestock production (Tafese Mesfine and Mekonnen Lemma, 2001; Teshale Sori *et al*., 2004).

2.5.2. Study of ethnoveterinary plants in Tigray

Studies made in Tigray Regional National State showed that ethnoveterinary medicine has played a paramount role in the control and treatment of livestock ailments, as in other parts of Ethiopia. Ethnovetrinary studies conducted in this region confirmed the significance of medicinal plant species to treat livestock ailments for example, 19 livestock ailments by 37 plant species (Abraha Teklay *et al*., 2013) in Kilte Awulaelo District while 22 livestock ailments by 20 plant species in Asgede Tsimbila District (Girmay Zenebe *et al*., 2012); 9 livestock ailments by ten plants species in Dess'a Forest (Abrha Tesfay, 2008); 14 livestock ailments by 31 plant species in Ofla District (Nurya Abdurhman, 2010); and 18 livestock ailments by 22 plant species in Seharti-Samre District (Gidey Yirga *et al*. 2012) were recorded in the Regional State.

2.6. Vegetation of Ethiopia

The Ethiopian region is characterized by a wide range of ecological, edaphic, and climatic conditions that account for the wide diversity of its biological resources, both in terms of floral and faunal wealth. According to IBCR (1999), the vegetation of Ethiopia includes Afro-alpine and Sub-afroalpine vegetation; Dry evergreen Montane vegetation; Moist Evergreen Montane forest; Wetland; Evergreen scrub; *Combertum-Terminalia* woodland; *Acacia-Commiphora* woodland; Lowland Semi evergreen forest and Lowland Semi-desert and desert areas. The main vegetation type of the study area is dry evergreen montane forest and grassland complex with shrubs and small to large-sized trees while the low land of Erob District is categorized under desert and semi-desert scrubland.

Furthermore, the work of Fris *et al*. (2010) showed the vegetation type of Ethiopia is recognized and categorized in to 12. These are Desert and semi-desert scrubland; *Acacia-Commiphora* woodland and bushland; Wooded grassland of the western Gambella region; *Combertum -Terminalia* woodland and wooded grassland; Dry ever green Afromontane forest and grassland complex; Moist ever green Afromontane forest; Transitional rain forest; Ericaceous belt; Afroalpine belt; Riverine vegetation; Fresh water lakes, lakeshores, marshes, swamps and flood plains vegetation and Salt water lakes, lake shores, salt marshes and pan vegetation types.

2.6.1. Threats to Medicinal Plants

Studies indicate that both anthropogenic such as deforestation, firewood, farming, fodder and forage, construction and natural causes such as irregularities of rain are the main threats to medicinal plants. As the Earth's population continues to grow, more resources are demanded. Thus, it is understandable that an increase in population is demanding more resources. The intensive harvesting of wild medicinal plants due to the increasing use has in many places resulted in overexploitation, and forms a serious threat. Several plant species have been exploited to such an extent that they are seldom found in unprotected areas (Cunningham, 1991; Williams, 2004). Indiscriminate, destructive and unsustainable harvesting, trade, pollution with plastics, tins, papers and bottles affect medicinal plant species (Brown,. 1992; Dold and Cocks, 2002; David, 2008; Offiah *et a*l., 2011; Tshisikhawe *et al*., 2012; Kayombo *et al*., 2013; Nahashon, 2013).

2.6.2. Threats to medicinal plant species in Ethiopia

In Ethiopia, more than 85% of the population lives in rural areas depending on natural resources for their livelihoods, economic development, and food security causing prolonged resource depletion (USAID, 2008). Abebe Demisse (2001) and IBC (2005) also showed that the diversity of plants in Ethiopia is in the process of erosion due to anthropogenic pressure like habitat destruction and deforestation for various reasons such as timber production, agriculture, land degradation and climate change. Another study conducted by Mirutse Giday *et al.* (2010) also showed that habitat disturbance, deforestation, selective cutting and increasing trend of using herbicides caused medicinal plants to be scarce. Furthermore, Zemede Asfaw (2001) also confirmed that Ethiopian medicinal plants are considered to be at conservation risk due to over use and destructive harvesting of roots and bark in addition to the other factors.

2.6.3. Study of threats to medicinal plant species in Tigray Regional State

As in many other parts of the country, medicinal plant species in Tigray Regional State are highly exposed to various anthropogenic and natural factors though in recent years in particular there are efforts to protect and conserve them. Studies conducted by different authors in Tigray Regional State confirmed that the principal threats of medicinal plants are drought, deforestation, soil erosion, construction, overgrazing, over harvesting, firewood collection, charcoal making, agricultural expansion, fodder and forage, urbanization and beehive making (Yitebitu Moges and Tewodrose Tsegaye, 2002; Abrha Tesfay, 2008; Gidey Yirga, 2010; Nurya Abdurhman, 2010: Emiru Birhane *et al*., 2011; Gidey Yirga *et al*., 2012; Girmay Zenebe *et al*., 2012; Abraha Teklay *et al*., 2013; Kalayu Mesfin *et al*., 2013).

2.7. Conservation of Medicinal Plants and Associated Knowledge

2.7.1. Issues on MP and knowledge on them

It is understandable that an increase in population is demanding more resources, but with careful management of our natural resources, a sustainable balance can be achieved. Conservation aims at protecting species, their habitats and ecosystems from excessive rates of extinction (Sahney and Benton, 2008). According to Cunningham (1993), there are some conservation measures that have been undertaken around the world aimed at protecting plant species from further destruction. Conservation of medicinal plant resource is a critical ecological, cultural and economic issue (Van On *et al*., 2001).

According to Singhal (2005), sustainable medicinal plant management is not an option but imperative for rural health and community well-being, particularly primary healthcare. Methods such as having land for cultivating medicinal plants, sacred groves and protected areas have been used for conservation of medicinal plants (Brown, 1992; David, 2008; Hamilton, 2008; Berhanemeskel Weldegerima, 2009).

2.7.2. Conservation of medicinal plants and associated knowledge in Ethiopia

In Ethiopia, there are attempts of conservation and protection of biodiversity of areas which harbor medicinal plants species effected by the Ethiopian government and local people. Plant Genetic Resources Institute (PGRI, 1996); IBC as gene bank, field gene banks: botanical garden, protected areas (IBC, 2005); public parks such as Addis Ababa city has about 14 public parks (GFCP, 2006); WAJIB (Oromiya) (Abdurahiman Kubsa *et al.*, 2003); Adaba-Dodola (Oromia) and Lake Tana watershed in Amhara (Abdurahiman Kubsa *et al.*, 2003); field gene bank (IBC, 2011) play a significant role in protecting and conserving medicinal plants by the government. Protected areas are useful for conserving medicinal plants (Hamilton, 2008).

Various local beliefs and cultural traditions in Ethiopia play their role in conserving medicinal plants such as saving the life of the mother plant by taking the lateral root without damaging the main root, taking only small portion at a time; some traditional medicines are made only by selected families or ethnic groups in the community; some ailments such as *Tinea versicolor* once a plant or its part is used as a remedy there is restriction on a person not to eat and cut the plant any more; most plant remedies are only collected on selected days, ritual and spiritual protected areas for celebration of “Gada” and “Jaarii”, “Errecha” and “Qe’ee Ayyantuu (Endalew Amenu**,** 2007; Etana Tolasa, 2007; Fisseha Mesfin *et al*., 2009).

Establishing closed areas, customary institutions and laws such as in Borana and Guji Zones of Oromia Regional State assist in plant species conservation (Bassi and Tache, 2007; Bokutache Dida, 2011). According to IBC (2009), herbalist Abebech Shiferaw (Deshet Traditional Herbal Medicine Treatment Center located twenty kilometres to the south of Addis Ababa) is conserving some 600 species of herbs, shrubs, grasses and trees having medicinal value in 4 ha in a field gene bank. Sacred sites have often led to well-conserved areas with high biological diversity within (UNESCO, 2003). Sacred forests are the bedrock for people and communities' religious and spiritual beliefs and cultural identity (Soutter *et al*., 2003).

In general, even though efforts to conserve the natural vegetation of the country are lower than what is desirable, traditional farming systems, sacred places, places of worship like the compounds of churches and mosques, graveyards, monasteries, state forests, community forests, cultural forests, national parks and reserves, growing large trees in the vicinity of living quarters, etc. are important sites and practices for conservation. According to Zemede Asfaw (2001), homegardens are important targets for *in-situ* and *ex situ* conservation of traditional medicinal plants in Ethiopia. Studies also showed some traditional practitioners in Ethiopia have also started to conserve medicinal plants by cultivating at homegardens, though the effort was minimal (Endalew Amenu**,** 2007; Ermias Lulekal *et al*., 2008; Mengistu Gebrehiwot, 2010; Mersha Ashagre, 2011).

2.7.3. Conservation of medicinal plants and associated knowledge in Tigray

Regardless of the large scale environmental degradation and recurrent drought, medicinal plants have been playing significant role in controlling and treating of various human and livestock ailments in Tigray National Regional State of Ethiopia. The number of medicinal plants that has been used to treat human and livestock ailments in the Region is large. As studies indicated, homegardens, protected vegetation, religious areas as in the compounds of church, enclosure areas and cultivation are some attempts made to conserve them. Few medicinal plant species are cultivated and grown in homegardens in the Region (Nurya Abdurhman, 2010; Emiru Birhane *et al*., 2011; Gidey Yirga *et al*., 2012; Girmay Zenebe *et al*., 2012; Abraha Teklay *et al*., 2013; Kalayu Mesfin *et al*., 2013). Other studies conducted in the Region also showed establishing closed areas in places such as Degu'a Tembien, Alamata, Abreha Atsbeha (Sarah Tewolde-Berhan, 2003; Rinaudo, 2010) which would play a significant role in protecting medicinal plant species in the Region. Furthermore, Participatory Forest Management (PFM) such as Tekeze River Valley, Western Tigray Zone and North Western Zone (Veerakumaran, 2007) and Dess’a Forest in North-Eastern escarpment of Tigray (Abrha Tesfay, 2008) harbor and conserve medicinal plants. According to Gidey Yirga (2010), avoiding harvesting of whole plant is a means to protect scarcity and extinction of medicinal plant species made in the Region by the local people.

In general, a review of literature on medicinal plants of Tigray showed that Erob and Gulomahda districts are among the districts that have not been studied with a focus on ethnobotany of medicininal plants. However, circumstantial evidence indicates that there is a rich culture and use of plant resources for various purposes including medicine. These factors were behind the initiation of this research on the ethnobotany of medicinal plants in the two districts.

CHAPTER THREE

3. MATERIALS AND METHODS

3.1. Description of the Study Districts

3.1.1. Geographical location

Tigray National Regional State is one of the nine regional states forming the northernmost part of Ethiopia and bordered by Eritrea in the north, Sudan to the west, Amhara National Regional State to the southwest and Afar National Regional State in the east. It is located 12.5^{o}15$^{'}$ – 14^{o} 50' N and 36^{o} 27' – 39^{o} 59$^{'}$ E (Emiru Birhane *et al*, 2011**;** Gebre Hadgu *et al*., 2013).

The study districts are found in Eastern Zone of Tigray National Regional State of Ethiopia. This zone is located between 13° 41' – 13° 46' N and 39° 21' – 39° 34' E with an elavation of 248-3298 m a.s.l. (Gebremeskel Gebretsadik *et al*., 2013) and has eight districts namly Adigrat, Wiqro, Atsbi Wenberta, Ganta Afeshum, Hawzen, Saesi-Tsaedaemba, Erob and Gulomahda found in the east of the Eastern Zone of this Regional State.

Erob District is bordered on the south by Saesi-tsaedaemba District, on the west by Gulomahda District, on the north and east by Eritrea, and on the southeast by the Afar Regional State. This district is named after the Erob people, who are the predominant ethnic group living there. It is located 945 km north of Addis Ababa at 14^{o}10′-14^{o} 30′ N and 39^{o} 21' - 39^{o} 50′ E (ARDOED, 2013) and an altitudinal range of 900-3,200 meters (Asfaha Zigta and Waters-Bayer**,** 2001; ARDOED, 2013) (Figure 1).

Gulomahda District is found at 915 km north of Addis Ababa (Gebrehiwot Weldegebrial and Fekadu Beyene, 2012). It is located at 14° 30' - 14° 50' N and 39° 20' - 39° 35' E and has an altitude of 1500 - 3200 m a.s.l. (ARDOGD, 2013) and bordered on the south by Ganta-afeshum District, on the west by the Central Zone, on the north by Eritrea and on the east by Erob District (Figure 1).

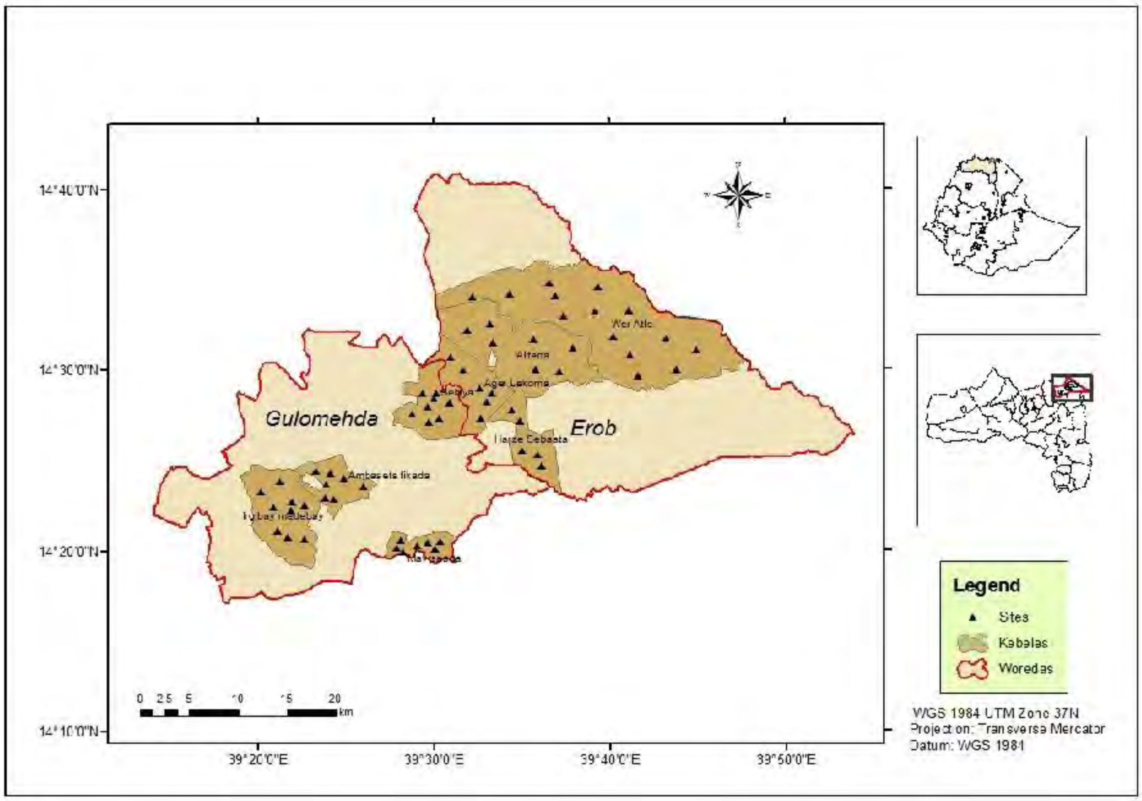


Figure 1 Map of the Study Area

3.1.2. Climate

The climate of the study districts is generally sub-tropical with an extended dry period of nine to ten months and a maximum effective rainy season of 50 to 60 days. The rainfall pattern is predominantly uni-modal (June to early September) (Belete Taffere, 2002).

There are considerable variation in altitude (900-3,200 m a.s.l.), temperature (5-30°C) and rainfall of 200-600 mm/year in Erob District (Asfaha Zigta and Waters-Bayer, 2001). The lower area of Erob is arid (Belete Taffere, 2002).

Data obtained from NMA(2012), showed the lowest mean monthly minimum temperature was 10.60^{o}C recorded in December whereas the highest was 18.49^{o}C recorded in June in Dewuhan, Erob. The lowest mean maximum temperature was 22.78^{o}C recorded in January, whereas the highest was 30.37^{0}C recorded in June. The lowest mean monthly average temperature was 16.70^{o}C recorded in December whereas the highest was 24.43^{o} C recorded in May. The analysis of meteorological data of seven years (2005-2011) of Erob District taken from Mekelle Metrology Service Agency by using R–Software indicates that this District receives high rainfall between July and August (KIREMT) and a little bit between March and April (Figure 2). The highest mean annual average rainfall was 100.1mm recorded in July, whereas the lowest mean average was 2.68 mm recorded in January. The highest total rainfall was 518.9 mm recorded in 2007, whereas the lowest total was 217.00 mm recorded in 2008. The maximum mean annual rainfall was 43.24 mm recorded in 2007 and the minimum mean annual rainfall was 18.08 mm recorded in 2008. The mean annual rainfall of the study area is 28.42 mm (Figure 2).

Data obtained from NMA (2012), showed the lowest mean monthly minimum temperature was 5.90 ^{o}C recorded in December whereas the highest was 11.70^{o}C recorded in June in Fatsi, Gulomahda. The lowest mean maximum temperature was 22.00^{o}C recorded in July and August, whereas the highest was 25.80 ^{o}C recorded in May. The lowest mean monthly average temperature was 14.35^{o}C recorded in December whereas the highest was 18.30^{o}C recorded in May. This District also receives high rainfall between July and August

(KIREMTI) and a little bit between March and April (Figure 3). The highest mean annual average rainfall was 142.09 mm recorded in July, whereas the lowest mean average was .07 mm recorded in January. The highest total rainfall was 684.3 mm recorded in 2006, whereas the lowest total was 231.7 mm recorded in 2004. The maximum mean annual rainfall of the area was 57.03 mm recorded in 2006 and the minimum mean annual rainfall was 34.47 mm recorded in 2009. The mean annual rainfall of the study area is 42.78 mm. The main rainfall season called *KIREMTI,* is usually during July and August (TFPDP, 2000). Gulomahda District receives an average annual rainfall ranging from 400 to 500 mm (Gebrehiwot Weldegebrial and Fekadu Beyene, 2012), categorized as semi-arid area (Belete Taffere, 2002).

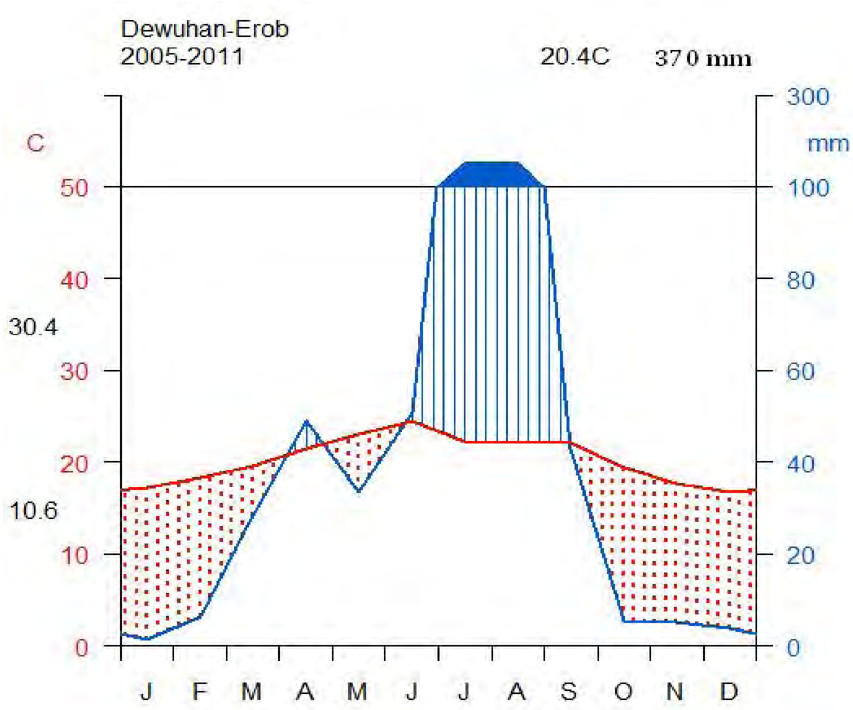


Figure 2 Climadiagram of Dewuhan/Erob District

(Data Source: National Meteorological Service Agency, Mekelle (2011/12)

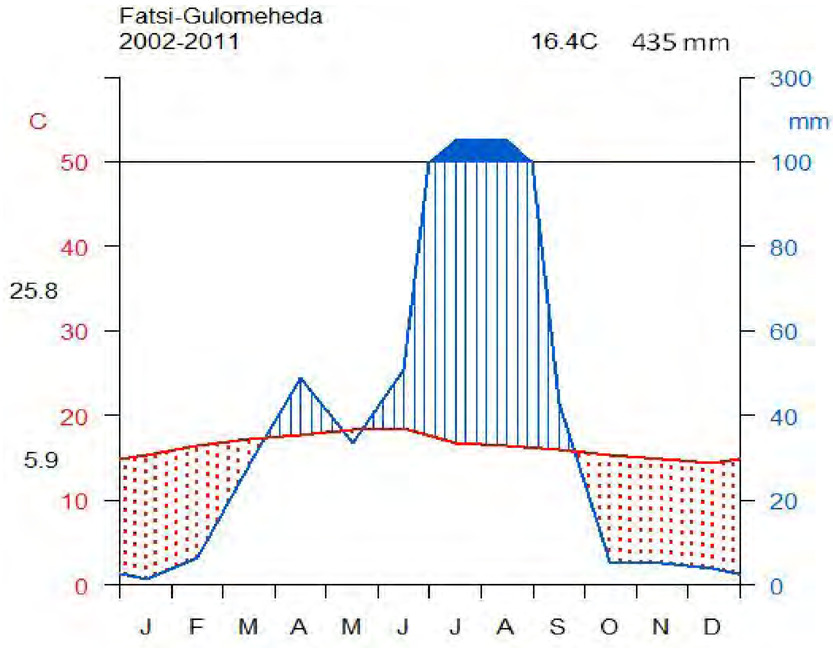


Figure 3 Climadigram of Fatsi/Gulomahda District

(Data Source: National Meteorological Service Agency, Mekelle (2011/12)

3.1.3. Topography and soil type

The topography of Erob District is characterized by extremely rugged steep-slope terrain and deep narrow valleys with little or no potential for crop production (Asfaha Zigta and Waters-Bayer, 2001). According to ARDOED (2013), the topography of the District is classified into three based on altitude as mountains, moderate slope and flat land with the highest mountain topography accounting for 82,016.80 ha (85%). Moreover, the soil types are also classified into three with the highest number of silt accounting for 77,189.6 ha (80%) followed by sand 17, 367.70 ha (18.00%) and others 1,929.60 ha (2.00%).

According to ARDOGD (2013), the topographic category of Gulomahda district is classified into three based on altitude as mountains, moderate slope and flat land with the dominance of mountain topography though, it is not quantified. Moreover, the soil was classified into three types with the highest percentage of loam soil accounting for 35,638.26 ha (60%) followed by sand 14,849.27 ha (25%) and clay 8,909.56 ha (15%).

3.1.4. Vegetation

The main vegetation type of the study area is dry evergreen Afromontane forest and grassland complex with shrubs and small to large-sized trees while the low land of Erob District is categorized under desert and semi-desert scrubland (IBCR, 1999; Fris *et al*., 2010).

Data obtained from agricultural and rural development offices of the study districts and field observation confirmed that the area is covered with scattered vegetation dominated by *Acacia etabica, Aloe* spp.*, Becium grandiflorum*, *Dodonaea angustifolia*, *Opuntia ficus-indica*, *Euphorbia abyssinica and Solanum schimperianum* in the Erob District (Figure 4A). Moreover, the vegetation of Gulomahda District is dominated by *Acacia etabica*, *Aloe elegans, Becium grandiflorum*, *Euclea racemosa*, *Dodonaea angustifolia*, *Opuntia ficus-indica* and *Rumex nervosus* (Figure 4B).

Figure 4 Parts of plant communities found in the study districts

3.1.5. Demographics

Based on the CSA (2007), Erob District has an estimated total population of 25, 862, of whom 12, 576 are males and 13,286 are females. In addition, data obtained from FSSE (2010) confirmed that there were 7,071 households, comprising 4,233 males and 2,838 females heads in the District. It is also indicated that 3.62% of its population are urban dwellers, which is much less than the Zone average of 19.6%. It has an area of 933.45 km^2. Erob District has an estimated population density of 27.71 people per km^2, which is much less than the Zone average of 141.59.

The two largest ethnic groups in Erob District are the Erob (Saho ethnic group) contributing 91.83% while Tigray (Tigray ethnic group) was 6.94%. All other ethnic groups contribute 1.23% of the population. Saho is spoken as a first language followed by Tigringa and few other languages. Based on CSA (2007) national census conducted in Erob District, 55.99% were followers of Ethiopian Orthodox Christianity while 40.64% were Catholics and 3.31% were followers of other religious.

According to CSA (2007), the total population of Gulmeheda District was 84,762, of whom 40,787 were males and 43,975 were females. In addition, data obtained from FSSG (2010) confirmed that there are 16,319 households, of whom 10,344 have males and 5,975 female as heads. The report also indicated that 11,197 (10.45%) of its population are urban dwellers, which is less than the Zone average of 19.6% with an estimated area of 633.74 square kilometers. The report also showed that Gulomahda District has an estimated population density of 133.75 people per square kilometer.

According to CSA (2007), the majority of the inhabitants of Gulomahda District follow Ethiopian Orthodox Christianity (99.22%), few were followers of of other religious 0.78%. The three largest ethnic groups reported in Gulomahda were the Tigrayan (96.29%), the Saho (1.99%), and foreign nationals from Eritrea (1.59%); all other ethnic groups made up 0.13% of the population. Tigringa is spoken as a first language by 98.33% while 1.55% speaks Saho; the remaining 0.14% spoke all the other languages reported.

3.1.6. Land use

According to Agricultural and Rural Development Office of Erob District (2013), the total area of Erob District is 933.45 sq.km. The District office confirmed the highest part of the District is grazing land accounting for 19,297.40 ha (20.00%) followed by bush-and shrub-land accounted for 19,297.30 ha (20.00%), closure area accounted for 16,258.05 ha (16.85%), grass land 3,859.48 ha (4.00%) and others 37774.67 ha (39.15%) such as non-usable land, farm land, land for house, cultivated (gardening) . A closed area (enclosure) is a method by which an area is protected from human and livestock interference (Sarah Tewolde-Berhan *et al*., 2003).

The total area of Gulomahda District is 633.74 sq.km (ARDOGD, 2013). The types of land use changed from time to time, depending on the economic change. For instance, residential land use is increasing from time to time taking land from farming. The data also indicated that the highest area coverage is non-farming land that accounted for 47,774.09 ha (80.43%) followed by farming land 11623 ha (19.57%). From the non-farming land, protected land accounted for 14, 617.70 ha (24.61%), land for house construction 6873 ha (11.57%), non-usable land 6109.10 ha (10.29%), grassing land 963 ha (1.62%), preserved for grassing 520 ha (0.88%), natural forest 200 ha (0.34%) and others 18491.29 ha (31.13%).

3.1.7. Agriculture

According to CSA (2001), of the 5,864 ha of private land surveyed, 82.25% was under cultivation, 5.32% pasture, 6.31% fallow, 0.24% woodland, and 14.23% was devoted to other uses. For the land under cultivation in this District, 65.36% was planted with cereals, 3.22% with pulses, and 0.85% with oil seeds. Fruit trees were planted on 724 ha, and 5 ha of land are for *Rhamnus prinoides* (Rhamnaceae). About 74.26% of the farmers grew crops and raised livestock, while 23.82% only grew crops and 1.91% only raised livestock. Land tenure in this District is distributed amongst 97.49% of the residents owning land, 1.4% renting, and 1.11% under other forms of tenure (CSA, 2001).

According to Agricultural and Rural Development Office of Erob District (2013), *Hordeum vulgare*, *Zea mays* and *Triticum aestivum* (all Poaceae) are highly cultivated crop plants in the District for consumption and marketing. The indigenous soil and water harvesting techniques of farmers in the Erob area have helped them produce cereal crops such as *Hordeum vulgare*, *Eragrostis tef* and the fruit *Opuntia ficus-indica* (Cactaceae), which are the most important sources of nutrition (Asfaha Zigta and Waters-Bayer, 2001). Field observation, interviewed informants and the Rural Development Office of the District confirmed that *Opuntia ficus-indica* makes an important contribution to the households' food intake especially from June to September. *Opuntia ficus-indica* is a very important plant species in Erob District (Addisu Gebre-Medhin, 2008). Ingeneral, cattle and goat production with limited cultivation of crops constitutes the farming system of the District.

CSA (2001) interviewed 4,045 farmers in Gulomahda District that hold an average of 0.19 ha of land. Of the 787 ha of private land surveyed, 80.56% was in cultivation, 3.94% pasture, 0.89% fallow, 0.51% woodland, and 14.23% was devoted to other uses. From the land area under cultivation in this District, 53.88% was planted with cereals, 2.03% pulses, and 0.25% oilseeds. Fruit trees were planted on 191 ha. About 76.54% of the farmers grew crops and raised livestock and 12.44% only grew crops while 11.03% only raised livestock. Land tenure in this District is distributed amongst 95.3% residents who own the land, 1.65% renting, and 3.18% under other forms of tenure. Data obtained from Agricultural and Rural Development Office of Gulomahda District (2013) indicated that *Hordeum vulgare*, *Triticum aestivum*, *Zea mays*, *Sorghum bicolor*, *Eragrostis tef*, *Vicia faba* and *Pisum sativum* are crops which are cultivated in the District for consumption and marketing. Farmlands are characterized by high fragmentation, which results in continuing decline of agricultural productivity (Gebrehiwot Weldegebrial and Fekadu Beyene, 2012).

3.1.8. Human health

There are four governmental health centers and six government health posts (HOED, 2013) in Erob District. In the study site, there are four health officers and two nurses, 43 clinical nurses, five laboratory technicians, two environmental health workers, five mid-wives, five pharmacists and 43 extension and related workers.

The health problems in Erob District are directly or indirectly related to the problems of sanitation, inadequate diet, lack of potable water and poor physical condition of the houses. Data obtained from Health Office of Erob District (2013) show the three common health problems in the District based on the number of local people who have visited health services are lung disease, stomach pain and eye disease in 2008/09; lung disease, amoeba and eye disease in 2009/10; Acute upper respiratory infections, malaria and eye disease in 2010/1l; upper respiration infection, moderate malnutrition and trauma in 2011/12 (Table 1).

There are six governmental health centers and 15 health posts (HOGD, 2013) in Gulomahda District. In the study sites, there are six health officers, 31 clinical nurses, eight laboratory technicians, two environmental health workers, 11 pharmacists and 52 extension and related workers.

The health problems in Gulomahda District are also directly or indirectly related to the problems of sanitation, lack of potable water and poor physical condition of the house. Data obtained from Health Office of Gulomahda District (2013) indicated the frequent occurrence and prominent health problems in the district in the past four years. Accordingly, the three common health problem in the District, based on the number of local people who have visited health services for treatment, are lung disease, eye diseases and diarrhea in 2007/08; eye diseases, lung diseases and malaria in 2008/09; eye diseases, malaria and lung diseases in 2009/10; malaria, skin diseases and acute upper respiratory in 2010/11 (Table 2).

Table 1 Ten top human ailments in 2009-2012 and number of patients treated in Erob District

(Source: Erob Health Office, 2013).

2008/09		**2009/10**		**2010/11**		**2011/12**	
Diseases	**Total**	**Disease**	**Total**	**Diseases**	**Total**	**Disease**	**Total**
TB	2182	TB	3927	Acute Upper Respiratory Infections	3069	Upper respiration infection	4674
Stomach pain	1321	Amoeba	1907	Malaria	1229	Moderate malnutrition	1847
Eye disease	1187	Eye disease	1490	Eye disease	920	Trauma	1502
Gastritis	1012	Diarrhea	1308	Diarrhea	828	Urinary tract infection	1017
Diarrhea	890	Gastritis	908	Helminnthias	743	Eye disease	1000
Wound	682	Tonsillitis	818	Dispepsia	678	Pneumonia	969
Tonsillitis	647	Cough	758	Tonsillitis	528	Diarrhea	890
Cough	351	Arthritis	746	Arthritis	502	Intestinal parasite	755
Dental diseases	468	Wound	543	Par/diseases	474	Dyspepsia	671
Arthritis	454	Skin diseases	524	Skin disease	464	Helminthiasis	658

Table 2 Ten top human ailments in 2007-2011 and number of patients treated in Gulomahda District

(Source: Gulomahda Health Office, 2013).

2007/8		**2008/09**		**2009/10**		**2010/11**	
Diseases	**Total**	**Diseases**	**Total**	**Diseases**	**Total**	**Diseases**	**Total**
Lung diseases	3399	Eye diseases	2466	Eye diseases	3486	Malaria	2961
Eye diseases	2486	Lung diseases	2455	Malaria	2942	Skin diseases	2202
Diarrhea	1887	Malaria	1663	Lung diseases	2379	Acute upper respiratory	2164
Malaria	1610	Diarrhea	1516	Diarrhea	2270	Eye diseases	1759
Other wounds	1561	Other wounds	1048	Cough	1338	Diarrhea	1639
Int. parasite	1144	Cough	951	Skin diseases	1194	Pneumonia	1524
Skin wound	1013	Int. parasite	932	Gastritis	1055	other parasitic inf.	867
Cough	1026	Wounded	895	Int. parasite	1040	Dyspepsia	479
Abdominal diseases	958	Gastritis	789	Teeth & gum diseases	482	Acute febrile illness	423
Gastritis	788	Other int. diseases	657	Tonsillitis	446	Teeth & gum infection	312

3.1.9. Livestock health

According to ARDOED (2013), there are one governmental veterinary health clinic and three government veterinary health posts in Erob District. In this District, there are also three qualified veterinary health workers. Data obtained from ARDOED (2013) showed that the District consists of a total of 128,619 livestock population of which 47,568 were goats followed by 45,100 poultry, 19,690 cattle, 8,555 sheep, 7,659 donkeys and 47 others such as mule and horse. Goat and cattle production with limited cultivation of crops constitutes the farming system of the area. There are problems such as irregular climatic condition, inadequate health services and facilities and occurrence of different diseases. Due to poor access to modern medicine services and low-income level of most households, the local people use local traditional herbal medicine and traditional ethnoveterinary services to treat their livestock ailments. The livestock diseases reported in the study area include both external and internal parasites. Some of the major livestock external diseases in the study area are mange mite, a skin disease caused by several species of tiny mites, tick and others including lice and pasteurellosis.

In Gulomahda District, there are three governmental veterinary health clinics and six government veterinary health posts (ARDOGD, 2013). In the study District, there are also eight qualified veterinary health workers (seven diplomas and one certificate). ARDOGD (2013) also indicated that the District consists of 73,431 poultry which is the highest followed by 43,462 sheep, 42,001 cattle, 36,873 goats, 6,356 donkeys, 84 horses, 42 mules and nine camels. The livestock diseases reported in the study area include pasteurellosis, diarrhea; anthrax, Newcastle disease virus or Avian Paramyxovirus-1 Infection (hen), internal parasites (fashola), rabies, foot and mouth diseases and external parasites infection such as ticks and louse. Due to poor access to modern medicine services and low-income level of most households and the general trust they have on traditional medicine, the local people use traditional ethnoveterinary services in the cases of livestock ailments.

3.2. Materials and Methods

3.2.1. Reconnaissance survey

A reconnaissance survey of the study area was conducted from July 12-17, 2010 and specific study sites were selected. Fieldwork materials and related equipment such as GPS, digital camera, plant press and supportive letters were made ready for the fieldwork.

3.2.2. Sample size determination and selection of informants

Sample size determination

Informants for data collection for this study included male and female under different age groups from households in purposefully and randomly selected eight kebeles (four from each district) based on the altitudinal difference of the sites, the security suitability for photographing and GPS works. The sample size for collecting quantitative data for this research, to ensure the required representative sample size of households from the eight kebeles, was determined using Cochran's (1977) formula as indicated by Bartlett and Higgins (2001) as follows:

$$n = \frac{N}{1+N(e)^2}$$

n = sample size for the research; N= total number of households in all eight kebeles

e= maximum variability or margin of error 5% (.05); 1= the probability of the event occurring.

According to Erob and Gulomahda districts' administrations, the total number of households in four kebeles of Erob District was 3,885 and the total number of households in four kebeles of Gulomahda District was 4,250 (Table 3). Therefore, sample size was determined on the total number of 8,135 households.

$$n = \frac{N}{1+N(e)^2} = \frac{8135}{21.3375} = 382$$

The required sample size was 382 (respondents). Sample size for each kebele was calculated using proportion of the number of households in each kebele to the total number of households of the two kebeles. Therefore, the sample size of Ambesete-fekade (Gulomahda District) with a total household of 819 was 38 (819 x 381/8135 = 38). Same calculation was used for the other study kebeles and three to five key informants were taken purposefully from each kebele (a total of 34) based on their knowledge, recommended by the local people and the remaining 348 general informants (respondents) were taken by random sampling method (coin tossing method) (Table 3).

Table 3 Number of households included in the study

District	**Kebele**	**Total households**	**Key informants**			**General informants**			**Included households**		
			M	**F**	**Total**	**M**	**F**	**Total**	**M**	**F**	**Total**
Erob	Hagere-lekuma	824	2	2	4	17	18	35	19	20	39
	Alitenia	1607	3	2	5	50	20	70	53	22	75
	Hareze-sebhata	526	2	1	3	14	8	22	16	9	25
	Weratele	928	4	-	4	27	13	40	31	13	44
	Subtotal	3885	11	5	16	108	59	167	119	64	183
Gulomahda	Anbesete-fikada	819	3	1	4	20	14	34	23	15	38
	May-tsaeda	736	5	-	5	25	5	30	30	5	35
	Rigbay-medabay	1052	4	-	4	38	7	45	42	7	49
	Sebeya	1643	4	1	5	35	37	72	39	38	77
	Subtotal	4250	16	2	18	118	63	181	134	65	199
Total		8135	27	7	34	226	122	348	253	129	382

Selection of informants

As shown in Table 3, general informants were selected randomly from the households whereas key informants were selected purposively. Martin (1995) indicated that when recording indigenous knowledge held by knowledgeable traditional healers or by certain social groups, the choice of key informants is crucial. The purposive sampling technique is a type of non-probability sampling that is most effective when one needs to study a certain cultural domain with knowledgeable experts within. The selected informants in the sample sites were interviewed using semi-structured interview on the identification, management and use of the TM plants and the informants participated in showing where the TMPs that they use to cure both human and livestock ailments were found. The key informants included herbalists, elders and knowledgeable persons. In addition, age categorization was done according to the work of Chandra *et al*. (2010) by dividing them into age groups. Samples should be representatives from different social groups when people are interviewed to some particular knowledge (Höft *et al*., 1999).

3.2.3. Interviewing protocol and ethical considerations

Formal written permission to undertake the study in the two districts was obtained from the relevant district administrations. In order to develop a positive mind-set between informants and the researcher as well as to create a positive interaction, the objective of the study was explained in a simple way. This was done by relating the study to their living environment referring to what it had been in the past and connecting it with the present. After everything was made clear and the informants were told about the purpose and benefit of the study and after they understood t the value of the research, the interview was administered. The local people verbally declared that they support the study having understood that the present and future generations will benefit from it. Each selected informant also gave personal consent voluntarily to be interviewed by the researcher. Accordingly, ethnobotanical data were collected based on a comprehensive participation, friendly interactions and the willingness of informants.

3.2.4. Data collection trips

Data collection trips were made from August 10 to September 8, 2010; November 2 to December 30, 2011, March 5 to April 2, 2011 and September 23 to October 17, 2012. Medicinal plants reported as remedies by the informants were collected from their sources including the wild, cultivated field and homegardens (Figure 5). Identification of common and well known species was made in the field and the rest were identified at the National Herbarium (ETH) of the AAU using taxonomic keys in the Flora of Ethiopia and Eritrea, by comparison with already identified herbarium specimens and with assistance of taxonomic experts in few difficult cases. The necessary data about the plants such as habit, habitat, altitude, latitude, longitude and many others including preparation were recorded based on the semi-structured interview format (Appendices 1, 2, 3 and 4). Each medicinal plant specimen was given a collection number and local name, tagged, pressed, dried and brought to the National Herbarium (ETH), for confirmation of the already determined plant specimens and to identify the unidentified ones. The specimens were kept in deep freezers for 72 hours and made ready for mounting and storage.

3.3. Methods of Ethnobotanical Data Collection

3.3.1. Semi-structured interview

Semi-structure interview guide was prepared following Martin (1995) and Cotton (1996) (Appendix 1) and interviews were administrated. Semi-structured interviews were conducted to all the 382 informants in places where the informants were most comfortable and during the time they wanted or chose. Most of the interviews and discussions were held in Tigrigna in both districts and few held in Saho in Erob District and information was gathered technically by the researcher from the villagers and accessible informants on an informal basis to maximize the outcome.

3.3.2. Group discussion

Group discussion was conducted six times (three in each study districts) with 7-12 community members which are not included in the 382 informants during the study about the status of the vegetation associated with their ethnomedicinal knowledge, status of, threats and conservation attempt, effect of modernization and others including marketibilatiy of MPs. A number of people interacted face- to -face and actively discussed the matter in order to share information about a topic. During the discussion, the informants were free to state about the traditional medicinal plants and their knowledge about them without interference.

3.3.3. Field observation

Field observation was conducted in the study sites, capturing important points such as the plant community and the status of the medicinal plants in each visually identified plant ethno-community type and cultivation practices of medicinal plants by the local people were also recorded.

3.3.4. Guided field walk

Guided field walk is a combination of observation and interview methods. In this method, the researcher was guided by some interviewee through areas where the plants of interest were expected to be found. Specimen collection and recording was done at spot while the interview was undergoing. It gave time to observe and discuss signs of harvesting or patterns of plant distribution and disturbance.

3.3.5. Market survey

Market survey was done in sample markets within the study districts to observe and collect data on the marketability and trade of medicinal plants (Figure 5). Therefore, a market survey was conducted to gather the ethnobotanical information, to distinguish and record the type of herbal drugs sold in the market, and the multipurpose role of some medicinal plants. Broad scale observations and interviewing was also conducted with men and women selling, buying, retailing MPs and doing many other things in the market.

Figure 5 Part of market survey and interview in the study area

(A) Dewuhan/ Erob; (B) Sebeya /Gulomahda (Photo: Tadesse Beyene, Nov., 2011).

3.4. Quantifying Ethnobotanical Data

3.4.1. Ranking and comparison

Preference ranking

Preference ranking is the ranking or ordering of a set of objects such as medicinal plants to determine their order of cultural importance across a community. The most important in the set is given the highest number, decreasing in number as the members of the set decrease in importance. A preference ranking of *Aloe elegans* for use in treating eight different ailments in Erob District and a preference ranking of *Schinus molle* for treating seven different ailments in Gulomahda District were computed by taking ten key informants each from Erob and Gulomahda districts to find out the degree of effectiveness on those medicinal plants.

A preference ranking of four and six medicinal plant species were also computed by taking eight key informants to find out the degree of effectiveness of these medicinal plant species treating the highly cited livestock ailment (itchy state) in Erob and Gulomahda districts, respectively.

In addition, ranking of nine highly cited threats of medicinal plant species was also undertaken by 10 randomly selected key informants to find out the most serious threats of medicinal plants. Preference or priority ranking was done by asking people to give score to a set of short-listed items and make a list of the most valuable or most threatening items and present in rank order following Martin (1995).

Paired comparison

Paired comparisons on some most effective plants in treating a particular disease was conducted using random number table and flipping coins. A paired comparison of five highly cited medicinal plants used to treat a highly cited human ailment (febrile infection) was done using eight informants. Finally, scores of each species were summed up and ranked based on the preference of the eight key informants against febrile. In pair wise ranking, relatively few items are included; because the time needed to carry out the task increases exponentially as additional items included and the total number of pairs required increases as shown by the value of n (n-1)/2 where 'n' stands for number of items to be compared (Martin, 1995).

Furthermore, paired comparisons of four highly cited medicinal plant species from Erob District and another four highly cited medicinal plant species from Gulomahda District used for treating the second highly cited ailment of livestock (leech) were also conducted using random number table and flipping coins. Finally, scores of each species were summed up and ranked based on the preference of eight key informants for the medicinal plant species used against leech.

Triadic comparisons

A triadic comparison of six highly cited medicinal plant species used against abdominal pain of human was done in Erob and Gulomahda districts. Each pair of medicinal plants appear a total of four times (n-2=6-2=4) in the full sets of the 20 triads. An overall ranking was made by adding together all the preferable value given by informants to each species in each triad.

Triadic comparison is another way to obtain overall similarity judgments to present items, three at a time, and ask informants to pick the one that is most important or different from the other two or which two go together. The total number of possible triads in such comparison is given by n! /3! (n - 3)! Where n is the number of the items being compared (Martin, 1995). The overall ranking was made by adding together the ranks given in each triad.

Direct matrix ranking

Based on information gathered from informants, ten multipurpose plant species and ten use diversities of these plants were listed for ten selected key informants from Erob and Gulomahda districts each to assess their relative importance in their respective localities. Each key informant was asked to assign use values 10 (best) to 1 (least used). Consequently, each key informant assigned use values for the ten multipurpose medicinal plant species and the scores of each species were summed up and ranked.

Direct matrix ranking is a more complex version of preference ranking. Instead of arranging a series of objects on one characteristic such as ‘value’ or ‘desirability’, informants order them by considering several attributes one at a time. In other words, preference ranking is based on a single dimension whereas direct matrix ranking draws explicitly upon multiple dimensions. Direct matrix ranking can be done as a group exercise in which participants reach consensus on the ranking of each item or vote according to their individual assessments (Martin, 1995).

Informant consensus

Informants consensus of medicinal plant species including those plant species used to treat human and livestock ailments as well as highly cited human and livestock ailments was done in Erob and Gulomahda districts. Informant consensus means agreement among informants. In ethnobotany, informant consensus values give good indication about particular species that serve for particular health problems and about specific medicinal plants used for several health problems. Medicinal plants with higher informant consensus need to be seriously considered for further ethnopharmacological studies, since they are species widely applied by many people and they have been utilized for a long time (Macia *et al*., 2005).

Informant consensus factor (ICF)

ICF was calculated to identify the agreements of the informants on the reported cures for the group of ailments. Medicinal plants that are supposed to be effective in treating certain diseases are grouped according to WHO (1998) and Gazzaneo *et al*. (2005). The medicinal plants that are effective in treating groups of ailments have a higher informant consensus factor value.

ICF was calculated by taking the number of use citations in each category (nur) minus the number of species used (nt), divided by the number of use citations in each category minus one (Heinrich *et al*., 1998). The reported ailments were categorized and then the ICF values were calculated.

$$ICF = \frac{n_{ur} - n_t}{n_{ur} - 1}$$

Fidelity level (FL)

Fidelity level (FL) values were calculated for each medicinal plant species obtained from the study area on the fact that the medicinal plants that had the highest FL values could be an indication of their good healing potential and commonly used ones. The FL quantifies the importance of a species for a given purpose. Most commonly used medicinal plants have high fidelity level value. Friedman *et al*. (1986) used a technique designed to highlight species that have healing potential for specific major purposes and merit further biomedical research. FL was calculated as the ratio between the number of informants who suggested the use of a species for the same major purpose (I_p) and the total number of informants who mentioned the plant for any use (I_U). The FL was used in the study to quantify the importance of a species for a given purpose. The value of FL that is close to 100% showed the species are used by large number of people while a value close to 1% showed that the respondents disagree on that species to be used in the treatment of ailments (Jaroli *et al*., 2010).

$$FL = \frac{I_p}{I_u}$$

$$FL\ \% = \left(\frac{I_p}{I_u}\right) \times 100$$

3.4.2. Use value (UV) and relative importance (RI)

The local importance of each species cited in the study area was calculated using two different techniques namely Use-value and Relative importance.

Use-value (UV). UV is a quantitative method that demonstrates the relative importance of species known locally, which reflects the importance of each species to informants.

UV = ΣUi/n (Rossato *et al*. 1999; Silva and Albuquerque 2004 cited in Albuquerque *et al*., 2006) where Ui = the number of uses mentioned by each informant for a given species and n = the total number of informants that mentioned any use for that species.

Relative importance (RI). RI is calculated using the formula RI = NUC + NT (Bennett & Prance 2000 cited in Albuquerque *et al*., 2006) where NUC = number of use-categories of a given species (NUCS) divided by the total number of use-categories of the most versatile species (NUCVS) and NT is given by the number of types of uses attributed to a given species (NTS) divided by the total number of types of uses attributed to the most important taxon (NTMIT), independent of the number of informants that cite the species. The highest possible RI value for a given species is two.

Benefit Sharing

The principle of prior and responsibilities recognizes that indigenous people and local communities have prior, proprietary rights and cultural responsibilities for all natural resources within them that these peoples have traditionally inhabited or used, together with all knowledge, intellectual property and traditional resources rights associated with such resources and their use. Furthermore, the Convention on Biological Diversity guarantee the conservation, sustainable use and equitable sharing of the benefits of genetic resources of biological diversity to the local people (McAfee, 1999). Therefore, the local people should be benefited from their resource according to the principles and Convention on Biological Diversity.

3.5. Jaccard`s Coefficient of Similarity (JCS) Between the two Districts

JCS is used for comparing the similarity of sample sets measuring similarity between sample sets and uses for presence-absence data. JCS was calculated in order to see medicinal plant similarity between Erob and Gulomahda districts. JCS was calculated as follows using the formula given by Kent and Coker (1992) and Höft, *et al*. (1999).

$$JCS = \frac{c}{(a+b+c)}$$

Accordingly:

a = Number of species found only in Erob District

b = Number of species found only in Gulomahda District

c = Number of common species found in Erob and Gulomahda districts

Finally, JCS was multiplied by 100 in order to obtain the percentage similarity in species composition between the study districts as applied by Kent and Coker (1992). Values close to one showed that most of the species are commonly, while values close to 0 indicated dissimilar plant assemblages.

3.6. Other Techniques and Statistical Applications

The selection of a particular technique for application to the data analysis was based on the effectiveness of the technique for sound interpretation of the results and identification of the inter-relationships that may exist among the variables studied. T-test was performed by using the software SPSS version 20.0 to check whether there were significant differences at 95% confidence level on the mean number of plant species belong to the plant families; mean number of ailments treated by MPs and mean number of MPs used to treat each ailments. Pearson's correlation for the reported MPs with the number of ailments being treated by them and Chi-square (χ^2) analysis to check the dependency between males and females on conservation of medicinal plants at 95% confidence level were performed in the study districts. Furthermore, Pearson's correlation coefficient (r) was used to compare the relation of medicinal plant knowledge among different social groups (age and knowledge; knowledge among different educational levels). T-test was also carried out to check whether there were significant differences at 95% confidence level among the average numbers of medicinal plant species reported between male and female; married and single; Saho and Tigrigna speakers and orthodox and catholic followers. One- way analysis of variance (ANOVA) test was performed by using the software SPSS version 20.0 to check whether there were significant differences at 95% confidence level among the reported mean knowledge of MP by the local people of eight kebeles of the study districts.

3.7. Classification of Plant Communities in the Study Area

The vegetation of the area was classified based on the dominant plant species as seen visually following the recommended method of plant ethno-community classification for ethnobotanical studies (Martin 1995) and observation during fieldwork and discussion with the informants. This helped to identify where more medicinal plants were found distributed within the study area. The identified plant ethno-communities are named as community dominated by a species or two species.

CHAPTER FOUR

4. RESULTS

4.1. Medicinal Plants in the Study Area

4.1.1. Taxonomic diversity

The people in the study area use diverse plant species for traditional medicinal purpose to treat both human and livestock ailments. A total of 121 plant species that belong to 100 genera and 52 families were claimed to be used for traditional medicinal purpose by the local people of both districts (Appendices 5 and 6). Plants said to be used to treat human ailments only were 87 (71.90%), those used to treat both human and livestock ailments were 27 (22.31%) and seven (7.79%) were those used to treat livestock ailments only.

Eighty five medicinal plants species that belong to 72 genera and 42 families were recorded from Erob District (Appendices 5 and 6), which are used to treat 82 ailments (Appendix 6). Of these 85 MPs, 62 species were reported for use to treat 47 human ailments only while four plant species were used to treat four livestock ailments only. Furthermore, 19 plant species were also used to treat 11 human ailments and 20 livestock ailments by the local people. Thus, 81 plant species were said to be used to treat 58 human ailments while 23 were claimed for use to treat 24 livestock ailments.

One hundred and two medicinal plants that belong to 88 genera and 48 families were obtained from Gulomahda District (Appendices 5 and 6) which were claimed to be used to treat 85 ailments (Appendix 8). Of these, 102 MPs, 72 plant species were said to be used to treat 54 human ailments only while four plant species were those used for treating four livestock ailments only. In addition, the local people also used 26 plant species to treat 13 human and 14 livestock ailments. In general, 98 plant species were those used to treat 67 human ailments and 30 plant species for 18 livestock ailments. Furthermore, the study revealed that the number of genera and plant species that belong to each family and the number of plant species that belong to each genus were different.

Of all the families, Asteraceae had the highest number 10 (10.00%) of genera followed by Lamiaceae that had seven (8.00%) genera in both districts. In Erob District, the Asteraceae contributed the highest number, seven (9.46%) genera, followed by Lamiaceae and Solanaceae having six (8.11%) genera each. In Gulomahda, Asteraceae also had the highest number, eight (8.89%) genera, followed by Lamiaceae that had six (6.67%) genera (Table 4 and Appendix 5).

Table 4 Number of genera in each family in the two districts

Family	**Number of genera belonging to each family**								
	Erob District			**Gulomahda District**			**Both districts**		
	Genera	**%**	**Rank**	**Genera**	**%**	**Rank**	**Genera**	**%**	**Rank**
Asteraceae	7	9.72	1	8	9.09	1	10	10.00	1
Solanaceae	6	7.79	2	5	5.68	3	6	6.00	3
Lamiaceae	6	8.11	2	6	6.82	2	7	8.00	2
Fabaceae	4	5.55	4	5	5.68	3	6	6.00	3
Euphorbiaceae	3	4.05	5	4	4.54	5	4	4.00	5
Cucurbitaceae	2	2.70	7	4	4.54	5	4	4.00	5
Boraginaceae	3	4.05	5	2	2.27	8	3	3.00	10
Others	41	55.73	-	54	61.36	-	60	60.40	-
Total	72	100.00	-	88	100.00	-	100	100.00	-

The study also revealed the number of plant species that belong to each genus vary from genus to genus (Appendix 6). Of the total, the genus *Solanum* contributed the highest number of medicinal plant species (4, 3.31%) in the study area. In Erob District, *Solanum* contributed the highest number of medicinal plant species (3, 3.53%). In Gulomahda District, *Euphorbia, Rumex* and *Solanum* had the highest numbers being represented by three (2.94%) medicinal plant species each (Table 5).

Table 5 Six plant genera with the highest number of medicinal species

Number of plant species belonging to each genus											
Erob District				**Gulomahda District**				**Both districts**			
Generic name	**No.**	**%**	**Rank**	**Generic name**	**No.**	**%**	**Rank**	**Generic name**	**No.**	**%**	**Rank**
Solanum	3	3.53	1	*Euphorbia*	3	2.94	1	*Solanum*	4	3.31	1
Acacia	2	2.35	2	*Rumex*	3	2.94	1	*Euphorbia*	3	2.48	2
Aloe	2	2.35	2	*Solanum*	3	2.94	1	*Rumex*	3	2.48	2
Capsicum	2	2.35	2	*Acacia*	2	1.96	4	*Acacia*	2	1.65	4
Euphorbia	2	2.35	2	*Aloe*	2	1.96	4	*Aloe*	2	1.65	4
Indigofera	2	2.35	2	*Eucalyptus*	2	1.96	4	*Capsicum*	2	1.65	4

4.1.2. Number of plant species belonging to each family

Variable number (1-10) of plant species belonging to each family were used by the local people for medicinal purpose (Appendix 5). Accordingly, the family Solanaceae contributed the highest number of plant species accounting for 10 (11.77%) followed by Asteraceae and Lamiaceae that had seven (8.24%) species each in Erob District. On the other hand, Asteraceae and Solanaceae contributed the highest number of plant species accounting for nine (8.82%) each followed by Lamiaceae contributing eight (7.84%) in

Gulomahda District. In both districts, Solanaceae, Asteraceae and Lamiaceae contributed the highest number of medicinal plant species 11 (9.09%) each (Table 6).

Table 6 Plant families with the highest number of plant species

Family	**Number of plant species belonging to each family**								
	Erob District			**Gulomahda District**			**Both districts**		
	Spp.	**%**	**Rank**	**Spp.**	**%**	**Rank**	**Spp.**	**%**	**Rank**
Solanaceae	10	11.77	1	9	8.82	1	11	9.09	1
Asteraceae	7	8.24	2	9	8.82	1	11	9.09	1
Lamiaceae	7	8.24	2	8	7.84	3	11	9.09	1
Fabaceae	4	4.71	5	6	5.88	4	7	5.79	4
Euphorbiaceae	5	5.88	4	6	5.88	4	6	4.96	5
Cucurbitaceae	3	3.53	6	4	3.92	6	4	3.31	6
Polygonaceae	3	3.53	6	4	3.92	6	4	3.31	6
Boraginaceae	3	3.53	6	2	1.96	10	3	2.48	8
Others (non ranked)	43	50.57	-	54	52.96	-	64	52.89	-
Total	85	100.00	-	102	102.00	-	121	100.00	-

4.1.3. Endemic plant species used for traditional medicine

Of the total plant species, two that are endemic to Ethiopia were being used by the local people in their traditional medical lore. Therefore, one endemic plant species was used by the people of Erob District, while both the two endemic plant species were used by the people of Gulomahda District (Appendix 2).

4.2. Growth Forms and Sources of Traditional Medical Plants

4.2.1. Growth forms of medicinal plant species

Herbs were the dominant growth form among the reported medicinal plants that constituted 38 (44.71%) in Erob District and 43 (42.31%) in Gulomahda District followed by shrubs 31 (36.47%) in Erob District and 40 (39.22%) in Gulomahda District and trees 16 (18.82%) in Erob District and 19 (18.63) in Gulomahda District. A total of 55 (45.46%) herbs were reported from Erob and Gulomahda districts with five (4.13%) of them being climber herbs (Appendix 2).

4.2.1.1. Growth forms of medicinal plant species used to treat human ailments

The growth forms of the reported MPs showed that herbs constituted the dominant growth form with 37 (45.68%) species followed by 27 (33.33%) shrub species, 14 (17.28%) tree species, 3 (3.70%) lianas in Erob District and 42 (42.86%) herbs followed by 37 (37.76%) shrub species 17 (17.35%) tree species, two (2.04%) linanas in Gulomahda District (Appendix 2).

4.2.1.2. Growth forms of medicinal plant species used to treat livestock ailments

Shrubs made the dominant growth form among the reported medicinal plants that constituted 12 (52.17%) species followed by five (21.74%) herbs and tree species each, one (4.35%) liana in Erob District and 16 (53.33%) shrub species followed by nine (30.00%) herbs, five (16.67%) trees in Gulomahda District (Appendix 2).

4.2.2. Sources of medicinal plants in the study area

The local people collected medicinal plant species to treat human and livestock ailments from different environments including homegardens, cultivated field and the wild (Figure 6 and Appendix 2).

Figure 6 Photos showing the sources of medicinal plants

A= Olea *europaea* (Oleaceae) in the homegarden and B= plantation of *Rhamnus prinoides* (Rhamnaceae) in a farm land in Dewuhan/Erob District; C=A woman collecting fresh leaves of *Cordia africana* (Boraginaceae) from natural grassing area in Anbesete-fikdada /Gulomahda District (Photo by Tadesse Beyene, December 2012)

The greater proportion of the medicinal plants used in the study area were found to be collected from the wild (natural) environment mainly from disturbed plant community, fallow land and some from farm land and homegarden (Appendix 2). Accordingly, plant species collected from the wild for medicinal use by the local people of Erob and Gulomahda districts were dominant among the reported medicinal plants accounting for 49 (57.65%) and 56 (54.90%), respectively. Over all, wild habitat is the dominant source contributing species 68 (56.20%) in the study area (Figure 7).

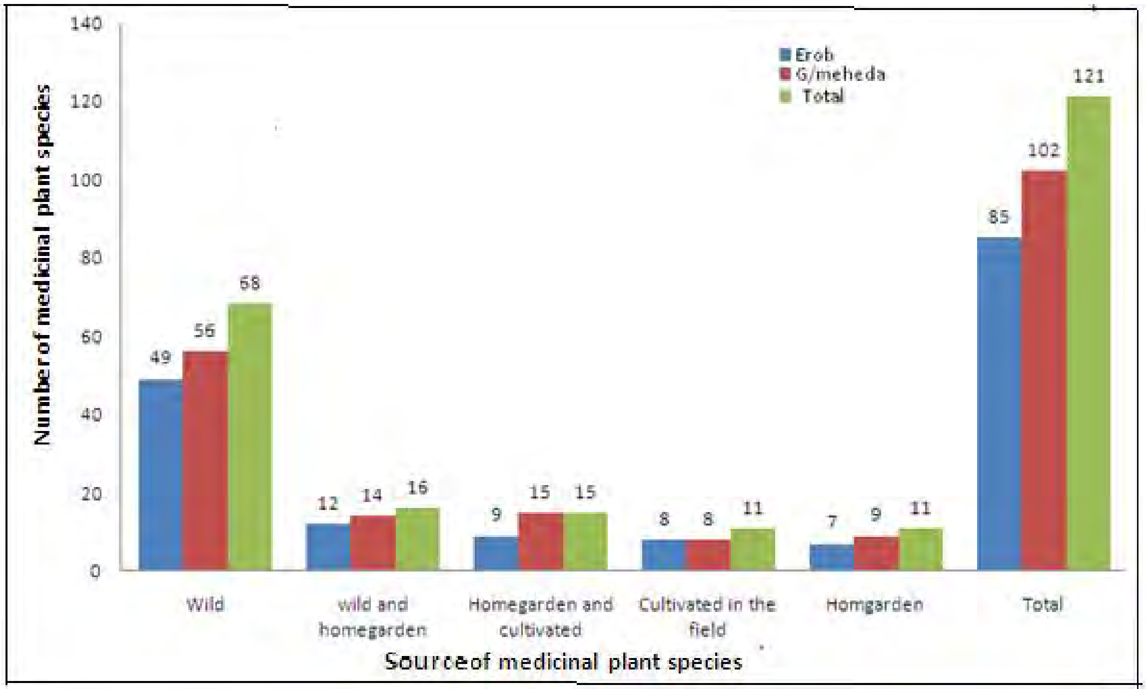


Figure 7 Histogram showing sources of medicinal plants in the study districts

4.2.2.1. Sources of medicinal plants used to treat human ailments

Most of the medicinal plants used to treat human ailments were collected from the wild by the local people of Erob and Gulomahda districts accounting for 44 (55.00%) and 52 (53.06%) species, respectively (Figure 8).

4.2.2.2. Sources of medicinal plants used to treat livestock ailments

It was also found that most of the medicinal plants used in the study area to treat livestock ailments were found to be collected from the wild by the local people of Erob and Gulomahda districts 18 (78.26%) and 21 (70.00%) species, respectively (Figure 9).

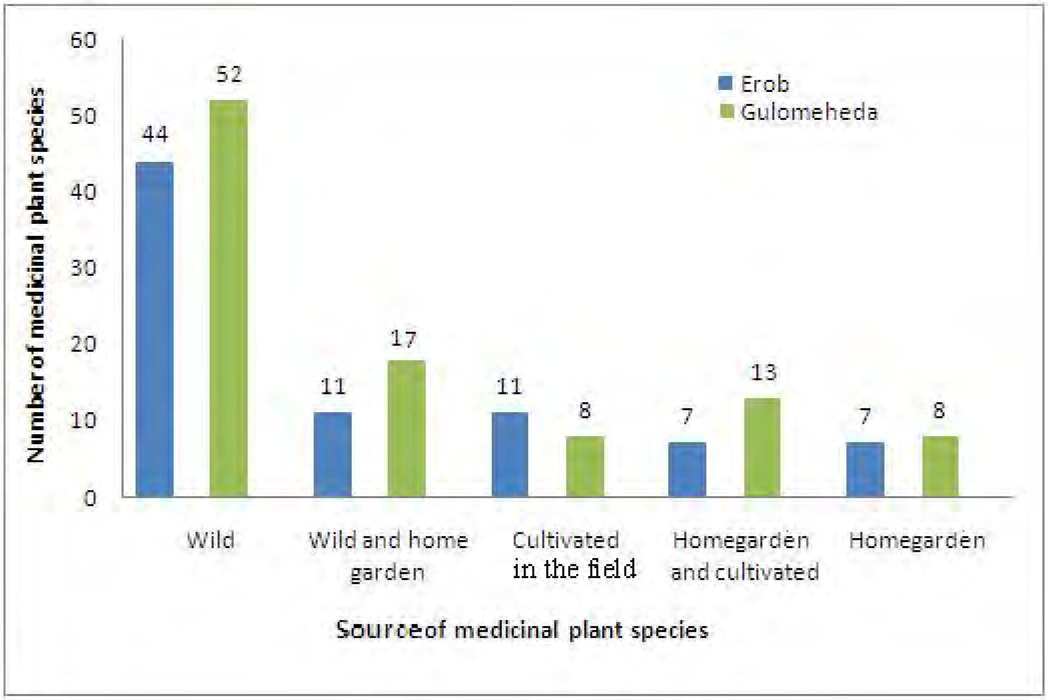


Figure 8 Graph showing medicinal plants used to treat human ailments

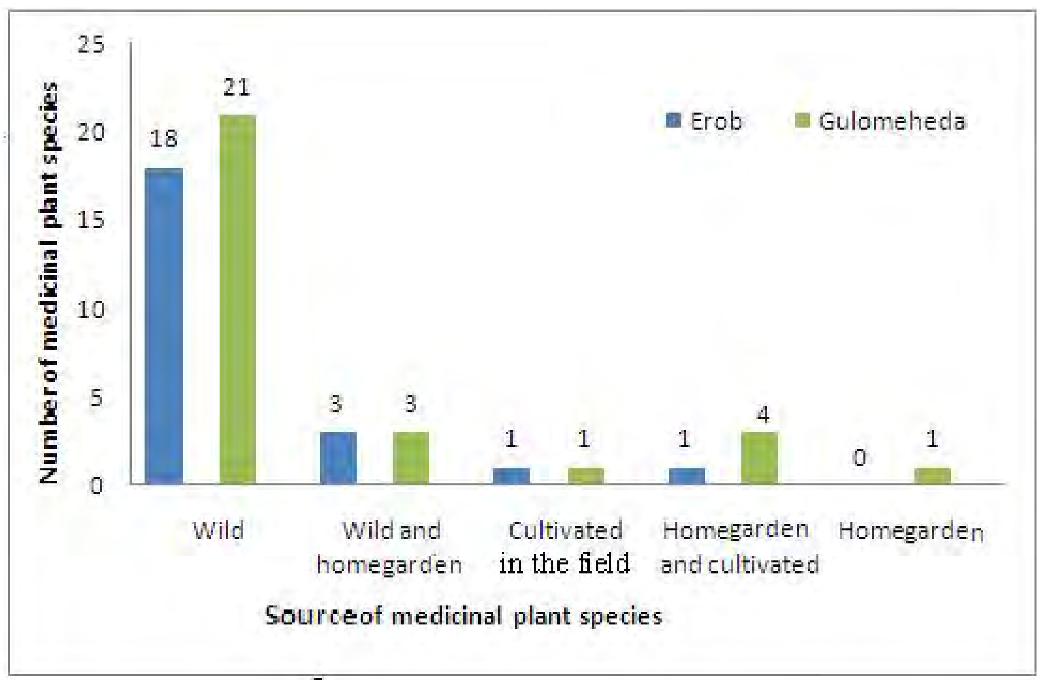


Figure 9 Graph showing sources of medicinal plants used to treat livestock ailments

4.3. Number of Ailments Treated by Each Plant Species

The finding showed that the number of ailments treated by each plant species varies from plant to plant (Appendix 7). Accordingly, *Aloe elegans* was a medicinal plant species that has been used to treat the highest number of ailments which accounted for 10 (13.89%) ailments followed by *Meriandra dianthera* and *Solanum schimperianum* treating seven (9.72%) ailments each in Erob District. Similarly, *Aloe elegans* was found being used to treat the highest number of ailments in Gulomahda District which accounted for 10 (11.77%) ailments followed by *Meriandra dianthera* treating eight (9.41%) and *Hypoestes forskaolii*, *Lepidium sativum* and *Schinus molle* treating seven (8.24%) ailments each (Table 7).

Table 7 List of plant species used to treat more number of ailments

(One plant species may be used to treat one or more than one ailments)

Erob District				**Gulomahda District**			
Plant species	**Ailments treated**	**%**	**Rank**	**Plant species**	**Ailments treated**	**%**	**Rank**
Aloe elegans	10	13.89	1	*Aloe elegans*	10	11.77	1
Meriandra dianthera	7	9.72	2	*Meriandra dianthera*	8	9.41	2
Solanum schimperianum	7	9.72	2	*Hypoestes forskaolii*	7	8.24	3
Datura stramonium	6	8.44	*4*	*Lepidium sativum*	7	8.24	3
Calpurnia aurea	6	9.72	4	*Schinus molle*	7	8.24	3
Aloe macrocarpa	5	6.94	6	*Maytenus senegalensis*	6	8.06	6
Olea europaea	5	6.94	6	*Achyranthes aspera*	6	8.06	6
Rumex nervosus	5	6.94	6	*Ficus palmata*	6	8.06	6

4.3.1. Number of human ailments treated by each plant species

There was variation in the number of human ailments treated by each plant species, ranging from one to eight in the study districts. Accordingly, *Aloe elegans* was reported for use to treat the highest number of human ailments which accounted for eight (5.13%) ailments followed by *Solanum schimperianum*, seven (4.49%), and *Meriandra dianthera*, six (3.85%), by the local people of Erob District. Similarly, *Hypoestes forskaolii*, *Meriandra dianthera* and *Schinus molle* were found to be used in treating the highest number of human ailments in Gulomahda District which accounted for seven (3.21%) ailments each (Table 8).

Table 8 List of plant species used to treat more number of human ailments

Erob District				**Gulomahda District**			
Plant species	**Treated human ailments**			**Plant species**	**Treated human ailments**		
	No.	**%**	**Rank**		**No.**	**%**	**Rank**
Aloe elegans	8	5.13	1	*Hypoestes forskaolii*	7	3.21	1
Solanum schimperianum	7	4.49	2	*Meriandra dianthera*	7	3.21	1
Meriandra dianthera	6	3.85	3	*Schinus molle*	7	3.21	1
Olea europaea	5	1.92	4	*Ficus palmata*	6	2.75	4
Aloe macrocarpa	5	3.21	4	*Lepidium sativum*	6	2.75	4
Schinus molle	4	2.56	6	*Achyranthes aspera*	4	1.83	6
Euphorbia polyacantha	4	2.56	6	*Allium sativum*	4	1.83	6

4.3.2. Number of livestock ailments treated by each plant species

The number of livestock ailments treated by one species varie from plant to plant species and ranged from one to four in the study districts. Accordingly, *Calpurnia aurea, Datura* *stramonium* and *Nicotiana glauca* were used to treat the highest number of livestock ailments that accounted for four (10.00%) ailments Erob District. Similarly, *Calpurnia aurea,* which was chosen to treat the highest number of livestock ailments in Gulomahda District accounted for four (9.30%) ailments followed by *Laggera tomentosa* and *Maytenus senegalensis* that treated three (6.98%) ailments each (Table 9).

Table 9 List of plant species used to treat more number of livestock ailments

Erob District				**Gulomahda District**			
Plant species	**Treated livestock ailments**			**Plant species**	**Treated livestock ailments**		
	#	**%**	**Rank**		**#**	**%**	**Rank**
Calpurnia aurea	4	10.00	1	*Calpurnia aurea*	4	9.30	1
Datura stramonium	4	10.00	1	*Laggera tomentosa*	3	6.98	2
Nicotiana glauca	4	10.00	1	*Maytenus senegalensis*	3	6.98	2
Rumex nervosus	3	7.50	4	*Achyranthes aspera*	2	4.65	4
Aloe elegans	2	5.00	5	*Aloe elegans*	2	4.65	4
Achyranthes aspera	2	5.00	5	*Nicotiana glauca*	2	4.65	4
Kalanchoe marmorata	2	5.00	5	*Otostegia integrifolia*	2	4.65	4
Laggera tomentosa	2	5.00	5	*Sideroxylon oxyacanthum*	2	4.65	4
Tarchonanthus camphoratus	2	5.00	5	*Vernonia rueppellii*	2	4.65	4

4.4. Number of Plant Species Used to Treat Each Ailment

The type and number of medicinal plant species used to treat each human and livestock ailment varied from ailment to ailment. Some human and livestock ailments had opportunities to be treated by many different medicinal plant species than others.

4.4.1. Number of plant species used to treat each human ailment

Abdominal pain was treated by 14 (17.50%) plant species followed by febrile and tooth infection/pain treated by 10 (12.50%) each in Erob District. Similarly, abdominal pain was treated by the highest number of plant species that accounted for 19 (19.79%) species followed by wound treated by 18 (18.75%) species and febrile treated by 12 (12.50%) species Gulomahda District (Table 10 and Appendix 8).

Table 10 List of human ailments treated by more number of plant species

Erob District				Gulomahda District			
Human ailments	**# of plant Spp**	**%**	**Rank**	**Human ailments**	**# of plant Spp**	**%**	**Rank**
Abdominal pain	14	17.50	1	Abdominal pain	19	19.79	1
Febrile	10	12.50	2	Wound	18	18.75	2
Tooth infection/pain	10	12.50	2	Febrile	12	12.50	3
Tinia scaplis	9	11.25	4	Tonsillitis	10	10.42	4
Wound	9	11.25	4	Evil eye	8	8.33	5
Amoeba and other internal parasites	5	6.25	6	Snack venom	8	8.33	5

4.4.2. Number of plant species used to treat each livestock ailment

Leech was treated by different plant species which accounted for five (21.74%) followed by itch four (17.39%) by the local people of Erob District. On the other hand, cough was treated by the highest number of plant species 8 (27.59%) followed by itch and leech, six (20.69%) each, by the local people of Gulomahda District (Table 11 and Appendix 8).

Table 11 List of livestock ailments treated by the highest number of plant species

Erob District				Gulomahda District			
Livestock ailments	**# of plant spp.**	**%**	**Rank**	**Livestock ailments**	**# of plant spp.**	**%**	**Rank**
Leech	5	21.74	1	Cough	8	27.59	1
Itchy state	4	17.39	2	Itchy state	6	20.69	2
Cough	3	13.04	3	Leech	6	20.69	2
Blotting	3	13.04	3	Ecto-parasite	4	13.79	4
Fracture	3	13.04	5	Fracture	4	13.79	4
Ecto-parasite	2	8.70	6	Frothy blottis	2	6.90	6
Wound	2	8.70	6	Wound	2	6.90	6

4.4.3. Number of plant species used to treat ailments of livestock categories

Twenty three plant species were used to treat 24 ailments of cattle, goat, sheep, donkey, horse and mule in Erob District. The number of plant species used to treat varies from animal to animal. Accordingly, the highest plant species (22, 33.33%) were used to treat 22 (31.88%) ailments of cattle followed by 17 (25.76%) plant species used to treat 17 (24.64%) goat and sheep ailments each in Erob District. Similarly, 30 plant species were used to treat 18 ailments of cattle, goat, sheep, donkey, horse and mule in Gulomahda District. Of these, the highest number of plant species (28, 35.90%) were used to treat 17 (32.08) ailments of cattle followed by 22 plant species used to treat 15 (28.30%) goat and sheep ailments each (Table 12).

Table 12 Number of plant species used to treat livestock ailments

Animal	Erob District						Gulomahda District					
	No. of plant spp. used to treat livestock ailments			No. of ailments			No. of plant spp. used to treat livestock ailments			No. of ailments		
	No.	%	Rank	No	%	Rank	No.	%	Rank	No.	%	Rank
Cattle	22	33.33	1	22	31.88	1	28	35.90	1	17	32.08	1
Goat	17	25.76	2	17	24.64	2	22	28.21	2	15	28.30	2
Sheep	17	25.76	2	17	24.64	2	22	28.21	2	15	28.30	2
Donkey	4	6.06	4	5	7.25	4	2	2.56	4	2	3.77	4
Horse	3	4.55	5	4	5.78	5	2	2.56	4	2	3.77	4
Mule	3	4.55	5	4	5.78	5	2	2.56	4	2	3.77	4
Total	66	100.00	-	69	100.00	-	78	100.00	-	53	100.00	-

4.5. Parts of Medicinal Plants Used to Treat Human and Livestock Diseases

The people of the study districts reported using various parts of plant species to treat both human and livestock ailments (Appendix 9). The plant parts used to treat human and livestock health problems include leaves, roots, latex, bulb, seeds, fruits, bark and flowers. The most frequently required plant part by the Erob and Gulomahda people in the preparation of remedies was leaf that accounted for 37 (43.53%) and 33 (32.35%) preparations, respectively (Table 13).

Table 13 Used parts of medicinal plant species

Erob District				Gulomahda District			
Plant part used	**No.**	**%**	**Rank**	**Plant part used**	**No.**	**%**	**Rank**
Leaves	37	43.53	1	Leaves	33	32.35	1
Leaves and Root	10	11.77	2	Leaves and root	13	12.75	2
Latex	5	5.88	3	Seed and fruit	12	11.77	3
Fruit	5	5.88	3	Latex	8	7.84	4
Leaves and stem	4	4.71	5	Root	8	7.84	4
Root	4	4.71	5	Leaves and branch	3	2.94	6
Branch	3	3.53	7	Bulb	3	2.94	6
Leaves and fruit	2	2.35	8	Above ground	2	1.96	8
Leaves and branch	2	2.35	8	Leaves and fruit	2	1.96	8
Root bark	2	2.35	8	Leaves and bud	2	1.96	8
Others	11	12.94	-	Others	16	15.69	-
Total	85	100.00	-	Total	102	100.00	-

4.5.1. Parts of medicinal plants used to treat human ailments

Eighty one plant species were used in Erob District to treat 58 human ailments with leaf only used most frequently accounting for (33, 41.25%) cases followed by leaves and roots (8, 10.00%). Ninety-eight plant species were used by the people of Gulomahda District to treat 67 human ailments. The leaf was the part of plants most used for preparation of remedies by the people of Gulomahda District accounting for (29, 30.21%) cases followed by fruit/seed only as well as leaf and root 12 (12.50%) each (Table 14 and Appendix 9).

Table 14 Used parts of medicinal plant species to treat human ailments

Erob District				Gulomahda District			
Plant part used	**No.**	**%**	**Rank**	**Plant part used**	**No.**	**%**	**Rank**
Leaves	33	40.74	1	Leaves	29	29.59	1
Leaves and Root	8	9.88	2	Leaves and root	13	13.26	2
Latex	5	6.17	3	Seed and fruit	12	12.24	2
Seed	5	6.17	3	Latex	8	8.16	4
Fruit	4	4.94	5	Root	7	7.14	5
Leaves and stem	4	4.94	5	Leaves and branch	3	3.06	6
Root	4	4.94	5	Bulb	3	3.06	6
Leaves and branch	2	2.47	8	Leaves and fruit	2	2.04	8
Leaves and fruit	2	2.47	8	Leaves and stem	2	2.04	8
Root bark	2	2.47	8	Above ground	2	2.04	8
Others	12	14.82	-	Others	17	17.35	-
Total	81	100.00	-	Total	98	100.00	-

4.5.2. Parts of medicinal plants used to treat livestock ailments

Cases in which only leaves were used for preparation of remedies for livestock ailments were the highest accounted for 13 (56.52%) and 20 (68.97%) species in Erob and Gulomahda districts respectively (Table 15 and Appendix 9).

Table 15 Used part of medicinal plant species to treat livestock ailments

Erob District				Gulomahda District			
Plant part used	**No.**	**%**	**Rank**	**Plant part used**	**No.**	**%**	**Rank**
Leaves only	13	56.52	1	Leaves only	21	70.00	1
Leaves and root	2	8.70	2	Root	3	10.00	2
Latex	2	8.70	2	Leaves and root	2	6.67	3
Root	2	8.70	2	Latex	1	3.33	4
Bark	1	4.35	5	Leaf and branch	1	3.33	4
Leaf and branch	1	4.35	5	Root and latex	1	3.33	4
Root and latex	1	4.35	5	Seed	1	3.33	4
Seed	1	4.35	5	Total	30	100.00	-
Total	23	100.00	-				

4.6. Conditions of Preparation of Herbal Remedies for Human and Livestock Ailments

Herbal medicines were prepared from fresh, dry and fresh/dry plant material to treat human and livestock ailments in the study districts. The highest value was that of the fresh plant part which accounted for 53 (62.25%) plant species in Erob District and 62 (60.78%) in Gulomahda District in treating human ailments (Figure 10A). Over all, the highest value was that of the fresh plant part which accounted for 77 (63.64%) species in the study area (Figure 10).

The highest value was that of the fresh plant part which accounted for 54 (66.67%) species in Erob District and 59 (61.46%) in Gulomahda District in treating human ailments (Figure 11A). In the case of treating livestock ailments in the study districts, fresh plant parts were still dominating with 20 (86.96%) and 25 (86.21%) preparations of herbal remedies by the local people of Erob and Gulomahda districts, respectively (Figure 11B).

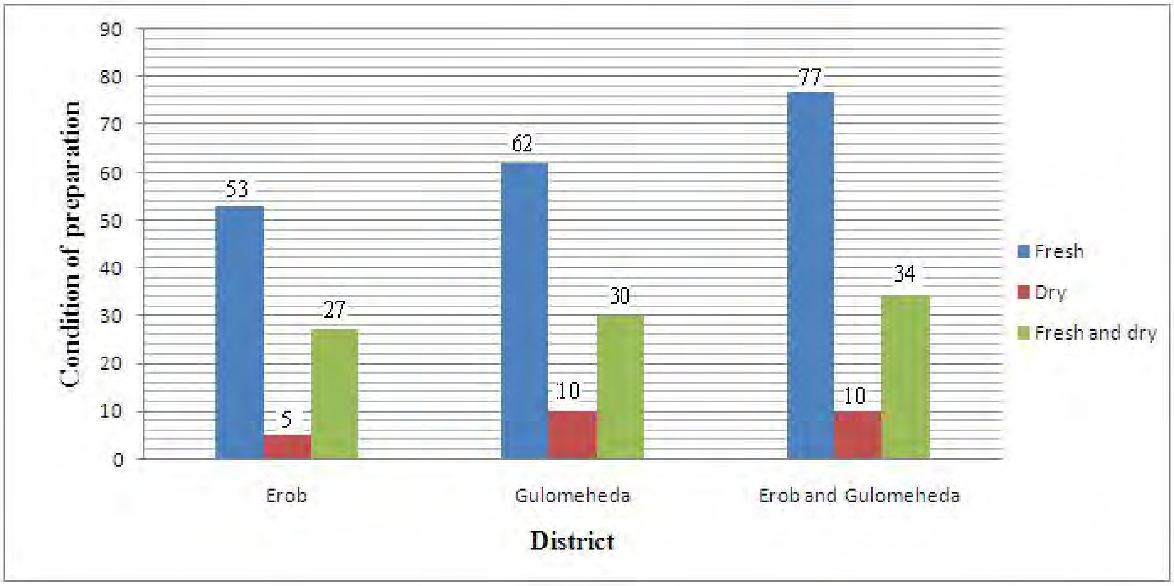


Figure 10 Histogram showing conditions of preparation of herbal remedies

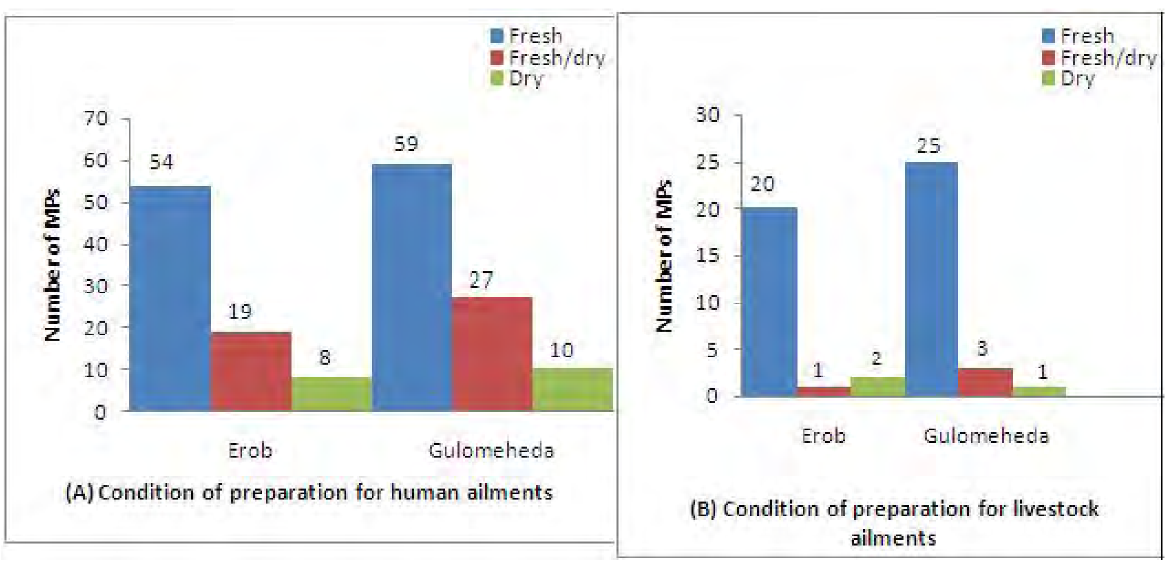


Figure 11 Histogram showing conditions of preparation of herbal remedies

(A= for human and B= livestock ailments)

4.7. Mode of Herbal Medicine Preparation

Herbal medicines were prepared in diverse modes of preparation by the local people of the study area to treat both human and livestock ailments (Appendix 4). Most of the collected traditional medicinal plants were prepared in concoction form accounting for 59 (35.76%) followed by 29 (17.58%) in crushed and pounded form and fumigant (smoke and vapor) 22 (13.33%) in Erob District. Similar result was obtained from Gulomahda District in which concoction was the highest accounting for 75 (36.32%) followed by 33 (15.94%) crushed and pounded form and unprocessed 29 (14.01%). The combined data from both district showed most of the collected traditional medicinal plants were prepared in concoction form 75 (32.33%) followed by 40 (17.24%) in crushed, pounded form and 37 (15.95%) unprocessed and as fumigant (smoke &vapor) 28 (12.07%) in the study area.

4.7.1. Mode of herbal medicine preparation to treat human ailments

Eighty one medicinal plant species were prepared by 165 different methods in Erob District and 98 medicinal plants by 214 different methods in Gulomahda District to treat various human ailments. Most of the collected traditional medicinal plants were used without any processing and this accounted for 50 (30.30%) cases followed by 34 (20.61%) that were crushed and pounded and 27 (16.36%) was used concoction in Erob District. Similar modes of remedy processing were seen in Gulomahda District where unprocessed remedies accounted for 66 (30.81%) cases followed by 46 (21.50%) concoction and crushing and pounding (41, 19.16%) (Figure 12A).

4.7.2. Mode of herbal medicine preparation to treat livestock ailments

Twenty three medicinal plant species were prepared by 40 different methods in Erob District to treat 24 livestock ailments and 29 medcinal plants by 46 different methods in Gulomahda District to treat 18 livestock ailments. Accordingly, most of the collected traditional medicinal plants were used in concoction form which accounted for 22 (55.00%) cases followed by 10 (25.00%) unprocessed plant medicines in Erob District. Similar modes of remedy preparation were recorded in Gulomahda District in which concoction was the highest (24, 52.17%) followed by 12 (26.09%) cases where plant medicines were prepared by crushing and pounding (Figure 12B).

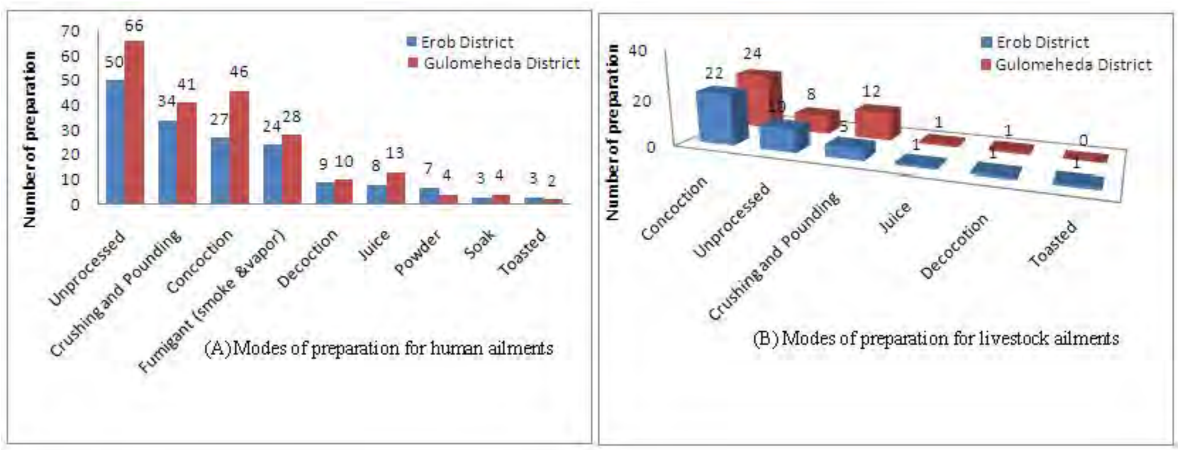


Figure 12 Graphs showing modes of herbal medicine preparation

(A=to treat human ailments and B=livestock ailments)

4.8. Dilution of Herbal Medicine

Herbal remedies were mostly processed using grinder made from iron, wood, black (basal) stone, palms and fingers of the hand by the local people of the study districts to extract and squeeze out the juice of the plant. Furthermore, the local people prepared herbal medicines with or without diluents.

4.8.1. Dilution of herbal medicine to treat human ailments

The findings showed that most of the herbal medicines used to treat humans were prepared without dilution in 109 (66.06%) cases in Erob District and 139 (64.95%) in Gulomahda District. On the other hand, some herbal medicines were prepared with the use of water as dilutant, which accounted for 32 (19.40%) in Erob District and 53 (24.77%) in Gulomahda District (Table 16).

Table 16 Diluents in the preparation of herbal remedies for human ailments

Type of dilution	**Erob District**			**Gulomahda District**		
	No. of preparation	**%**	**Rank**	**No. of preparation**	**%**	**Rank**
No dilution	109	66.06	1	139	64.95	1
Water	32	19.40	2	53	24.77	2
Water and. Honey	5	3.03	3	2	0.94	6
Honey	4	2.42	4	4	1.87	4
Tea	4	2.42	4	2	0.94	6
Yogurt	3	1.82	6	2	0.94	6
Coffee and/or milk	3	1.82	6	3	1.40	5
MES	2	1.21	8	1	0.47	9
Hair butter	2	1.21	8	6	2.80	3
Gasoline	1	0.61	10	1	0.47	9
Honey, butter	-	-	-	1	0.47	9
Total	165	100.00	-	214	100.00	-

4.8.2. Dilution of herbal medicine to treat livestock ailments

A total of 23 ethnoveterinary plants were prepared by 40 different methods to treat 24 livestock ailments in Erob District and 29 traditional medicinal plants were prepared by 46 different methods to treat 18 livestock ailments in Gulomahda District. Most of the herbal medicines used to treat livestock ailments were prepared without dilution and this accounted for 21 (52.50%) cases followed by water as diluent (19, 47.50%) in Erob District. On the other hand, most of the livestock remedies were prepared using water as diluent (26, 56.52%) followed by no diluent (19, 41.40%) and fresh butter (1, 2.17%) in Gulomahda District.

4.9. Route of Herbal Remedy Application

Traditional medicines prepared from medicinal plant species were administered and applied in different ways by the people of the study districts (Appendix 4). Accordingly, nearly half of the herbal medicines were applied internally which accounted for 119 (49.79%) preparation followed by 118 (49.37%) for external application used by the people of Erob District. Highest number of remedies were taken orally which accounted for 106 (44.35%) followed by 88 (36.82%) in the cases of dermal application in Erob District. Similar application was observed in Gulomahda District where internal application was the most frequently used one (137, 51.31%) followed by external (127, 47.56%) application. Oral application was the most used accounting for 119 (44.57%) followed by 91 (34.08%) dermal application (Table 17).

Table 17 Route of herbal medicine application

Application	Type of application	Erob District			Gulomahda District		
		No.	%	R	No.	%	R
Internal	Oral	106	44.35	1	119	44.57	1
	Nasal	7	2.93	4	12	4.49	4
	Ear	4	1.67	6	4	1.50	6
	Eye	2	0.84	7	2	0.75	8
	Total	119	49.79	-	137	51.31	-
External	Dermal	88	36.82	2	91	34.08	2
	Fumigant	24	10.04	3	27	10.11	3
	Tied to	6	2.51	5	9	3.37	5
	Total	118	49.37		127	47.56	-
Others	In and around the house	2	0.84	7	3	1.12	7
	Total	2	0.84	-	3	1.12	-
Grand Total		239	100.00	-	267	100.00	-

4.9.1. Route of herbal remedy application to treat human ailments

Traditional herbal medicines were administered in different ways by the people of the study districts to treat human ailments (Appendix 4). Most of the herbal medicines were applied externally which accounted for 86 (52.12%) applications and 79 (47.87%) internal application in Erob District. On the other hand, it was found that taking medicine orally was the most frequently route of application accounted for 71 (43.03%) followed by dermal (61, 36.96%) application. Similar applications was reported by the people of Gulomahda District with external application taking the lead which accounted for 112 (52.33%) followed by internal (102, 47.67%) application. It was also found out that taking medicine orally took the lead accounting for 94 (43.93%) followed by dermal (77, 35.98%) (Table 18).

Table 18 Route of herbal medicine application for human ailments

Application	Type of application	Erob District			Gulomahda District		
		No.	%	Rank	No.	%	Rank
Internal	Oral	71	43.03	1	94	43.93	1
	Nasal	3	1.81	5	3	1.40	6
	Ear	4	2.42	4	4	1.87	4
	Eye	1	0.61	6	1	0.47	8
	Total	79	47.87	-	102	47.67	-
External	Dermal	61	36.96	2	77	35.98	2
	Fumigant	24	14.55	3	29	13.55	3
	Tied to	1	0.61	6	4	1.87	4
	Total	86	52.12	-	110	51.40	-
Others	In and around the house	-	-	-	2	0.93	7
	Total	-	-	-	2	0.93	-
Grand Total		165	100.00	-	214	100.00	-

4.9.2. Route of herbal remedies application to treat livestock ailments

Traditional medicine prepared from medicinal plant species were also administered and applied in different ways by the people of the study districts to treat livestock ailments (Appendix 4). Most of the administered herbal medicines prepared were applied on the external parts of the animal through dermal route which accounted for 16 (40.00%) followed by oral route (13, 32.50%) by the people of Erob District. On the other hand, taking medicine orally was highly frequented which accounted for 17 (36.96%) followed by dermal (16, 34.78%) in Gulomahda District (Table 19).

Table 19 Route of herbal medicine application for livestock ailments

Application	Type of application	Erob District			Gulomahda District		
		No.	**%**	**Rank**	**No.**	**%**	**Rank**
Internal	Oral	13	32.50	2	17	36.96	1
	Nasal	9	22.50	3	9	19.57	3
	Eye	1	2.50	4	1	2.17	5
External	Dermal	16	40.00	1	16	34.78	2
	Tied to	1	2.50	4	3	6.52	4
Total		40	100.00	-	46	100.00	-

4.10. Composition of Herbal Medicine Preparation

Herbal preparations varied in plant composition. A total of 205 herbal medicines were prepared from 85 medicinal plant species to treat 72 ailments in similar or different compositions in Erob District and 260 herbal medicines were prepared from 102 medicinal plant species to treat 81 ailments in similar or different composition in Gulomahda District. It was foundout that preparation from a single species which accounted for 187 (91.21%) was dominant in Erob District and use of two species was found in nine (4.39%) cases. The data obtained from Gulomahda District also showed preparation from single species cases to be 232 (89.23%) while double species were found in 14 (5.39%) cases (Table 20).

Table 20 Composition of herbal preparation

Composition of preparation	Erob District			Gulomahda District		
	No.	%	Rank	No.	%	Rank
Single Species	187	91.21	1	232	89.23	1
Double Species	9	4.39	2	14	5.39	2
Triple species	1	0.49	5	4	1.54	4
Quadruple species	2	0.98	4	3	1.15	5
Five species	5	2.44	3	6	2.31	3
Six species	-	-	-	1	0.39	6
Seven species	1	0.49	5	-	-	-
Total	205	100.00		260	100.00	-

4.10.1. Composition of herbal preparation used for treating human ailments

A total of 165 herbal medicines were prepared from 81 medicinal plant species to treat 58 human ailments in Erob District and in Gulomahda District 214 herbal medicines were prepared from 96 medicinal plant species to treat 67 human ailments. Preparations from single species (148, 89.70%) were dominant in Erob District. The data obtained from Gulomahda District also showed preparation from a single species accounted for 187 (87.38%) (Table 21).

Table 21 Composition of herbal medicine preparation to treat human ailments

Composition of preparation	Erob District			Gulomahda District		
	No.	%	Rank	No.	%	Rank
Single Species	148	89.70	1	187	87.38	1
Double Species	8	4.85	2	13	6.08	2
Triple species	1	0.61	5	4	1.87	4
Quadruple species	2	1.21	4	3	1.40	5
Five species	5	3.03	3	6	2.80	3
Six species	-	-	-	1	0.47	6
Seven species	1	0.61	6	-	-	-
Total	165	100.00	-	214	100.00	-

4.10.2. Composition of herbal preparation for treating livestock ailments

A total of 40 herbal medicines were prepared from 23 medicinal plant species to treat 24 livestock ailments in Erob District while in Gulomahda District 46 herbal medicines were prepared from 29 medicinal plant species to treat 18 ailments. Preparations from single species (39, 97.50%) were dominant followed by double (1, 2.50%) in Erob District. The data obtained from Gulomahda District also showed preparations from single species dominating (45, 97.83%) followed by using double species (1, 2.17%) in Gulomahda District.

4.11. Dosage of Herbal Medicine

The local people of both districts use different equipment to measure the amount of herbal medicine to be administerd as well as estimation. Most of the herbal medicines which accounted for 176 (96.17%) were administered to patients by estimation or without standardized unit of measurements of the plant remedies followed by coffee cup in 120

(65.57%) and tin can in 92 (50.27%) cases by the people of Erob District. Most of the local people of Gulomahda District also administered herbal medicine dosage by estimation accounting for 181 (90.96%) followed by coffee cup in 126 (63.32%) and tin can in 60 (30.15%) cases (Figure 13).

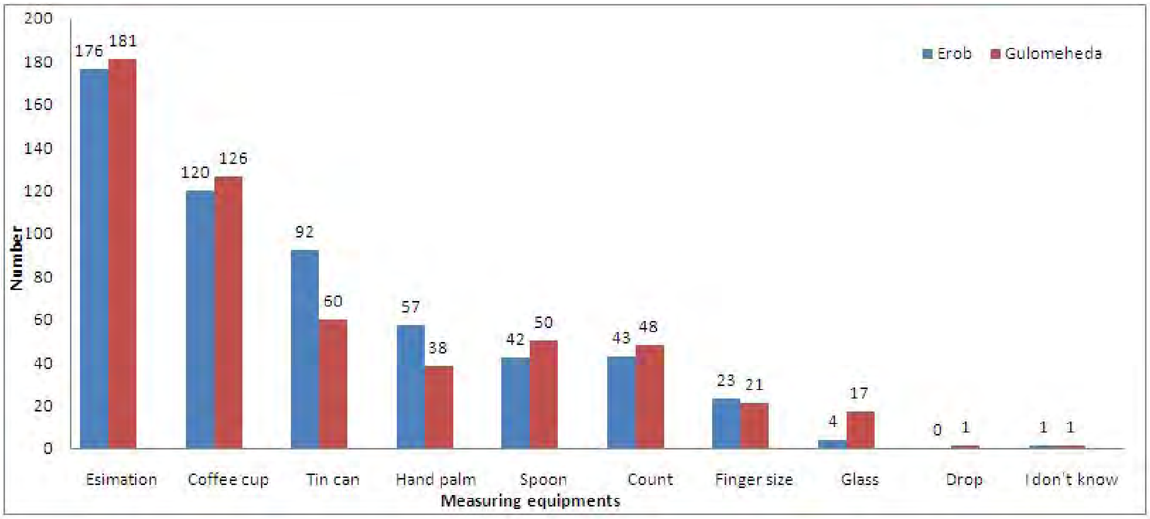


Figure 13 Histogram showing dose/ basis of decision on amount of medicinal plants used (One informant mentioned two and more than two dosage measurements)

4.11.1. Dosage of herbal medicine treating human patients

The local people of both districts use different equipment to measure the amount of herbal medicine as well as estimation to cure patients from ailments. Most of the herbal medicines involving 113 (68.49%) cases were administered to human patients by estimation or without known standardized unit of measurement. Others included coffee cup in 16 (9.32%) and tin can in 12 (7.27%) cases by the people of Erob District. Most of the local people of Gulomahda District also administered herbal medicine to human patients by estimation in 148 (69.16%), tin can in 17 (7.94%) and coffee cup in 15 (7.01%) cases (Table 22).

Table 22 Dose/basis of decision on amount of medicinal plant used to treat human ailments

Type of Measurement	Erob District			Gulomahda District		
	Number of herbal preparation	%	Rank	Number of herbal preparation	%	Rank
Estimation	113	68.49	1	148	69.16	1
Coffee cup	16	9.32	2	15	7.01	3
Tin can	12	7.27	3	17	7.94	2
Spoon	10	6.06	4	13	6.08	4
Count	7	4.24	5	6	2.80	6
Finger size	4	2.42	6	8	3.74	5
Drop	1	0.61	7	3	1.40	7
Tea cup	1	0.61	7	3	1.40	8
Tea glass	1	0.61	7	1	0.47	9
Total	165	100.00	-	214	100.00	-

4.11.2. Dosage of herbal medicine administered for the treatment of livestock ailments

The local people of both districts also use different equipment to measure the amount of herbal medicine administered as well as estimation to cure livestock ailments. More number of herbal medicines, accounting for 19 (47.5%), were administered to livestock by estimation. Others use tin can in 15 (37.50%) and coffee cup in five (12.5%) cases in Erob District. On the other hand, most of the local people of Gulomahda District administered herbal medicine for livestock using tin can which accounted for 18 (39.13%) cases followed by estimation in 17 (36.96%) and coffee cup in eight (17.39%) cases (Table 23).

Table 23 Dose/basis for decision on amount of medicinal plant used to treat livestock ailments

Type of Measurement	Erob District			Gulomahda District		
	Number of herbal preparation	**%**	**Rank**	**Number of herbal preparation**	**%**	**Rank**
Estimation	19	47.5	1	17	36.96	2
Coffee cup	5	12.5	3	8	17.39	3
Tin can	15	37.50	2	18	39.13	1
Spoon	-	-	0	1	2.17	4
Drop	1	2.50	4	1	2.17	4
Tea cup	-	-	-	1	2.17	4
Total	40	100.00	-	46	100.00	-

4.12. Mode of Herbal Medicine Administration

Herbal medicines are administered to patients in different ways in the study districts. Drinking was found to be the frequently used mode of herbal remedy administered which accounted for 54 (26.34%) cases followed by poultices in 36 (17.56%), chewing and fumigation in 24 (11.71%) cases each in Erob District. Drinking was also the highest mode of herbal remedy administered for 70 (26.92%) plant species followed by poultices for 50 (19.23%), fumigation (smoke and vapor) for 30 (11.54%) and chewing for 24 (9.25%) cases in Gulomahda District (Table 24).

Table 24 Types of medicine application/administration

Type of Application/Administration	Erob District			Gulomahda District		
	No.	**%**	**Rank**	**No.**	**%**	**Rank**
Drinking	54	26.34	1	70	26.92	1
Poultices	36	17.56	2	50	19.23	2
Chewing	24	11.71	3	24	9.23	4
Fumigation	24	11.71	3	30	11.54	3
Ointment	17	8.29	5	20	7.69	5
Rubbing	12	5.85	6	6	2.31	10
Eating	11	5.37	7	12	4.62	8
Nasal	8	3.90	8	14	5.39	6
Washing	8	3.90	8	13	5.00	7
Tied to	7	3.42	10	12	4.62	8
Powder spray	3	1.46	11	3	1.15	11
Brushing	1	0.49	12	2	0.77	13
Ear	-	-	-	1	0.39	14
Others including around home	-	-	-	3	1.15	12
Total	205	100.00	-	260	100.00	-

4.12.1. Mode of herbal medicine administration for treating human ailments

Herbal medicines were administered to human patients in different ways in the study districts. Drinking was the most frequently used mode of herbal remedy administered which accounted for 42 (25.46%) cases followed by poultices in 27 (16.36%) and fumigation (smoke and vapor) in 24 (14.55%) in Erob District. Drinking was also the most frequented mode of herbal remedy administered that accounted for 56 (26.17%) cases followed by poultices in 41 (19.16%) and fumigation (smoke and vapor) in 28 (13.08%) cases in Gulomahda District (Table 23).

Table 25 Types of medicine application/administration for treating human ailments

Type of Application/Administration	**Erob District**			**Gulomahda District**		
	No.	**%**	**Rank**	**No.**	**%**	**Rank**
Drink	42	25.46	1	56	26.17	1
Poultices	27	16.36	2	41	19.16	2
Fumigation	24	14.55	3	29	13.08	3
Chewing	24	14.55	3	24	11.22	4
Ointment	16	9.70	5	20	9.35	5
Rubbing	11	6.67	6	6	2.80	8
Eating	9	5.46	7	12	5.61	6
Washing	5	3.03	8	11	4.21	7
Powder spray	3	1.82	9	3	1.40	9
Tied to	2	1.21	10	6	2.80	8
Nasal	1	0.61	11	3	1.40	9
Brushing	1	0.61	11	2	0.94	12
Ear	-	-	-	1	0.47	13
Others such as placement around house, spraying, roasted seeds on swollen body	-	-	-	3	1.40	9
Total	165	100.00	-	214	100.00	-

4.12.2. Mode of herbal medicine administration for livestock

Herbal medicines are also administered to sick livestock in different ways in the study districts. Applying medicine as a drink was found to be the most frequently used mode of herbal remedy administered which accounted for 12 (30%) followed by poultices in nine

(22.50%) and nasal in seven (17.50%) cases in Erob District. Drinking was also the leading mode of herbal remedy administered for livestock that accounted for 14 (30.44%) followed by nasal in 12 (26.09%) and poultices in nine (19.57%) cases in Gulomahda District (Table 24).

Table 26 Types of medicine application/administration for livestock ailments

Type of Application/Administration	Erob District			Gulomahda District		
	No.	%	Rank	No.	%	Rank
Drinking	12	30.00	1	14	30.44	1
Poultices	9	22.50	2	9	19.57	3
Fumigation	-	-	-	1	2.17	6
Ointment	1	2.50	7	-	-	-
Eye	1	2.50	7	1	2.17	6
Eating	2	5.00	6	1	2.17	6
Washing	3	7.50	5	2	4.35	5
Rubbing	1	2.50	7	-	-	-
Tied to	4	10.00	4	6	13.04	4
Nasal	7	17.50	3	12	26.09	2
Total	40	100.00	-	46	100.00	-

4.13. Side Effects and Antidotes of the Administered Traditional Medicines

4.13.1. Possible side effects of human plant medicines and antidotes used

As explained by the knowledgeable elders and other general informants, out of the 165 herbal preparations used to treat 58 human ailments from 80 medicinal plant species, 127 (76.97%) were said to be without side effect in Erob District. Only 38 (23.03%) herbal preparations from 33 plant species administered against 21 human ailments were said to have some side effects. Of these, 22 (13.33%) herbal preparations though known to have side effects did not need application of antidotes. It was further explained that such side effects were due to the nature of the plants including burning sensation, for example, *Xanthium strumarium* when used against Tinia scaplis, bitter taste of *Olea europaea* when taken against tooth pain and bitter taste of *Indigofera amorphoide*s when taken against abdominal pain.

Some side effects were understood as indication for the working of the herbal medicine such as expulsion of the worm through the anus after about 30 minutes of taking the seed of *Cucurbita pepo* against tape worm and diarrhea when *Linum usitatissimum* was taken against constipation. On the other hand, 16 (9.70%) herbal preparations were associated with some kind of side effects which needed antidotes. Herbal medicine prepared from *Aloe elegans* to treat malaria may lead to a continuous diarrhea. In such situation, milk was ordered as antidote to control the harmful side effect of the administered herbal medicine. Herbal medicine prepared from *Melia azedarach* for abortion could cause a continuous diarrhea and vomiting and the prescribed antidotes were milk and milk products, coffee or SEWA (local beer) in Erob District.

It was also found that herbal medicines prepared from different plant species for the same ailments may or may not have antidotes. A herbal medicine prepared from *Schinus molle* to treat abdominal pain may lead to side effects for which coffee, milk, yogurt, SIWA (SEWA) was prescribed as antidotes. On the other hand, herbal medicine prepared from *Olea europaea* to treat abdominal pain did not require antidotes in Erob District (Appendix 10).

Out of the 214 herbal preparations from 96 medicinal plant species used to treat 67 human ailments, 161 (75.23%) herbal preparations were said to be without side effects in Gulomahda District. Only 53 (24.77%) herbal preparations from 42 (43.75%) plant species administered against 23 (34.33%) human ailments were reported to have side effects. Of these, 23 (10.75%) herbal preparations were with side effects but do not need antidotes. Included in this category were the bitter taste of *Verbena officinalis* used against abdominal pain, burning sensation of *Rumex nepalensis* against Tinia scaplis and abdominal burning sensation of *Allium sativum* against malaria. It was explained that such side effects were due to the nature of the plant. Some side effects were considered the indications for the working of the herbal medicines like, for example, the burning sensation of applying *Lycopersicon esculentum* when taken to treat wound and sweating after taking *Zehneria scabra* medicine to treat febrile.

On the other hand, 30 (14.02%) herbal preparations were with side effects which needed antidotes including, for example, the herbal medicine prepared from *Withania somnifera* to treat abdominal pain which would lead to a continuous diarrhrea and vomitting. In such situation, milk and milk products were prescribed as antidotes to control the harmful effects of the administered herbal medicine. Herbal medicine prepared from *Schinus molle* for abdominal pain would cause a continuous diarrhea which is cured by coffee, milk, yogurt or SEWA as antidotes in Gulomahda District.

It was also found that herbal medicines prepared from different plant species for the same ailments may or may not need antidotes. Herbal medicine prepared from *Cucumis ficifolius* to treat abdominal pain was controlled by administering coffee as antidote. On the other hand, herbal medicine prepared from *Solanum incanum* to treat abdominal pain did not require antidotes in Erob District (Appendix 10).

4.13.2. Side effects and antidotes for livestock

As explained by the knowledgeable elders and other general informants, it is not common to notice the side effects as well as use antidotes suitable for livestock treatments in the study districts. Out of the 40 herbal preparations used o treat 24 livestock ailments from 23 medicinal plant species, 38 (95%) herbal preparations had no noticeable side effect in Erob District. Only two (5.00%) herbal preparations from two plant species administered against one livestock ailment were known to have side effects which did not need antidotes. Such side effects were considered as indications for the working of the herbal medicine including, for example, dropping of leeches with mucous through the nostrils after some hour of applying the crushed and filtered leaves of *Nicotiana tabacum* and *Tarchonanthus camphoratus*.

In Gulomahda District, out of the 46 herbal preparations used to treat 18 livestock ailments from 29 medicinal plant species, 41 (89.13%) herbal preparations were found to be without noticeable side effects. Only five (10.87%) herbal preparations from five plant species administered against two livestock ailments were said to have some side effects but these still did not need antidotes. Such side effects were found to be the indications for the working of the herbal medicine including, for example, dropping of leeches with mucous through the nostrils after some hour of applying the crushed and filtered leaves of *Acacia etbaica*, *Maytenus senegalensis*, *Nicotiana tabacum*, *Tarchonanthus camphoratus*;

and bursting of the swelling on livestock bodies when it is smeared by the latex of *Euphorbia abyssinica* after one to four days.

4.14. Concerns of Healers in Administration of Traditional Medicines

It was found that administrations of herbal medicine were not standardized and there was no exact measurement of dosage in both districts. Healers and knowledgeable elders asserted that they determine the dosages based on age, physical appearance and occupation, duration of the illness and strength of the disease. Children are given small doses of medicine than the amounts considered in case of adult patients. As a result, the herbal remedies were simply recommended or prescribed in small amount such as drops, hand palms, coffee cups and for larger dosages the tin can or other local materials that are used for drinking are used. Local healers and knowledgeable elders have special care for pregnant women and physically weak persons. For example, pregnant women and physically weak persons are not given those medicines that have observable adverse effects such as vomiting and diarrhea.

The rate of administration depends on the type of illness and its side effects. Some administered traditional medicinal plants show some side effects such as vomiting, diarrhea, itchy state, sweating and temporary inflammations. According to the healers and knowledgeable elders, these effects are generally due to an overdose of the remedy. For toxification treatment, the patient is supposed to eliminate the poisons by vomiting. The people of the study area use cow milk and milk products, coffee and SEWA as common antidote.

4.15. Medicinal Plant Availability

The status of medicinal plant species in the study districts mostly depended on season. The accessibility of TMPs in the study districts were medium, especially herbs were accessable during the rainy season but their accessibility was reduced in the dry season. Data collected from Erob District showed that the status of medicinal plant species in their vicinity as medium was the highest (109, 59.56%) and rare in the dry season (39, 21.31%) and common in 35 (19.13%) cases. In case of Gulomahda District, still medium was the highest for the status of medicinal plants in their vicinity (112, 56.28%) followed by common (60, 30.15%) and rare 27 (13.57%). Though 58 informants (31.69%) from Erob District and 54 (27.14%) from Gulomahda District were not familiar and clear with the current status of medicinal plants, most of the informants (125, 68.31%) from Erob District and from Gulomahda District (145, 72.86%) agreed that medicinal plants were reduced in the study area especially in the dry period locally known as HAGAY.

4.16. Preferred Maturity Level and Season for Preparation of Herbal Medicine

Most of the key informants in both distincts agreed that the medicinal plants were harvested with no specific preference to any particular maturity level. However, some plants were reported to be harvested after parts attain full maturity such as fruits of *Carica papaya*, *Citrus aurantifolia*, *Coffea arabica*, *Cucurbita pepo* and *Lagenaria siceraria*. On the other hand, some plant species were preferred at their early stage such as the leaves of *Cordia africana*, *Rhamnus prinoides* and *Ruta chalepensis*. Most of the key informants responded that they had no special preference for season of collecting and use of herbal medicine. This is also supported by the fact that most of the informants did not collect medicinal plant species for later use i.e. they gather MP for immediate use when health problems are felt.

4.17. Medicinal Plants Requiring Longer period to Collect in Recent Years than Before

The key informants asserted that the period required to collect plant material for medicinal use varies from plant to plant species as well as from place to place. Plant species such as *Capparis micrantha, Croton macrostachyus, Lobelia giberroa* and *Vernonia rueppellii* in Erob District and *Aloe macrocarpa*, *Capparis micrantha*, *Crinum ornatum, Croton macrostachyus, Justicia schimperiana, Lobelia giberroa*, *Myrica salicifolia* and *Tarchonanthus camphoratus* in Gulomahda District each needed more than one hour to collect (Appendix 11).

4.18. Medicinal Plants and the Plant Communities in which they were Found

Eight “plant community types” were recognized from field observation based on the dominant plant species in the study districts (Table 27).

Table 27 Eight visually recognized plant communities types

No.	Plant community (P.C.) type	Recorded Mps	District/ found in
1	*Opuntia ficus-indicus* dominated P.C.	*Rumex nervosus*, *Euphorbia abyssinica*, *Hypoestes forskaolii*, *Leucas abyssinica*, *solanum species*, *Argemone mexicana*, *Achyranthes asper* and some others including *Aloe elegans*	Erob
2	*Euphorbia abyssinica* and *Aloe elegans* co-dominated P.C.	*Euphorbia polyacantha*, *Nicotiana glauca*, *Opuntia ficus-indicus* and many others including *Psiadia punctulata*	Erob
3	*Rumex nervosus* dominated P.C.	*Argemone mexicana*, *Nicotiana glauca*, *Schinus molle* and others including *Solanum incanum*.	Erob
4	*Becium grandiflorum* dominated P.C.	*Acacia origena*, *Aloe elegans*, *Calpurnia aurea*, *Clutia abyssinica*, *Cordia africana*, *Euphorbia abyssinica*, *Maytenus arbutifolia*, *Psiadia punctulata* and many others including *Tarchonanthus camphoratus*.	Erob
5	*Hypoestes forskaolii* and *Meriandra dianthera* co-dominated *P.C.*	*Aloe spp.*, *Calotropis procera*, *Laggera tomentosa*, *Leucas abyssinica* and some others including *Nicotiana glauca*	Gulomahda
6	*Acacia origena* and *Schinus molle* co-dominated P.C.	*Calpurnia aurea*, *Otostegia integrifolia* and others including *Vernonia rueppellii*	Gulomahda
7	*Calpurnia aurea* and *Dodonaea angustifolia* co-dominated P.C.	*Myrica salicifolia*, *Leucas martinicensis* and many others including *Vernonia rueppellii*	Gulomahda
8	*Aloe elegans* dominated P.C.	*Achyranthes aspera*, *Argemone mexicana*, *Becium grandiflorum*, *Hypoestes forskaolii*, *Leucas abyssinica* and several others including *Tagetes minuta*	Gulomahda

4.19. Facts about Respondents

4.19.1. Background of the informants

The 382 informants that were interviewed from both districts in this research consisted of 253 (66.23%) males and 129 (33.77%) females with 250 (65.45%) married and 132 (34.56%) singles. The age range was 18–80 years old. Most of the married informants (164; 42.93%) were aged 41 to 80 while 88 (23.04%) were 41 to 80 years old. On the other hand, the singles which accounted for 118 (30.89%) were aged 20 to 40 while 12 (3.14%) were 41 to 80 years old in both districts. The educational levels of the informants included illiterate (no modern education) to first degree and religious education. Furthermore, 104 (56.83%) both Saho speakers and catholic followers, 10 (5.47%) both Tigrigna speakers and orthodox followers, 35 (19.13%) both Saho speakers and orthodox followers and 34 (18.58%) both Tigrigna speakers and catholic follower informants were included from Erob District and all the 199 (100%) informants who have been interviewed from Gulomahda District were both Tigrigna language speakers and orthodox followers (Appendix 12).

4.19.2. Emic Categorization of plants, soil and land form by indigenous people

Based on the indigenous knowledge, the local people of Erob and Gulomahda districts have classified the plants of the area into four based on height and growth habits, the soil into six based on color and particle size and the land forms into five based on altitude, steepness, and depth with Saho and Tigrigna names (Table 28).

Table 28 Emic categories of plant form, soil types and land form by the Saho and Tigrigna speakers

Plant types			**Soil categories**			**Land form categories**		
Saho	Tigrigna	English	Saho	Tigrigna	English	Saho	Tigrigna	English
Hada	Om	Tree	Dabulku-A	Tselim hamed	Black soil	Koma	Emba	Mountain
Tetem	Kutkato	Shrub	Asabulku-A	Keih hamed	Red soil	Riy	Korobta	Hill
Tsehyay	Tsahyay	Herb	Hotsa	Hotsa	Sandy soil	Golo	Hagaf shintro	Valley
Harege	Hareg	Climber	Kokie	Kokhi /Horet	Stony soil	Meida	Golgol	Plain
			Si-hil	Delel	Loam soil	Gada	Shintro	River bed
			Adobulku-A	Baehel	Lime soil			

4.19.3. Knowledge source of traditional medicinal plants use

Most of the ethnomedicinal knowledge source in the study districts was linked with the family. In Erob District, the source of knowledge on TMP species was associated with the father and this accounted for 50 (27.32%) of the informants. In case of Gulomahda District, father was also the highest source of ethnomedicinal knowledge which accounted for 63 (31.65%) and some other sources accounted for lower proportions. Over all, in the study area, father was the highest source of ethnomedicinal knowledge which accounted for 113 (29.58%) (Table 29).

Table 29 Knowledge source on use of traditional medicinal plant species

Source of Knowledge	**Erob District**			**Gulomahda District**			**Over all**		
	No.	**%**	**Rank**	**No.**	**%**	**Rank**	**No.**	**%**	**Rank**
Father	50	27.32	1	63	31.65	1	113	29.58	1
Mother	44	24.05	2	32	16.08	2	76	19.90	2
Father and friends	26	14.21	3	25	12.56	3	51	13.35	3
Friends	26	14.21	4	25	12.56	3	51	13.35	3
Mother and neighbors	7	3.83	7	19	9.55	5	26	6.81	5
Father and mother	13	7.14	5	12	6.03	7	25	6.55	6
Brothers/sisters	2	1.09	9	15	7.54	6	17	4.45	7
Father, neighbors and friends	9	4.92	6	-	-	-	9	2.36	8
Mother and friends	5	2.73	8	3	1.51	8	8	2.09	9
Brother/sister & neighbor	1	0.55	10	3	1.51	8	4	1.05	10
Neighbors	-	-	-	2	1.01	10	2	0.52	11
Total	183	100.00	-	199	100.00	-	382	100.00	-

4.19.4. Willingness to share knowledge on use of traditional medicinal plants

The local people of the study districts have been found to be very willing to share and transfer their ethnomedicinal knowledge to their family members. The tendency of informants to share their knowledge on use of traditional medicinal plants with all their children was the highest which accounted for 79 (43.17%) in Erob District and 79 (39.70%) in Gulomahda District. In the study area as a whole, 158 (41.36%) of the general informants showed their willingness to share their MP knowledge with their children (Table 30). On the other hand, the tendency of the key informants to share their knowledge on use of traditional medicinal plants with the first son was the highest which accounted for 12 (75.00%) and 5 (27.77%) with all children in Erob District and in case of Gulomahda District, it was 13 (72.23%) with the first son and 5 (27.77%) with all children.

Table 30 Knowledge sharing of informants

Interest to whom to share knowledge	Erob District			Gulomahda District			Total		
	No.	%	Rank	No.	%	Rank	No.	%	Rank
Child	79	43.17	1	79	39.70	1	158	41.36	1
All interested	35	19.13	2	58	29.15	2	93	24.35	2
1st son	27	14.75	3	32	16.08	3	59	15.45	3
Brothers/sisters	21	11.48	4	7	3.52	5	28	7.33	4
Any family member	9	4.92	5	8	4.02	4	17	4.45	5
Friends	8	4.37	6	6	3.02	6	14	3.67	6
Child and friends	1	0.55	8	6	3.02	6	7	1.83	7
Child and brothers/sisters	3	1.64	7	3	1.51	8	6	1.57	8
Total	183	100.00	-	199	100.00	-	382	100.00	-

4.19.5. Causes of ailments

The people of the study area had some awareness on factors that cause humans to be unwell. Accordingly, human ailments were mostly associated with the rise of temperature (hot time) which accounted for 108 (34.51%) cases followed by injury (58, 18.53%) and poor sanitation (49, 15.66%) in Erob District. Similar results were obtained from Gulomahda District in that the rise of temperature was mostly associated with human ailments in 90 (31.04%) cases followed by injury (61, 21.04%) and poor living standard and poor sanitation 33 (11.38%) each. Over all results in the study area also showed that the rise of temperature was mostly associated with human ailments in 198 (32.84%) cases followed by injury (119, 19.74%) (Table 31).

The people of the study area also had some awareness on the causes of livestock ailments. Poor sanitation was the most common cause of livestock ailments in Erob District that accounted for 102 **(**62.58%) reported causes followed by animal to animal transfer (50, 30.68%), injury (10, 6.14%) and grazing *Sorghum bicolor* emerging tillers (EFEL) (1, 0.61%). Similar results were obtained from Gulomahda District accounting for 108 **(**61.02%) for poor sanitation followed by animal to animal transfer (63, 35.59%), injury (5, 2.83%) and tick infestation (1, 0.57%). The overall combined data from both district also showed similar output accounting for 210 **(**47.19%) for poor sanitation followed by animal to animal transmission (113, 25.39%), injuring (15, 3.37%). On the other hand, 102 (22.92%) from both studies were not clear with the causes of livestock ailments.

Table 31 Cause of human ailments

Cause's human ailments	Erob District			Gulomahda District			Total		
	No.	%	Rank	No.	%	Rank	No.	%	Rank
Extensive work during hot time	108	34.51	1	90	31.04	1	198	32.84	1
Injury	58	18.53	2	61	21.04	2	119	19.74	2
Poor sanitation	49	15.66	3	33	11.38	3	82	13.60	3
Poor living standard	45	14.38	4	33	11.38	3	78	12.94	4
Intensive work carrying the child	19	6.07	5	25	8.62	5	44	7.30	5
I don't know	12	3.84	6	17	5.86	6	29	4.81	6
Person to person	12	3.84	6	14	4.83	7	26	4.31	7
Opuntia ficus-indica (unripe)	4	1.28	8	6	2.07	8	10	1.66	8
Dust particles	2	0.64	9	5	1.72	9	7	1.16	9
Exposing to sun after having oily food	1	0.32	11	4	1.38	10	5	0.83	10
Poor awareness	2	0.64	9	2	0.69	11	4	0.66	11
Comb	1	0.32	11	-	-	-	1	0.17	12
Total	313	100.00	-	290	100.00	-	603	100.00	-

4.19.6. Symptoms of ailments

The people of the study area had some awareness to realize the health status of individuals by some visual symptoms (Appendix 13). Body (physical) weakness was the most cited symptom of human ailment in Erob District that accounted for 83 **(**15.46%) of the total reports followed by vomiting (69, 12.85%) and sentiment of queasiness (64, 11.92%). On the other hand, fever was the most cited symptom of human ailments that accounted for 86 **(**17.13%) of the reported symptoms followed by sweating (72, 14.34%) and frequent sleeping (63, 12.55%) by the people of Gulomahda District. Over all. weakness was the most cited symptom of human ailments that accounted for 145 **(**12.28%) of the reported symptoms followed by fever (144, 12.13%) in the study area (Table 32).

Table 32 Symptoms of human ailments as reported by informants

Symptoms	**Erob District**			**Gulomahda District**			**Total**		
	No.	**%**	**Rank**	**No.**	**%**	**Rank**	**No.**	**%**	**Rank**
Weakness	83	14.34	1	62	10.30	4	145	12.28	1
Vomiting	69	11.92	2	46	7.64	5	115	9.74	4
Sentiment of queasiness	64	11.05	3	20	3.32	11	84	7.11	7
Fever	58	10.02	4	86	14.29	1	144	12.13	2
Poor appetite	57	9.85	5	45	7.48	7	102	8.64	5
Sweating	53	9.15	6	72	11.96	2	125	10.58	3
Shivering	47	8.12	7	46	7.64	6	93	7.88	6
Diarrhea	39	6.74	8	21	3.49	10	60	5.08	10
Discomfort	27	4.66	9	-	-	-	27	2.29	11
Itch	25	4.32	10	41	6.81	9	66	5.59	9
Frequent sleeping	15	2.59	12	63	10.47	3	78	6.61	8
Others	42	7.24	-	100	16.6	-	142	12.02	-
Total	579	100.00	-	602	100.00	-	1181	100.00	-

The local people have indigenous ways to understand the health conditions of livestock by visualizing some symptoms. Sneezing came out as the most cited symptom of livestock ailments in Erob District which accounted for 91 **(**23.27%) and 79 **(**23.37%) in case of Gulomahda District (Table 33).

Table 33 Symptoms of livestock ailments as reported by informants

Symptoms	Erob District			Gulomahda District			Total		
	No.	%	Rank	No.	%	Rank	No.	%	Rank
Sneezing	91	23.27	1	79	23.37	1	170	23.32	1
Stationary (Inactive)	48	12.28	2	44	13.02	3	92	12.62	2
Coughing	42	10.74	3	31	9.17	4	73	10.14	3
Loss of hair	21	5.37	8	50	14.79	2	71	9.74	4
Salivation	41	10.49	4	21	6.21	6	62	8.51	5
Poor appetite	27	6.91	6	15	4.44	8	42	5.76	7
Rubbing	14	3.58	10	21	6.21	6	35	4.80	8
Diarrhea	20	5.12	9	14	4.14	9	34	4.66	9
Resting	22	5.63	7	11	3.26	11	33	4.53	10
Skinniness (Thinness)	8	2.05	12	14	4.14	9	22	3.02	11
Body imbalance	6	1.54	13	5	1.48	12	11	1.51	12
Fluid dropping from nose	9	2.30	11	-	-	-	9	1.24	13
Swelling	5	1.28	14	3	0.89	13	8	1.10	14
Stomach bulge	2	0.51	15	3	0.89	13	5	0.69	15
Nervousness	1	0.26	16	-	-	-	1	0.14	16
I don’t know	34	8.70	5	27	7.99	5	61	8.37	6
Total	391	100.00	-	338	100.00	-	729	100.00	-

4.19.7. Methods of preventing /controlling health problems

The findings showed that the local people are using different methods to prevent and control ailments. Sanitation, including tooth brushing, was the most common method used to prevent and control human ailments in Erob District which accounted for 103 (52.82%) of the responses followed by fumigation (38, 19.49%). Similar results were also obtained from Gulomahda District with the most frequent method being sanitation including tooth brushing that accounted for 104 (52.53%) reports. Sanitation which accounted for 207 (52.67%) was the most common method used to prevent and control ailments in both districts (Table 34).

The findings showed that all of the key informants are used different methods to prevent lviestock from ailments. Fumigation was the most common method used to prevent and control ailments in Erob District which accounted for 13 (26.53%) of the responses. In Gulomahda District, the most frequent method was sanitation that accounted for 15 (29.41%) reports. Over all, fumigation was the most common method used to prevent and control ailments in in the study area which accounted for reports of 26 (26.00%) key informants (Table 35).

Table 34 Methods of controlling /preventing human health problems

Means of controlling ailments	**Erob District**			**Gulomahda District**			**Total**		
	No.	**%**	**Rank**	**No.**	**%**	**Rank**	**No.**	**%**	**Rank**
Sanitation such as brushing ones teeth	103	52.82	1	104	52.53	1	207	52.67	1
Fumigating	38	19.49	2	33	16.67	3	71	18.07	2
I don’t know	29	14.87	3	36	18.18	2	65	16.54	3
Having a break	8	4.10	4	16	8.08	4	24	6.11	4
Smelling a crushed *Allium sativum* mixed with *Ruta chalepensis*	6	2.94	6	8	4.04	5	14	3.56	5
Be careful while playing	8	4.10	4	-	-		8	2.04	6
Not working with a baby on ones back	3	1.54	78	1	0.50	6	4	1.02	7
Total	195	100.00	-	198	100.00	-	393	100.00	-

Table 35 Methods of controlling /preventing livestock health problems

Means of controlling ailments	Erob District			Gulomahda District			Total		
	No.	%	Rank	No.	%	Rank	No.	%	Rank
Fumigating	13	26.53	1	13	25.49	2	26	26.00	1
Washing	11	22.45	2	7	13.73	4	18	18.00	4
Sanitation	9	18.37	3	15	29.41	1	24	24.00	2
Isolating the infected animal	9	18.37	3	11	21.57	3	20	20.00	3
Break	7	14.29	5	5	9.80	5	12	12.00	5
Total	49	100.00	-	51	100.00	-	100	100.00	-

4.19.8. Options to treat ailments

Most of the local people reported the use of different methods believed to be helpful in curing ailments such as malaria, Tuber culosis, troma modern medicine. They also preferred to use holy water for general health problems. The majority (99, 54.10%) of the informants reported using almost any option that is believed to cure ailments, including herbal medicine, modern medicine and holy water followed by both traditional medicinal plant and modern medicine (56, 30.60%) and more of traditional medicinal plant (28, 15.30%) in Erob District. Similar results were obtained from Gulomahda District in that most of the local people used options including herbal medicine, modern medicine and holy water to treat human health problems that accounted for 132 (66.33%) followed by both traditional medicinal plants and modern medicine (39, 19.60%) and more of traditional medicinal plants (28, 14.07%).

Most of the informants (92, 50.27%) used variable options including herbal medicines, modern medicine and holy water to cure livestock ailments in Erob District. Some informants 33 (18.03%) preferred TMP only and 32 (17.49%) informants like to use modern medicine only. Few informants (26, 14.21%) were not familiar what option they had to use when the livestock were sick in the district. Most of the local people of Gulomahda District (111, 55.78%) also used various options to treat livestock ailments including herbal medicine, modern medicine and holy water. Some informants also preferred to use both TMP and modern medicine 28 (10.07%) and more of TMP (23, 11.56%). Some informants 37 (18.59%) were not sure what option they had to use when animals were sick.

All the key informants (34, 100%) said that they use all possible options including herbal medicine, holy water, animal medicine, modern medicine and others including plastic materials that they believed would cure human and livestock ailments as necessary.

4.19.9. Documentation of traditional medicinal practice

All of the key informants (34, 100%) did not document any traditional medicinal practice. According to the results of the study, all of the key informants transfer ethnobotanical knowledge mainly by a word of mouth. Furthermore, they are not interested to collaborate with other knowledgeable people and healers.

4.19.10. Degree of acceptance for the use of TMPs

Most of the key informants of the study districts agreed that themselves as well as most of the local people are interested to use herbal medicine especially to treat some ailments including febrile illness, constipation, tooth pain, stomach pain and wound for human ailments and itchy state, leech and wound for livestock diseases. Effectiveness, cheapness and easy reacheability are the reasons why the local people preferred to use herbal medicine and this was said by 9 (56.25%) key informants in Erob District and 11 (61.11%) key informants in Gulomahda District. Few key informants (2, 12.5%) in Erob District added lack of modern medicine as another factor why the local people preferred traditional medicinal practice.

On the other hand, 5 (31.25%) key informant from Erob District and 7 (38.89%) key informant from Gulomahda District reported the tendency of the local people to be treated by herbal medicine was on the decline from time to time due to several reasons including the fact that most herbal medicines lack standardized dose, sometimes it harms patients, mostly when to take the herbal medicine is not clear, sometimes doesn’t cure entirely and preference of modern medicine. This is also confirmed during group discussion and while interviewing the general informants.

4.20. Concern of the Local People on Medicinal Plant Species

4.20.1. Keeping traditional medicine made from plants for later use

Most of the informants (157, 85.78%) from Erob and Gulomahda (159, 79.90%) did not preserve traditional medicines made from plant materials for later use. On the other hand, some informants (26, 11.48%) in Erob and 40 (20.10%) in Gulomahda districts stored and preserved some traditional medicines made from plants by drying them for later use mostly associated with their other uses. This is also confirmed by the key informants (34, 100%) that only few plant species were preserved for medicinal purpose such as the bark of *Croton macrostachyus*, crushed leaves of *Becium grandiflorum* and *Justicia schimperiana* which are stored in local containers such as *Lagenaria siceraria* (Cucurbitaceae), portion of broken pot, pieces of cloth, tin and bottles.

4.20.2. Problems in collecting medicinal plants

Regarding the challenge faced when herbal medicines are collected from the field, a good numbers of the informants (68, 36.17%) replied that rarity in the vicinity of villages was most series to obtain traditional medicinal plants. This was followed by those who said availability gets reduced in the dry season, scoring 62 (32.98%) in Erob District. On the other hand, reduction of herbal medicine in dry season was the main problem to find plant species for herbal medicine which accounted for 97 (42.54%) in Gulmeheda District followed by rarity in the vicinity (50, 21.93%). Reduction of herbal medicine in dry season which accounted for 118 (28.37%) was the main problem to find plant species for herbal medicine in the study area (Table 36).

Table 36 Problems in collecting medicinal plants

Problems in collecting medicinal plant species	**Erob District**			**Gulomahda District**			**Total**		
	No.	**%**	**Rank**	**No.**	**%**	**Rank**	**No.**	**%**	**Rank**
Most rare in nearby areas	68	36.17	1	50	21.93	2	118	28.37	2
Reduction in dry season	62	32.98	2	97	42.54	1	159	38.22	1
No problems	34	18.09	3	36	15.79	4	70	16.83	3
Some literate people condemn TM use	15	7.98	4	39	17.11	3	54	12.98	4
Some are not willing to show where they are found	4	2.13	5	3	1.32	5	7	1.68	5
Mostly inaccurate measurement	3	1.60	6	-	-	-	3	0.72	7
Poison of some animals such as snake and scorpion	2	1.06	7	3	1.32	5	5	1.20	6
Total	188	100.00	-	228	100.00	-	416	100.00	

4.20.3. Effect of modernization on traditional medicinal knowledge

Most of the informants from Erob District 100 (51.81%) were not familiar with the effect or interferences of modernization on traditional medicinal knowledge while 38 (19.69%) informants were familiar with the effect of modernization on traditional medicinal knowledge including expansion of health centers and the presence of health workers. In case of Gulomahda District 90 (38.79%) informants were familiar with the effects of modernization on traditional medicinal knowledge including expansion of health centers and the increase in the number of health workers in the district while 39 (16.81%) informants were not familiar with the effect of modernization on traditional medicinal knowledge. Over all, most of the informants that accounted for 139 (32.71%) were not familiar with the interferences of modernization on traditional medicinal knowledge in the study area (Table 37). Furthermore, all of the key informants from both districts (34, 100%) agreed that modernization including expansion of education, health services such as hospitals, clinics, health posts and western cultural influence have affected and interfered with the use of herbal medicines and associated knowledge

Table 37 Effect of interference of modernization on traditional medicinal knowledge

Effect of modernization on traditional medicinal knowledge	Erob District			Gulomahda District			Total		
	No.	%	Rank	No.	%	Rank	No.	%	Rank
I don't know	100	51.81	1	39	16.81	2	139	32.71	1
Expansion of health centers and health workers	38	19.69	2	90	38.79	1	128	30.12	2
Most educated people criticize when someone uses traditional medicine	23	11.92	3	21	9.05	3	44	10.35	3
Most of the educated people are inclined to use western medicine	11	5.70	4	20	8.62	5	31	7.30	4
Declining of traditional medicine uses	9	4.66	5	19	8.19	6	28	6.59	5
Young generation inclined toward using western medicine	6	3.11	6	22	9.48	4	28	6.59	5
Road and house construction	4	2.07	7	12	5.17	7	16	3.77	7
Urban dwellers are inclined toward using western medicine	2	1.04	8	7	3.02	8	9	2.12	8
Only few types of plants are planted	-	-	-	2	0.86	9	2	0.47	9
Total	193	100.00	-	232	100.00	-	425	100.00	-

4.20.4. Marketability of medicinal plants

Most of the local people agreed that plant species used for traditional medicinal purposes are not sold in the market for medicinal use only but associated with other uses such as *Allium sativum, Ruta chalepensis, Brassica nigra, Citrus aurantifolia, Lepidium sativum, Linum usitatissimum*. Most of the informants (130, 71.04%) in Erob District and in Gulomahda District agreed (137, 68.64%) that medicinal plants are sold in the market associated with other uses. On the other hand, 53 (28.96%) informants from Erob District and 62 (31.16%) informants from Gulomahda District agreed that medicinal plants are not sold in the market. All the key informants also agreed that trade of herbal medicine is not common and mostly plant materials are not sold in the market for medicinal use only but they are associated with other uses. However, the informants confirmed that the patient is expected to give incentive to the healer and knowledgeable elders something including a goat, sheep, poultry, bread and cash depending on his/her wealth after he/she recovered from his/her illness.

Market survey also indicated no widely observed trade on medicinal plants in the study area. It is observed that medicinal plants were sold in the market mainly associated with other uses such as food, spices, fire wood and others including odor. Interviews of both sellers and buyers in the market also confirmed some medicinal plant species sold in the market were associated with other uses such as food and spice. Some of the plant species sold in the market associating with other uses were *Allium sativum, Acacia etbaica, Olea europaea* subsp. *cuspidata, Ruta chalepensis, Artemisia absinthium, Brassica nigra, Citrus aurantifolia*, *Lepidium sativum, Linum usitatissimum, Ocimum basilicum, Trigonella foenum-graecum, Triticum aestivum* and *Capsicum annuum* (Figure 14).

Figure 14 Market survey of medicinal plants in the study area

A person selling *Allium sativum* (A), *Trigonella foenum-graecum* (B), *Ocimum basilicum* (C) on Saturday market of Dewuhan (Erob District) *Allium sativum* (D), *Ruta chalepensis* and *Allium sativum* (E) and *Citrus aurantifolia* (F) in Sebeya and Fasti market (Gulomahda District) (N.B. The red mark indicate the plant species) (Photo: By Taddese Beyene, 2012).

4.20.5. Conservation and protection of traditional medicinal plants

Most of the informants (120, 63.16%) from Erob District and 127 (58.80%) from Gulomahda District have made no attempt to conserve the traditional medicinal plants they used. On the other hand, 57 (30.00%) informants from Erob District and 56 (25.93%) from Gulomahda indicated that they cultivate MP in their homegardens (Table 38). Similar results were obtained from the interview conducted with the key informants that most of them which accounted for 21 (61.77%) didn’t attempt to conserve herbal medicines. Thirteen (38.23%) key informants were attempting to conserve herbal medicines in their homegardens, as live fence as well as cultivated fields and do not uproot of TMP species.

Table 38 Attempts to conserve traditional medicinal plant species

Conservation attempt	**Erob District**			**Gulomahda District**			**Total**		
	No.	**%**	**Rank**	**No.**	**%**	**Rank**	**No.**	**%**	**Rank**
No conservation	120	63.16	1	127	58.80	1	247	60.84	1
Homegarden	57	30.00	2	56	25.93	2	113	27.83	2
Avoiding uprooting	3	1.38	4	14	6.48	3	17	4.19	3
Live fence	7	3.68	3	9	4.17	4	16	3.94	4
Through proper use	2	1.05	5	7	3.24	5	9	2.22	5
Not to showing to others where they are found	1	0.53	6	3	1.39	6	4	0.99	6
Total	190	100.00	-	216	100.00	-	406	100.00	-

4.20.6. Threats to the medicinal plants

Almost all of the informants distinguish one or more than one threat that causes medicinal plants to be scarce in the study area. According to the informants, the highest reported threat for the scarcity of medicinal plant species was shortage of rain which accounted for 159 (27.46%) followed by firewood 131 (22.63%) in Erob District and 185 (26.58%) and 141 (20.26%), respectively, in Gulomahda District. Over all, scarcity of rain which accounted for 344 (26.98%) followed by firewood 272 (21.33%) were the most threats of MPs in the study area (Table 39).

Table 39 Threats to the medicinal plants

Threats	Erob District			Gulomahda District			Total		
	No.	%	Rank	No.	%	Rank	No.	%	Rank
Scarcity of rain	159	27.46	1	185	26.58	1	344	26.98	1
Use as firewood	131	22.63	2	141	20.26	2	272	21.33	2
Use as fodder	89	15.37	3	106	15.23	4	195	15.29	3
House construction	59	10.19	4	113	16.24	3	172	13.49	4
Charcoal making	16	2.76	9	33	4.74	5	49	3.84	5
Farming	22	3.80	7	22	3.16	7	44	3.45	6
Cutting for fencing	11	1.90	10	33	4.74	5	44	3.45	6
Uprooting	23	3.97	6	19	2.73	9	42	3.29	8
Wasteful use	20	3.45	8	21	3.02	8	41	3.22	9
Conflict	28	4.84	5	3	0.43	13	31	2.43	10
Furniture making	6	1.04	11	4	0.58	11	10	0.78	11
Tooth brush	2	0.35	15	6	0.86	10	8	0.63	12
Use before fruiting	4	0.69	12	3	0.43	13	7	0.55	13
Others (non ranked)	9	1.56	-	7	1.01	-	16	1.26	-
Total	579	100.00	-	696	100.00	-	1275	100.00	

The local people mentioned 15 factors which caused traditional medicinal plants to be scarce. The results of ten key informants priority ranking of nine highly cited threats that affect the traditional medicinal plant species are given in Tables 40 and 41.

The scarcity of rain (drought) was perceived to be the greatest threat that was ranked first, followed by conflict, fuel (firewood) and fodder in Erob District (Table 40). Scarcity of rain (drought) also came in the first rank as threat in Gulomahda District followed by fuel, conflict and farming (Table 41). Over all, scarcity of rain (168), conflict (156) and fuel

(150) were the three most treats of MPs in the study area which are stood 1st, 2nd and 3rd respectively.

Table 40 Priority ranks of threats to medicinal plants in Erob District

Threat	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	T	Rank
Scarcity of rain	9	8	9	8	7	8	9	8	9	9	84	1
Conflict	8	7	8	9	8	9	8	9	8	8	82	2
Fuel	7	9	7	6	9	7	6	5	7	7	70	3
Fodder	6	6	6	7	6	6	7	7	6	6	63	4
Wastage usage	5	4	3	5	1	5	2	4	5	3	37	5
Farming	3	2	5	3	3	3	3	5	3	5	35	6
House construction	4	3	4	2	4	2	3	3	2	4	31	7
Fence	2	5	1	4	2	2	5	2	4	2	29	8
Uprooting	1	1	2	1	5	1	1	1	1	1	15	9

Table 41 Priority ranks of threats to medicinal plants in Gulomahda District

Threat	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	T	Rank
Scarcity of rain	9	8	9	8	7	8	9	8	9	9	84	1
Fuel	7	9	7	9	8	7	8	9	8	8	80	2
Conflict	8	7	8	6	9	9	6	7	7	7	74	3
Farming	6	6	5	4	6	3	4	6	6	3	49	4
Fence	3	2	6	3	3	6	7	5	3	5	43	5
House construction	5	4	3	5	1	5	2	4	5	6	40	6
Wastage usage	4	3	4	2	4	4	3	3	2	4	33	7
Uprooting	2	5	1	7	2	2	5	2	4	2	32	8
Fodder	1	1	2	1	5	1	1	1	1	1	15	9

4.20.7. Methods recommended to conserve traditional medicinal plants

Almost all of the informants have recommended some methods to conserve and protect TMP species. More informants, 157 (37.47%), recommended to conserve and protect TMP species by replanting them, especially shrubs and trees. In Gulomahda District, the highest (181, 30.99%) method recommended was to conserve and protect TMP species in homegardens and planting in nearby areas. Over all, the highest (311, 34.48%) method recommended was replanting followed by homegardens and planting in nearby areas (301, 33.37%) (Table 42).

Table 42 Methods recommended by the local people of the study area to conserve TMPs

Recommended conservation and protection methods	**Erob District**			**Gulomahda District**			**Total**		
	No	**%**	**Rank**	**No**	**%**	**Rank**	**No**	**%**	**Rank**
Replanting	157	37.47	1	154	26.37	3	311	34.48	1
Homegarden and nearby areas	120	28.64	2	181	30.99	1	301	33.37	2
Protecting plant community having MP	62	14.80	3	160	27.40	2	122	13.53	3
Alternative energy including electrification and biogas	30	7.16	4	8	1.37	7	38	4.21	4
Avoidance of uprooting	12	2.86	6	20	3.42	4	32	3.55	5
Efficient use	13	3.10	5	19	3.25	5	31	3.44	6
Living fence	7	1.67	7	14	2.40	6	21	2.33	7
Keeping until seeding and fruiting	6	1.43	8	6	1.03	11	12	1.33	8
Education	4	0.96	9	7	1.20	9	11	1.22	9
Avoid to use rare plants	4	0.96	9	7	1.20	9	11	1.22	9
Planting in farm land	3	0.72	11	8	1.37	7	11	1.22	9
I don't know	1	0.24	12	-	-	-	1	0.11	12
Total	419	100.00	-	584	100.00	-	902	100.00	-

4.21. Group Discussion and Field Observation

During group discussion informants said that that some traditional medicinal plants were becoming scarce from time to time due to natural and anthropogenic factors. Sometimes, it was difficult to find some medicinal plants during the dry season especially the herbs. Some of the participants that had traditional medicinal plants in their homegardens and others were planning to cultivate some of the most essential ones. They also agreed that the diversity of plant species used for traditional medicine have been declining even though there were attempts and tendencies to conserve and protect plant communities in which traditional medicine plants are also found.

The knowledge on traditional medicinal plants especially of the young generation had seem to decline from time to time because of the expansion of health centers and health posts in each kebele and the growth of health workers which let them to prefer the Western healthcare system than the traditional medicine. They agreed that modernization led the young generation not to be interested in the use of traditional herbal medicine.

During treatments, a cross sign was made on the forehead of a patient suffering from febrile illness, cough and evil eye before and after administering traditional medicine to see the actions of the medicine for temperature dropping which was also mentioned by some healers and knowledgeable elders.

They also agreed that plants were not sold in the market for the purpose of traditional medicine but for other uses such as spices in the case of the medicinal crops *Ruta chalepensis* and *Allium sativum*, for food in the case of the seeds of *Linum usitatissimum*, fruits of *Citrus aurantifolia* and seeds of *Hordeum vulgare* and fresh leaves of *Rhamnus* *prinoides* in traditional beverage (MES) which was also confirmed during market survey and semi-structure interviews.

Group discussion also confirmed that trees and shrubs were exploited by Eritrean soldiers to build their cordons, for fire wood and for other purposes including for construction. The people who had been living under the military control and their neighbors were also forced to exploit plant species during that time because there were no other alternatives of fuel and light.

In general, key informants and general informants indicated that the people of their respective communities used traditional medicinal plants to treat both human and livestock health problems. They used different plant parts to prepare traditional medicine, different dosages and other ingredients based on the type of ailments (Appendix 4).

The findings confirmed that the informants gave priority to the immediate use of MPs than to their sustainable future. As a result, their harvesting style was destructive. However, spiritual beliefs played a great role in the conservation, protection and distribution of medicinal plants in the study area. The church compounds harbored and kept many medicinal plants that were used by the local people as source of TMP under the provisions of priests. The church compound of Aba-Libanos in Ambesete-fikada / Gulomahda District comprised plant species like *Acacia origena* and *Olea europaea* that were used by the local people for medicinal purpose (Figure 15 and Appendix 15).

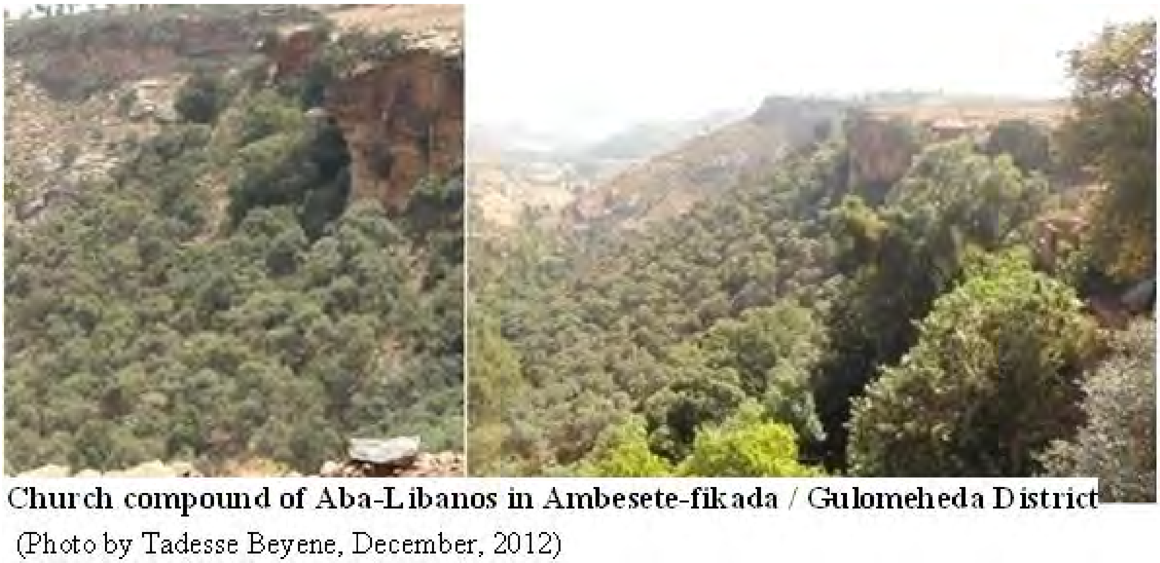
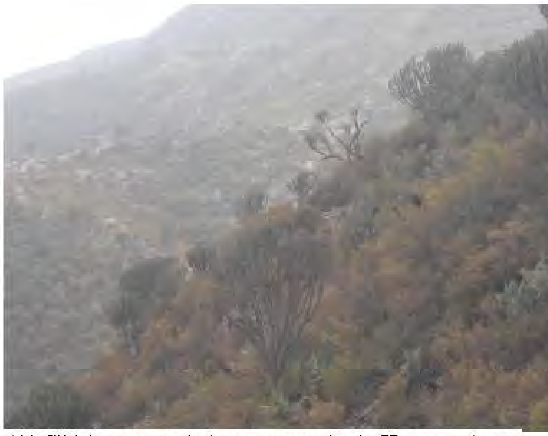


Figure 15 Church compound of Aba-Libanos in Ambesete-fikada / Gulomahda District

During field observation and group discussion, the presence of areas with protected plant community were observed which harbored many medicinal plants that were rare or absent in the adjacent unprotected areas. Sibida Protected Plant Community in Hareze-sebeata (Figure 16A and Appendix 14); Giniato Protected Plant Community in Hareze-sebeata (Figure 16B and Appendix 14), Arer Protected Plant Community in Dewuhan (Figure 16C and Appendix 14); As-aleta Protected Plant Community in Dewuhan (Figure 16D and Appendix 14) were all in Erob District.



(A) Sibida protected plant community in Hareze-sebeata

(B) Giniato protected plant community in Hareze-sebeata

(C) Arer protected plant community in Dewuhan

(D) As-aleta protected plant community in Dewuhan

Figure 16 Sample photos of protected plant communities in Erob District

(Photo: By Taddese Beyene, November, 2012)

Furthermore, Sihurto Protected Plant Community in Sebeya (Figure 17A and Appendix 14); Alakima Protected Plant Community in Rigbay-medabay (Figure 17B and Appendix 14); Sebeya Protected Plant Community in Sebeya (Figure 17C and Appendix 14) all in Gulomahda District harbor several medicinal plant species used by the local people.

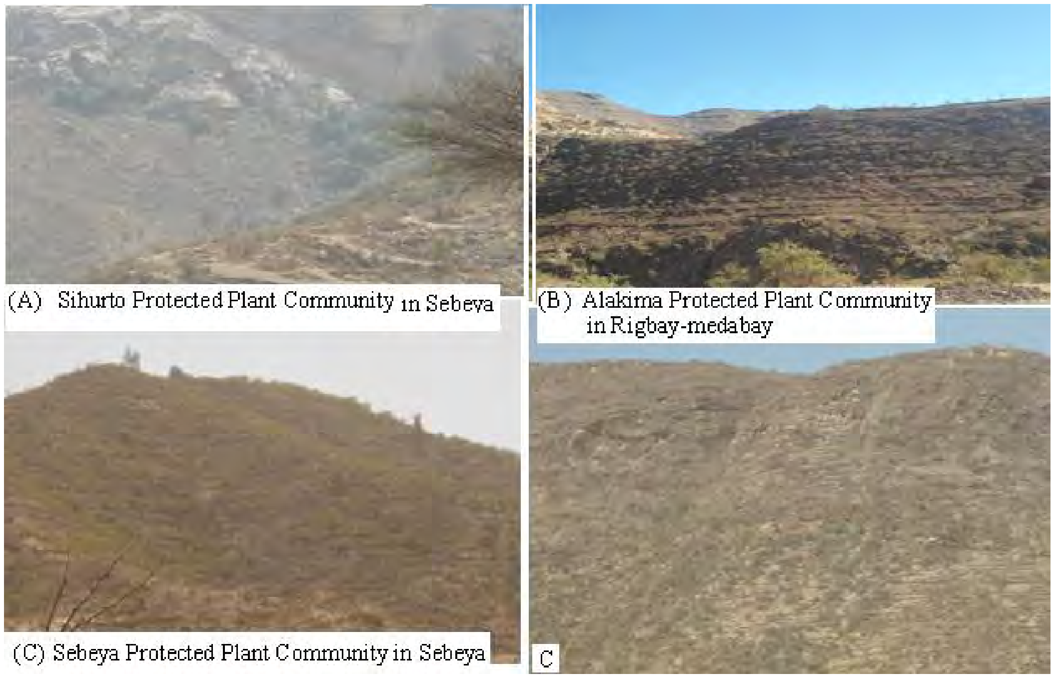


Figure 17 Sample photos of protected plant community in Gulomahda District

There were better number of MPs in areas that were used for gardening purpose as it was observed in Asabol gardening area in Dewuhan (Figure 18 and Appendix 14) in Erob District which contained MP such as *Psidium guajava*, *Rhamnus prinoides* (Figure 18 A) and *Lagenaria siceraria* (Figure 18B) which were used by the local people for medicinal purpose.

Figure 18 Asabol gardening area in Dewuhan/Erob District

(Photo: By Taddese Beyene, November, 2012)

The on-going efforts by the local people in all the study kebeles to rehabilitate degraded lands and protecting plant community enabled the area to harbor medicinal plant species such as *Acacia etbaica*, *Acacia origena*, *Dodonaea angustifolia* and *Calpurnia aurea* in Alitenia in Erob District (Figure 19A) and Sebeya in Gulomahda District (Figure 19B).

Figure 19 On-going efforts to rehabilitate degraded lands in the study area

(Alitenia in Erob District (A) and Sebeya in Gulomahda District (B) (Photo: By Taddese Beyene, Dec., 2012)

Field observation also confirmed the number and type of medicinal plants varied between area under protection and area which was not protected. The area under protection had better number of medicinal plants than the area which was not properly protected, for example, *Acacia etbaica*, *Euphorbia abyssinica, Hypoestes forskaolii*, *Rumex nervosus* and *Acacia origena* which were rare or absent in the unprotected nearby area in Dewuhan (Alitenia)/ Erob District (Figure 20).

Figure 20 Comparison of protected and non protected plant communities in Dewuhan/ Erob District

(Photo: By Taddese Beyene, Dec., 2012)

Group discussion with the local people indicated that the knowledge on traditional medicinal plants, especially of the young generation had been seen declining from time to time because of the expansion of health centers and health posts in each kebele and the increase in the number of health workers who influence them to prefer the western healthcare system than the traditional medicine. They agreed that modernization has led the young generation not to be interested in the use of traditional herbal medicine.

Group discussion confirmed that healers and knowledgeable elders did not have enough understanding about significance of neatness of the equipment used to prepare traditional medicines which is also confirmed by the key informants (34, 100%). One equipment have been used to prepare different type of traditional medicines without or little attempt to clean it such as by brushing it with neat less cloth, washing without detergents to prepare other herbal medicine to treat another ailment from another and different plants species.

Guided field walk

Ethnobotanical data collected from the study area by means of guided field walk indicated that most of the local people used traditional medicine prepared from plant parts during infection for both humans and livestock in different ways and dosages based on the type of ailment. The most common health problems mentioned were stomach pain, febrile illness, wound, leech, itchiness and many others.

They also reflected that accessibility of plants decreased during the dry season when it becomes difficult to find especially the herbs. They also agreed that the diversity of plant species used for traditional medicine have been declining even though there were attempts and tendencies of conserving and protecting plant communities in which traditional medicine plants were also found.

4.22. Folklore on Medicinal Plants

The local people of the study districts popularly used proverbs to describe the importance of plant species especially on utilization of plants for medicinal purposes. This could be easily understood from the following local sayings, just to mention some of the proverbs used to express the value of their health, and these are very popular in the area as informed by elders:

- ***E'ts yqetil we e'ts yehieyw*** (A drug can kill and a drug can save). This old proverb in Geez language on MP species showed the importance and curative power of herbal medicines if they are used appropriately according to the prescription of the herbalists and knowledgeable elders as well as taking into consideration the risks emanating from miss use or abuse.

- ***Agol yedhin kab agel*** (*Withania somnifera* is vital during critical health problems). This proverb indicates how the local people benefit from *Withania somnifera* to protect themselves from unexpected abrupt illness.
- ***Ent-kortseka kebdiha tetekem Atuch-ka*** (Use *Verbena officinalis* when you suffer from stomach pain). This proverb indicates that people of the study area would not suffer due to stomach pain if *Verbena officinalis* was found in the vicinity, provided that there was a person in the community who knows how to use it.
- ***Alewuna bizuhat bahlawi medhanitat kolay sorasur*** (There are many traditional medicines including those prepared from the root of plant species). This proverb indicates that there are many human and livestock ailments which are treated in the study area and this includes traditional medicines prepared from plant parts including roots. This further testifies that plant material has been used in the study area for a long time as medicine.

4.23. Importance of Medicinal Plant Species

Through various ethnobotanical ranking, comparison and sorting exercises, the most important and the priority MP species have been distinguished.

4.23.1. Community preferences for medicinal plants

Preference ranking of medicinal plant species used in treating the highest number of human ailments was done in both districts. It was foundout that *Aloe elegans* was known for treating eight different human ailments in Erob District. *Schinus molle* which was used for treating seven different human ailments also stood first in Gulomahda District (Appendices 4 and 7). The results showed that *Aloe elegans* was the most preferred MP to treat abdominal pain which accounted for 67 summed preference value of ten key informants followed by malaria (60) and arthritis /rheumatism (56) in Erob District (Table 43). For Gulomahda District, the findings showed that *Schinus molle* was the most preferred MP to treat abdominal pain which accounted for 58 followed by its use for treating vomiting (50) (Table 44).

Table 43 Preference ranking of *Aloe elegans* on treating eight human ailments in Erob District (8=best; 1=least)

Ailments	**Key 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}**		
Abdominal pain	6	7	7	4	8	8	6	8	7	6	67	1
Malaria	8	6	5	8	5	5	2	6	8	7	60	2
Arthritis /rheumatism	4	5	8	7	7	4	5	5	3	8	56	3
Hemorrhoids	5	8	1	2	6	6	7	2	6	5	48	4
Jaundice	7	3	6	3	4	2	8	1	4	3	41	5
Infection of eye	3	4	4	1	3	7	4	3	2	1	32	6
Head ache	2	2	3	5	1	1	3	7	1	4	29	7
house fly on the wound	1	1	2	6	2	3	1	4	5	2	27	8

Table 44 Preference ranking of *Schinus molle* on treating seven human ailments in Gulomahda District

(7=best; 1=least)

Ailments	**Key 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}**		
Abdominal pain	5	6	6	4	7	7	5	7	6	5	58	1
Vomiting	7	5	4	7	4	4	1	5	7	6	50	2
Abortion	3	4	7	6	6	3	4	4	3	7	47	3
Tonsillitis	4	7	1	2	5	5	6	2	5	4	41	4
Fever	6	2	5	3	3	2	7	1	4	2	35	5
Febrile	2	3	3	1	2	6	3	3	2	1	26	6
Wound (head)	1	1	2	5	1	1	2	6	1	3	23	8

Preference ranking of medicinal plant species used to treat the most cited livestock ailments was done in both districts. It was foundout that body itch was the most cited livestock ailment which ranked first in both districts (Appendix 15). *Acacia origena*, *Calpurnia aurea, Nicotiana glauca* and *Rumex nervosus* were the medicinal plant species used to treat body itch in Erob District and these four species plus two others (*Otostegia integrifolia*, and *Vernonia rueppellii*) were used against itch in Gulomahda District.

Regarding the preferences for these medicinal plant species in treating itch as perceived by the informants, the findings showed that *Calpurnia aurea* in Erob District (Table 45) and *Nicotiana glauca* in Gulomahda District (Table 46) were the most preferred MPs to treat itchiness, which accounted for 30 and 44 cases, respectively.

Table 45 Preference ranking of MPs treating itch of livestock in Erob District (84=best; 1=least)

Ailments	Key informants (R_1—R_8)								Total	Rank
	R_1	**R_2**	**R_3**	**R_4**	**R_5**	**R_6**	**R_7**	**R_8**		
Calpurnia aurea	3	4	4	4	4	4	3	4	30	1
Nicotiana glauca	4	3	2	2	2	3	4	2	22	2
Acacia origena	2	1	3	3	3	1	2	3	18	3
Rumex nervosus	1	2	1	1	1	1	2	1	10	4

Table 46 Preference ranking of MPs treating itch of livestock in Gulomahda District (6=best; 1=least)

Ailments	Key informants (R_1—R_8)								T	R
	R_1	**R_2**	**R_3**	**R_4**	**R_5**	**R_6**	**R_7**	**R_8**		
Nicotiana glauca	6	5	6	4	6	6	5	6	44	1
Vernonia rueppellii	4	6	5	6	5	4	6	4	40	2
Calpurnia aurea	5	4	4	5	4	5	4	5	36	3
Rumex nervosus	3	2	3	3	1	2	3	3	20	4
Acacia origena	1	3	2	1	2	3	2	1	15	5
Otostegia integrifolia	2	1	1	2	3	1	1	2	13	6

A paired comparison of five highly cited MPs used to treat a highly cited human ailment (febrile illness) (appendix 16) by ten key informants were done in Erob and Gulomahda districts among five medicinal plants. It showed that *Cordia africana* was the most preferred plant species, which has the highest score of 71 followed by *Cynoglossum lanceolatum* (70) in Erob District (Table 47). The preference ranking of these medicinal plants against febrile illness in Gulomahda District showed that *Cynoglossum lanceolatum* was the most preferred plant species against febrile illness, which obtained the highest score of 72 followed by *Cordia africana* (69) (Table 48).

Table 47 Pair wise ranking of five MPs used to treat febrile in Erob District

Plant species	Key Informants (R_1—R_{10})										
	R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**	**Total**	**Rank**
Cordia africana	8	7	8	6	8	8	4	6	8	8	71	1
Cynoglossum lanceolatum	7	7	4	8	7	7	8	8	7	7	70	2
Withania somnifera	6	5	7	5	6	5	7	5	5	6	57	3
Eucalyptus globulus	5	6	6	4	5	6	7	4	6	5	54	4
Schinus molle	4	5	5	7	4	4	4	7	4	4	56	5

Table 48 Pair wise ranking of five MPs used to treat febrile in Gulomahda District

Plant species	Key Informants (R_1—R_{10})										
	R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**	**Total**	**Rank**
Cynoglossum lanceolatum	7	8	4	7	7	8	7	8	8	8	72	1
Cordia a fricana	8	6	8	8	8	7	8	6	4	6	69	2
Withania somnifera	6	5	7	5	6	5	5	5	7	7	58	3
Eucalyptus globulus	5	4	6	6	5	6	6	4	7	5	54	4
Schinus molle	4	7	5	4	4	4	4	7	4	4	47	5

A paired comparison of four highly cited MPs used to treat the second highly cited livestock ailment (leech) (appendix 17) by eight key informants selected from Erob District showed that *Nicotiana tabacum* was the most preferred MP which scored 46 followed by *Meriandra dianthera (*42) (Table 49). Similarily, *Nicotiana tabacum* was the most preferred MP to treat leech which scored 45 followed by *Maytenus senegalensis* (42) in Gulomahda District (Table 50).

Table 49 Pair wise ranking of 4 MPs used to treat leech (livestock) in Erob District

Plant species	Erob District (Key Informants: R_1—R_8)									
	R1	R2	R3	R4	R5	R6	R7	R8	Total	Rank
Nicotiana tabacum	6	6	6	6	5	6	6	5	46	1
Meriandra dianthera	5	5	5	5	6	5	5	6	42	2
Tarchonanthus camphorates	4	3	4	3	4	3	3	4	28	3
Acacia etbaica	3	4	3	4	3	4	4	3	28	3

Table 50 Pair wise ranking of 4 MPs used to treat leech (livestock) in Gulomahda District

Plant species	Gulomahda District (Key Informants: R_1—R_8)									
	R1	R2	R3	R4	R5	R6	R7	R8	Total	Rank
Nicotiana tabacum	6	6	5	6	5	6	6	5	45	1
Maytenus senegalensis	5	5	5	5	6	5	5	6	42	2
Lycopersicon esculentum	4	3	5	3	4	3	3	5	30	3
Acacia etbaica	3	4	3	4	3	4	4	2	27	4

A triadic comparison of six highly cited MPs that were used to treat abdominal pain, which was the 2nd highly cited human ailment (appendix 16) by ten key informants showed that *Schinus molle* was the most preferred medicinal plant against abdominal pain which accounted for 66 scores followed by *Olea europaea* (57), *Verbena officinalis* (38) and *Aloe elegans* (22) in Erob Dstrict (Table 51). Triadic comparison of the same plant species in Gulomahda District showed *Verbena officinalis* was the most preferable medicinal plant against abdominal pain which scored 69 followed by *Olea europaea* (57), *Aloe elegans* (40) and *Cynoglossum lanceolatum* (23) (Table 52).

Table 51 Triadic comparison on 6 MPs against abdominal pain in Erob District

Medicinal plant	Key informants (R_1—R_{10})											
	R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**	**Total**	**Rank**
Schinus molle	7	8	5	8	4	6	10	7	3	8	66	1
Olea europaea	5	3	3	7	6	7	6	8	6	6	57	2
Verbena officinalis	5	4	5	2	2	4	2	3	9	2	38	3
Aloe elegans	2	3	4	1	6	2	1	1	1	0	21	4
Cynoglossum lanceolatum	1	2	2	1	1	1	1	1	1	3	14	5
Withania somnifera	0	0	1	1	1	0	0	0	0	1	4	6

Table 52 Triadic comparison on 6 MPs against abdominal pain in Gulomahda District

Medicinal plant	Key informants (R_1—R_{10})											
	R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**	**Total**	**Rank**
Verbena officinalis	8	7	9	8	3	6	10	7	3	8	69	1
Olea europaea	4	3	2	7	6	8	6	9	6	6	57	2
Aloe elegans	5	5	5	2	1	5	2	3	10	2	40	3
Cynoglossum lanceolatum	2	4	3	1	10	1	1	0	1	0	23	4
Schinus molle	1	1	1	1	0	0	1	1	0	3	9	5
Withania somnifera	0	0	0	1	0	0	0	0	0	1	2	6

4.23.2. Use diversities of the collected traditional medicinal plants

In the study area, it was found that some plants were reported to have uses other than their medicinal values such as fuel, house construction, fence and others including as food.

Of the total 85 medicinal plants documented from Erob District, 28 (18.54%) were reported to have only medicinal use. On the other hand, 57 (81.46%) of the traditional medicinal plants had additional uses. Accordingly, use as fuel came up with the highest number of plant species (35, 23.18%) followed by food (23, 13.25%) (Table 53).

Of the total 102 medicinal plants documented in Gulomahda District, 28 (15.82%) were reported to have only medicinal use. On the other hand, 74 (84.18%) of the traditional medicinal plants had additional uses. Accordingly, use as fuel had the highest number of plant species (44, 24.86%) followed by food (26, 14.69%) (Table 53).

To sum up, of the total 121 medicinal plants documented in the study area, 39 (19.31%) were reported to have only medicinal use. On the other hand, 82 (80.69%) of the traditional medicinal plants have additional uses. Use of medicinal plants as fuel turned out to be with the highest number of plant species (45, 22.28%) followed by food (29, 13.36%) and fence (15, 7.43%) (Table 53).

Based on their use diversity in the study districts, ten multipurpose plant species were selected. Ten top use diversities of these plants were listed for ten randomly selected key informants from Erob and Gulomahda districts, respectively, to assess their relative importance in their respective localities. The ten uses included medicinal, fodder and forage, food, fuel, construction, stick, fencing, tooth brush, fumigation and furniture making. Each key informant was asked to assign use values 10 (best) to 1 (least) used and responses of each key informant assigned use values for the ten multipurpose medicinal plant species and the scores of each species were summed up and ranked (Tables 54 and 55).

Acacia etbaica, *Olea europaea*, *Cordia africana* and *Juniperus procera* were ranked 1st, 2nd, 3rd and 4th respectively and hence were found to be the most preferred medicinal plants by the local people of Erob District for various uses (Table 54).

Table 53 Use diversity of medicinal plants gathered from the study area

Type of use	**Erob District**			**Gulomahda District**			**Total**		
	No.	**%**	**Rank**	**No.**	**%**	**Rank**	**No.**	**%**	**Rank**
Fuel	35	23.18	1	44	24.86	1	45	22.28	1
Only medicinal	28	18.54	2	28	15.82	2	39	19.31	2
Edible (food, drink)	20	13.25	3	26	14.69	3	29	14.36	3
Fence (living and non- living)	13	8.61	4	14	7.91	4	15	7.43	4
Fodder	8	5.30	5	10	5.65	5	11	5.45	5
Spice	7	4.64	6	6	3.39	12	9	4.46	6
Shade	7	4.64	6	5	2.83	13	8	3.96	7
House construction	4	2.65	9	5	2.83	13	5	2.48	9
Forage	5	3.19	8	5	2.83	13	5	2.48	9
Mat	3	1.99	12	3	1.70	19	4	1.98	11
Tooth brush	2	1.33	14	4	2.26	16	4	1.98	11
Making injera, bread and local beer	4	2.65	9	4	2.26	16	4	1.98	11
Equipment	4	2.65	9	4	2.26	16	4	1.98	14
Fumigation of container	3	1.99	12	3	1.70	19	3	1.49	14
Stick	2	1.33	14	2	1.13	21	2	0.99	16
Ornamental (Odor)	1	0.66	17	1	0.57	25	2	0.99	16
Broom	1	0.66	17	2	1.13	21	2	0.99	16
Hay	1	0.66	17	2	1.13	21	2	0.99	16
Glue	1	0.66	17	2	1.13	21	2	0.99	16
Others (hive hanging, cloth making, container, detergent, pot washing)	2	1.33	14	7	3.96	11	7	3.47	8
Total	151	100.00	-	177	100.00	-	202	100.00	-

On the other hand, the results showed that, *Olea europaea*, *Cordia africana*, *Acacia etbaica* and *Dodonaea angustifolia* were ranked 1st, 2nd, 3rd and 4th and hence they were the most preferred medicinal plants by local people of Gulomahda District for various uses (Table 55).

Overall, *Olea europaea* (1735), *Acacia etbaica* (1719), *Cordia africana* (1606), *Dodonaea angustifolia* (1180) and *Juniperus procera* (1169) were ranked 1st, 2nd, 3rd, 4th and 5th and hence they were the most preferred medicinal plants by local people of Erob and Gulomahda district for various uses.

Table 54 Average score for direct matrix ranking of ten MP species in Erob District

(M=’Medicinal, C= Construction, F=Fuel, Fr=Forage, Fd=fodder, Fu= Furniture, St=Stick, Tb= Tooth brush, Fg= Fumigation, Fe=fence, Fo=Food)

Plant species	**M**	**C**	**F**	**Fr&Fd**	**Fu**	**St**	**Tb**	**Fg**	**Fe**	**Fo**	**Total**	**Rank**
Acacia etbaica	87	91	89	84	94	94	83	91	97	96	906	1
Olea europaea	85	78	78	88	79	76	84	85	85	85	823	2
Cordia africana	76	86	77	77	52	84	76	84	75	75	762	3
Juniperus procera	67	44	66	66	52	76	56	47	67	67	608	4
Dodonaea angustifolia	77	64	59	55	34	65	58	41	63	55	571	5
Maytenus senegalensis	46	63	47	47	75	44	69	75	45	43	554	6
Ziziphus mauritiana	57	32	54	55	62	44	40	25	42	42	453	7
Calpurnia aurea	45	21	48	25	57	25	59	35	51	18	384	8
Ficus ingens	18	14	26	16	45	15	25	35	33	35	262	9
Aloe elegans	12	12	14	11	14	22	15	14	23	12	159	10

Table 55 Average score for direct matrix ranking of ten MP species in Gulomahda District

Plant species	M	C	F	Fr&Fd	Fu	St	Tb	Fg	Fe	Fo	Total	Rank
Olea europaea	94	93	99	89	94	95	85	91	94	78	912	1
Cordia africana	85	88	88	87	79	78	87	87	90	75	844	2
Acacia etbaica	76	89	87	87	50	85	86	83	85	85	813	3
Dodonaea angustifolia	67	45	66	65	59	75	57	44	64	67	609	4
Juniperus procera	70	75	58	55	24	65	55	51	53	55	561	5
Maytenus senegalensis	48	62	47	47	75	45	67	75	44	45	555	6
Ziziphus mauritiana	52	35	64	75	65	44	48	25	42	46	496	7
Calpurnia aurea	45	24	28	25	57	23	55	25	21	28	331	8
Ficus ingens	17	15	21	11	38	15	15	38	13	35	218	9
Aloe elegans	12	13	12	11	14	12	13	12	13	14	126	10

4.24. Informant Consensus and Relative Cultural Importance (RCI) Indices

4.24.1. Agreement of informants on MP species to treat a particular ailment

The informants consensus obtained during this study indicated that some medicinal plant species were more popular than others (Appendix 18). *Argemone mexicana* was cited by the highest number of informants in Erob and Gulomahda districts to treat human ailments (Table 56). Over all, *Argemone mexicana* (214), *Achyranthes aspera* (170) and *Cynoglossum lanceolatum* (193) are the most cited and thus popular medicinal plants in treating human ailments ranked 1st, 2nd and 3rd in the study area.

Table 56 Informant consensus of most popular medicinal plants treating human ailments

Scientific name	**Erob District**			**Gulomahda District**		
	No. of informants	**%**	**Rank**	**No. of informants**	**%**	**Rank**
Argemone mexicana	104	6.83	1	110	6.00	1
Achyranthes aspera	91	5.98	2	79	4.31	3
Cynoglossum lanceolatum	87	5.72	3	106	5.78	2
Rhamnus prinoides	64	4.21	4	40	2.18	9
Ruta chalepensis	62	4.08	5	69	3.76	5
Verbena officinalis	56	3.68	6	45	2.46	7
Olea europaea	53	3.48	7	42	2.29	8
Acacia etbaica	50	2.29	8	46	2.51	6
Withania somnifera	47	3.09	9	64	3.49	8
Schinus molle	44	0.92	10	75	4.09	4

In addition, the informants' consensus also indicated some medicinal plant species were more popular than others for treating livestock ailments in the study districts (Appendix 17). *Nicotiana tabacum* and *N. glauca* were the most cited medicinal plant species used for treating livestock ailments in the study districts (Table 57).

Table 57 Informant consensus of medicinal plants treating livestock ailments

(One plant species was cited by more than one informant)

Scientific name	Erob District			Gulomahda District		
	No. of informants	%	Rank	No. of informants	%	Ra nk
Nicotiana tabacum	91	37.14	1	93	23.08	1
Nicotiana glauca	82	33.47	2	93	23.08	1
Acacia etbaica	12	4.90	3	13	3.23	7
Tarchonanthus camphoratus	8	3.27	4	5	1.24	15
Datura stramonium	7	2.86	5	-	-	-
Meriandra dianthera	6	2.45	6	14	3.47	6
Leucas abyssinica	-	-	-	24	5.96	4
Otostegia integrifolia	-	-	-	29	7.16	3
Calpurnia aurea	1	0.41	17	17	4.22	5

Various human ailments were treated traditionally by medicinal plant species locally in the study districts. The number of ailments mentioned varied from district to district. Accordingly, 49 human ailments that were common to both Erob and Gulomahda districts were listed. Furthermore, other nine human ailments were those found only in Erob District giving a total of 58 human ailments treated by traditional medicinal plants in the district. The most cited human ailment in this District was febrile illness (144, 14.23%) followed by wound (134, 13.24%) and tonsillitis (107, 10.57%) (Table 58 and Appendix 16).

Similarly, 18 human ailments were confined to Gulomahda District, additional to the 49 ailments that were common to both. This gives a total of 67 human ailments treated by traditional medicinal plants in this District. The most cited human ailment in Gulomahda

District was febrile illness which accounted for 173 (13.70%) reports followed by wound (153, 12.11%) and abdominal pain (127, 10.06%) (Table 58 and Appendix 16).

Table 58 Highly cited human ailments

Human ailment	**Erob District**			**Gulomahda District**		
	No.	**%**	**Rank**	**No.**	**%**	**Rank**
Febrile	144	14.23	1	173	13.70	1
Wound	134	13.24	2	153	12.11	2
Tonsillitis	107	10.57	3	109	8.63	4
Abdominal pain	97	9.58	4	127	10.06	3
Cough/ Catarrh	75	7.41	5	93	7.36	5
Ring worm	46	4.55	6	42	3.33	7
Head ache	41	4.05	7	40	3.17	8
Dandruff	39	3.85	8	51	4.04	6
Tooth infection	38	3.76	9	34	2.69	10
Constipation	18	1.79	13	37	2.93	9
Others	273	26.98	NR	404	31.99	NR
Total	1012	100.00	-	1263	100.00	-

Out of the 27 livestock ailments recorded from both districts, 24 were recorded from Erob District and 18 from Gulomahda District. Livestock ailments common to both districts were 15 while nine were restricted to Erob District only and three livestock ailments to Gulomahda District only (Appendix 15).

The number of informants who cited each livestock ailment varied. Body itch was the most cited livestock ailment which accounted for 91 (32.62%) reports followed by external parasite/louse and leech infestation 50 (21.46%) each in Erob District. Similar results were also obtained from Gulomahda District in which itchiness accounted for 101 (36.86%) followed by external parasite/louse (42, 15.33%) and leech infestatios (41, 14.96%) (Table 59).

Table 59 Informant citations of livestock ailments

Livestock Health problems	Erob District			Gulomahda District		
	No.	**%**	**Rank**	**No.**	**%**	**Rank**
Itchy state	91	32.62	1	101	36.86	1
External parasite/ such as louse	50	17.92	2	42	15.33	2
Leech	50	17.92	2	41	14.96	3
Nose cancer	-	-	-	5	1.83	9
Swelling in the neck	31	11.11	4	10	3.65	6
Frothy blottis	29	10.39	5	26	9.49	4
Wound	5	1.79	6	4	1.46	10
Fracture	3	1.08	7	2	0.73	14
Diarrhea	2	0.72	8	7	2.56	7
Cough	2	0.72	8	16	5.84	5
Liver fluke	2	0.72	8	-	-	-
Swelling of hooves	1	0.36	11	4	1.46	10

4.24.2. ICF and relative cultural importance (RCI) Indices of MP species

The medicinal plants that are presumed effective in treating diseases in groups of ailments obtained higher values of informant consensus factor. Plants used against problems of the respiratory system had the highest ICF value (0.95) followed by medicinal plants used against febrile illness and headache (0.91) in Erob District. Plants used against febrile illness and headache had the highest ICF value (0.93) followed by plants used against problems of the respiratory system (0.92) in Gulomahda District (Table 60).

Table 60 Informant Consensus Factor (ICF)

Illness category	Erob District				Gulomahda District			
	Nt	Nur	ICF	Rank	Nt	Nur	ICF	Rank
Febrile illness and headache	15	186	0.92	2	16	214	0.93	1
Problems of the respiratory system	5	79	0.95	1	9	100	0.92	2
Oro-dental and pharyngeal disease	20	147	0.87	3	19	148	0.88	3
Skeletal, muscle, and connective tissues	7	48	0.87	3	10	56	0.84	6
Problems of the digestive system	29	137	0.79	6	27	204	0.87	4
Skin and subcutaneous tissues	47	267	0.83	5	54	348	0.85	5
Undefined pains or illnesses	12	48	0.77	8	15	81	0.83	7
Infectious and parasite-related diseases	18	78	0.78	7	20	61	0.68	9
Neoplasies	4	10	0.67	10	-	-	-	-
Problems of the genitourinary system	7	8	0.14	11	10	31	0.70	8
Problems of the circulatory system	2	2	-	12	3	7	0.67	10
Problems of the sensory system – eye	2	5	0.75	9	8	9	0.13	11

Fidelity level (FL) values were calculated for all 121 medicinal plants obtained from the study area (Appendix 19). FL values for 13 commonly used individual medicinal plants in both districts against the corresponding human ailments were calculated and presented in Table 61.

The most frequently utilized medicinal plants were *Achyranthes aspera, Argemone mexicana, Cordia africana, Nicotiana tabacum, Rhamnus prinoides. Verbena officinalis* and *Ziziphus mauritiana* had each an FL value of 1.00 (100%) in Erob District (Table 61). The FL 1.00 (100%) from Gulomahda District was obtained for *Argemone mexicana*, *Cordia africana*, *Lycopersicon esculentum*. *Nicotiana tabacum*, *Rhamnus prinoides* and *Ziziphus mauritiana* (Table 61).

Table 61 Fidelity level (FL) values of 13 highly cited medicinal plants

Scientific name	**Example of ailment**	**Erob District**			**Gulomahda District**		
		FL	**%**	**Rank**	**FL**	**%**	**Rank**
Argemone mexicana	Wound	1.00	100	1	1.00	100	1
Cordia africana	Febrile	1.00	100	1	1.00	100	1
Nicotiana tabacum	Leech	1.00	100	1	1.00	100	1
Rhamnus prinoides	Tonsillitis	1.00	100	1	1/00	100	1
Ziziphus mauritiana.	Dandruff	1.00	100	1	1.00	100	1
Achyranthes aspera	Tonsillitis	1.00	100	1	0.92	92	12
Verbena officinalis	Abdominal pain	1.00	100	1	0.84	84	14
Cynoglossum lanceolatum	Febrile	0.98	98	8	0.99	99	7
Hordeum vulgare	Head ache	0.98	98	8	0.94	94	11
Ruta chalepensis	Cough	0.98	98	8	0.99	99	7
Withania somnifera	Febrile	0.96	96	11	0.95	95	10
Schinus molle	Abdominal pain	0.84	84	12	0/96	96	9
Lycopersicon esculentum	Cut	0.82	82	13	1.00	100	1

Use values were calculated for 85 MPs obtained from Erob District and 102 MPs obtained from Gulomahda District (Appendix 20). Some medicinal plants were found to have high UVs while others possessed low.

The UV of MPs collected from Erob District showed that *Cordia africana* had the highest score (4.45) followed by *Olea europaea* (4.38). On the other hand, *Olea europaea* had the highest UV (4.07) followed by *Cordia africana* (4.06) in Gulomahda District (Table 62).

Table 62 Ranking of most important plant species using Use Value data

Scientific name	**Erob District**				**Gulomahda District**			
	ΣUi	**N**	**UV**	**Rank**	**ΣUi**	**N**	**UV**	**Rank**
Cordia africana	163	35	4.66	1	130	32	4.06	2
Olea europaea subsp. *Cuspidata*	232	53	4.38	2	171	42	4.07	1
Carissa spinarum	102	26	3.92	4	79	21	3.76	3
Acacia etbaica	184	50	3.68	7	171	46	3.72	7
Ziziphus mauritiana	113	30	3.77	5	122	35	3.49	8
Juniperus procera	19	6	3.19	9	15	4	3.75	5
Ficus ingens	-	-	-	-	10	3	3.33	9
Eucalyptus globulus	89	26	3.42	8	91	25	3.64	7
Hordeum vulgare	159	43	3.70	6	94	34	2.77	21
Acacia origena	3	1	3.00	12	22	7	3.14	12
Maytenus arbutifolia	8	2	4.00	3	57	18	3.17	11
Triticum aestivum	-	-	-	-	3	1	3.00	13
Melia azedarach	19	6	3.17	10	29	10	2.90	19

Relative importance (RI) values were also calculated for 85 MPs from Erob District (Appendix 21) and 102 MPs from Gulomahda District (Appendix 22) and foundout that some plants had high RI values while and others were with low RI.

Accordingly, *Olea europaea* scored the highest RI value (2.00) followed by *Cordia africana* (1.61) and *Acacia etbaica* (1.46) in Erob District. The highest RI value (2.00) in Gulomahda District was also scored by *Olea europaea* followed by *Cordia africana* (1.50) and *Acacia etbaica* and *Dodonaea angustifolia* (1.13) each (Table 63).

Table 63 Ranking of the traditional medicinal plant species using Relative Importance values

Scientific name	Erob District		Gulomahda District	
	RI	Rank	RI	Rank
Olea europaea	2.00	1	2.00	1
Cordia africana	1.61	2	1.50	2
Acacia etbaica	1.46	3	1.13	3
Dodonaea angustifolia	1.34	4	1.13	3
Aloe elegans	1.09	5	1.07	5
Maytenus senegalensis	1.06	7	1.01	6
Calpurnia aurea	0.97	9	0.94	7
Carissa spinarum	1.00	8	0.94	7
Solanum schimperianum	1.09	5	0.94	7

4.25. Distribution and Similarities for the reported TMPs between the two districts

The reported medicinal plant species were found distributed from 1500-4000 m a.s.l. (appendix 2). The highest number of medicinal plant species were collected in altitude between 1500 and 2500 m a.s.l. which accounted for 94 (77.69%) followed by 27 (22.31%) from 2501m and > m a.s.l.

Of the total 121 MPs, 66 (54.55%) were common to both districts, 19 (15.70%) MPs were restricted to only the Erob District and 36 (29.75%) to only the Gulomahda District (Appendix 23). The JCS in TMP composition between Erob and Gulohmeda districts gave a value of came to 0.55 (55%).

Jaccard similarity coefficient of some selected districts of the country with Erob and Gulomahda districts shows the occurrence of some common TMPs that have been used by different society found in the different areas of Ethiopia (Table 64).

Table 64 JCS of some selected districts with Erob and Gulomahda districts

Districts	**JCS**		**Source of the TMPs in each districts**
	Erob	**Gulomahda**	
Kilte Aulaelo (Tigray)	29.22	33.33	Abraha Teklay *et al*., 2013
Endrta (Tigray)	15.46	16.22	Gidey Yirga, 2010
Chifra (Afar)	4.42	5.47	Tesfaye Seifu, 2004
Debark (Amh.)	20.57	22.42	Eskedar Abebe, 2011
Zegie Peninsula(Amh.)	12.59	16.55	Tilahun Teklehayma *et al*., 2007.
BMN P (Oro.)	6.89	8.56	Haile Yineger, *et al*., 2008
Mana Angetu (Oro.)	10.53	11.92	Ermias Lulekal *et al*., 2008
Chelya (Oro.)	11.54	14.37	Endalew Amenu, 2007
Wonago (SNNPRS)	19.80	22.38	Fisseha Mesfin *et al*., 2009
Sheko (SNNPRS)	9.09	7.45	Mirutse Giday *et al*., 2010

4.26. Comparison of Knowledge Among Different Groups

The knowledge on the reported medicinal plant species that the local people of Erob District have ranged from 3-18; mean = 8.31; SD = 3.65 and CV = 0.439 while for Gulomahda it ranged from 3-22; mean = 9.06; SD = 4.02 and CV = 0.443.

Comparison of the reported MPs used to treat ailments

Insignificant difference was obtained on mean number of ailments treated by the 66 common MPs between Erob (2.56 ±.23) and Gulomahda (2.96 ±.22) (t (65) = -1.23, p

(2.19) > 0.05. Similarly, the mean number of ailments treated by the reported MPs between Erob (2.29 ±.19) and Gulomahda (2.55 ±.16) (t (185) = -1.04, p (0.30) > 0.05) was insignificant.

Comparison of ailments treated by the reported MPs

Insignificant difference was obtained on mean number of plant species used to treat human ailments between Erob (2.16±.31) and Gulomahda (2.88 ±.42) (t (148) = -1.38, p (0.17) > 0.05). Similarly, the mean number of plant species used to treat livestock ailment between Erob (1.67 ± 0.23) and Gulomahda (2.26 ± 0.51) was insignificant (t (41) = -1.14, p (0.26) > 0.05).

Comparison of plant species belonging to the common plant families

Insignificant difference on the mean number of plant species that are belonging to the 37 common plant families was obtained between Erob (2.16 ± 0.34) and Gulomahda (2.46 ± 0.37) (t (72) = -0.59, p (0.56) > 0.05).

Comparison of overall reported MPs with treated ailments

The computed Pearson's correlation for the reported MPs with the number of ailments being treated by them in the study districts (kebeles) was found significant (F (1, 6) =52.38, P (0.00) < 0.05), with r = 0.95 (Figure 23).

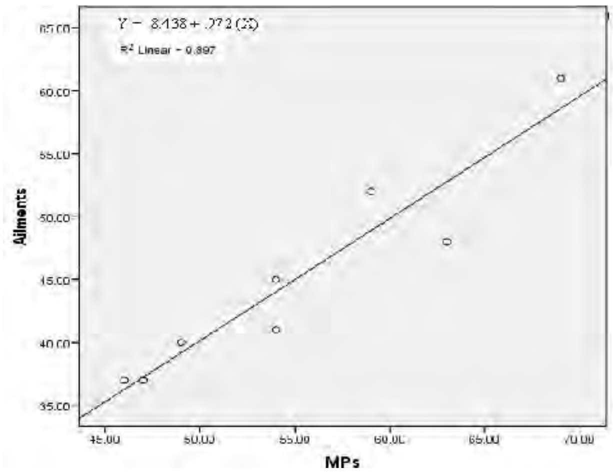


Figure 21 Relationship of reported MPs with number of treated ailments

Gender relation to conservation of medicinal plant species

Insignificant relationship between gender and conservation of medicinal plants was found in the study area (χ^2 (1) =1.21, P (0.27) > 0.05) in Erob and χ^2(1) =0.02, P(0.23) > 0.05) in Gulomahda.

Comparison of knowledge among different age groups

Significant difference was observed between age and knowledge in the study districts (F (1,181) = 445.29, P (0.00) <0.05), with r = 0.84 in Erob (Figure 21 A). Similarly, F (1,197) = 277.81, P (0.00) < 0.05), with an r = 0.77 in Gulomahda (Figure 21B).

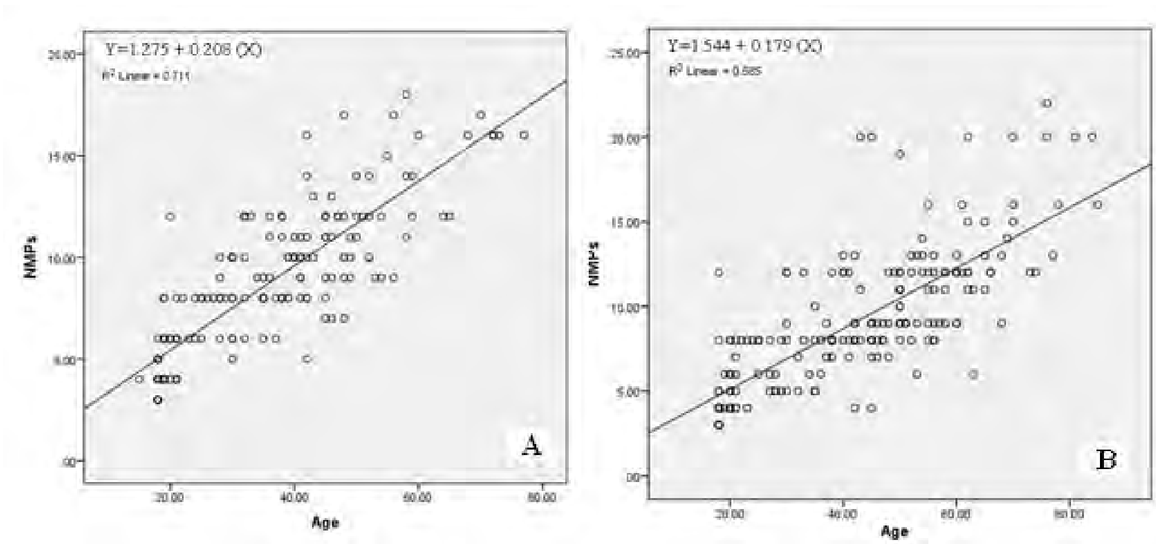


Figure 22 Comparison of TMPs knowledge among age groups

(A= Erob District and B=Gulomahda District)

Comparison of knowledge among different educational levels

Significant difference was obtained between knowledge and educational levels in the study area. (F (1,181) = 43.71, P (0.00) < 0.05), with r = 0.44 in Erob (Figure 22A) and (F (1,197) = 54.91, P (0.00) < 0.05), with r = 0.47 in Gulomahda (Figure 22B).

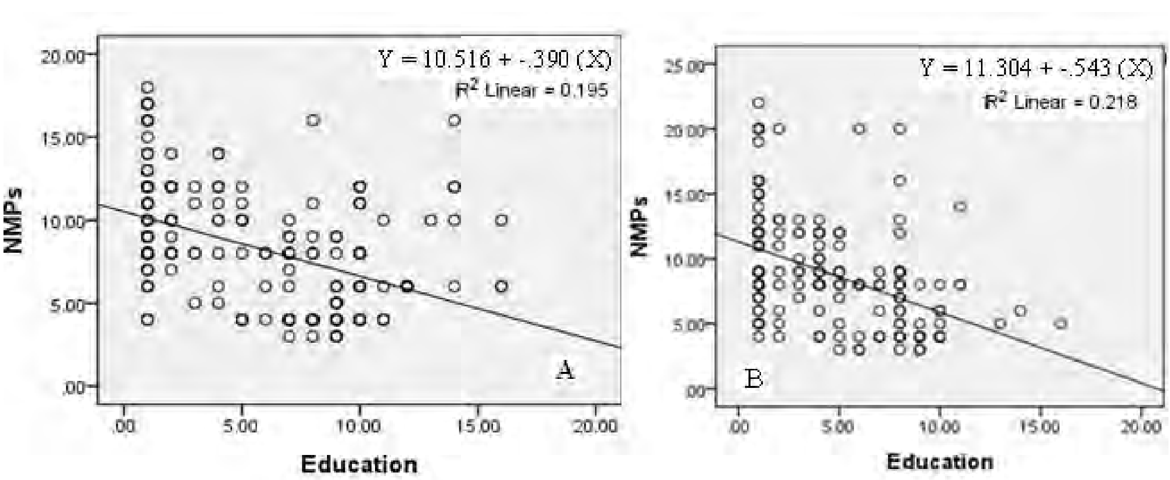


Figure 23 Comparison of knowledge among people of different educational levels

(A=Erob District and B=Gulomahda District)

Comparison of knowledge between male and female

Insignificant mean knowledge difference of MPs reported b/n male (8.3697 ± 0.45562) and female (7.89 ± 0.46) in Erob (t (181) = -0.86, (p 0.39) > 0.05) and male (9.41 ± 0.37) and female (8.34 ± 0.43) in Gulomahda (t (197) = 1.77, p (0.08) > 0.05)**.**

Comparison of knowledge among members of the same gender

Insignificant mean knowledge difference of MPs reported by females between Erob (7.40 ± 0.58) and Gulomahda (8.34 ± 0.43) was obtained (t (103) = -1.317, p (0.19) > 0.05)**.** In case of males, significant mean knowledge difference of MPs reported by males b/n Gulomahda (9.41 ± 0.37) and Erob (8.37 ± 0.35) was obtained (t (251) = -2.05, p (0.04) < 0.05).

Comparison of knowledge between married and single

Significant mean knowledge difference was found between married (10.17 ± 0.22) with those of single (5.86 ± 0.25) in the reported TMPs (t (380) = 12.15, p (0.00) < 0.05) in the study area; married (10.16 ± 0.30) with those of single (5.46 ± 0.27) in Erob (t (181) = 11.70, p (0.00) < 0.05). In Gulomahda, similar result was obtained married (10.17 ±0.31) with those of single (6.36 ± 0.46) (t (197) = 6.72, p (0.00) < 0.05) was obtained.

Comparison of MP knowledge among people of eight kebeles

The lowest mean knowledge was observed in Weratele (7.16 ± 0.51) and the highest from Alitenia (8.95 ± 0.42) in Erob District. Similarly, the lowest mean knowledge was observed in Anbesete-fikada (7.68 ± 0.58) and the highest in Sebeia (10.40 ± 0.47) in Gulomahda (Figure 24).

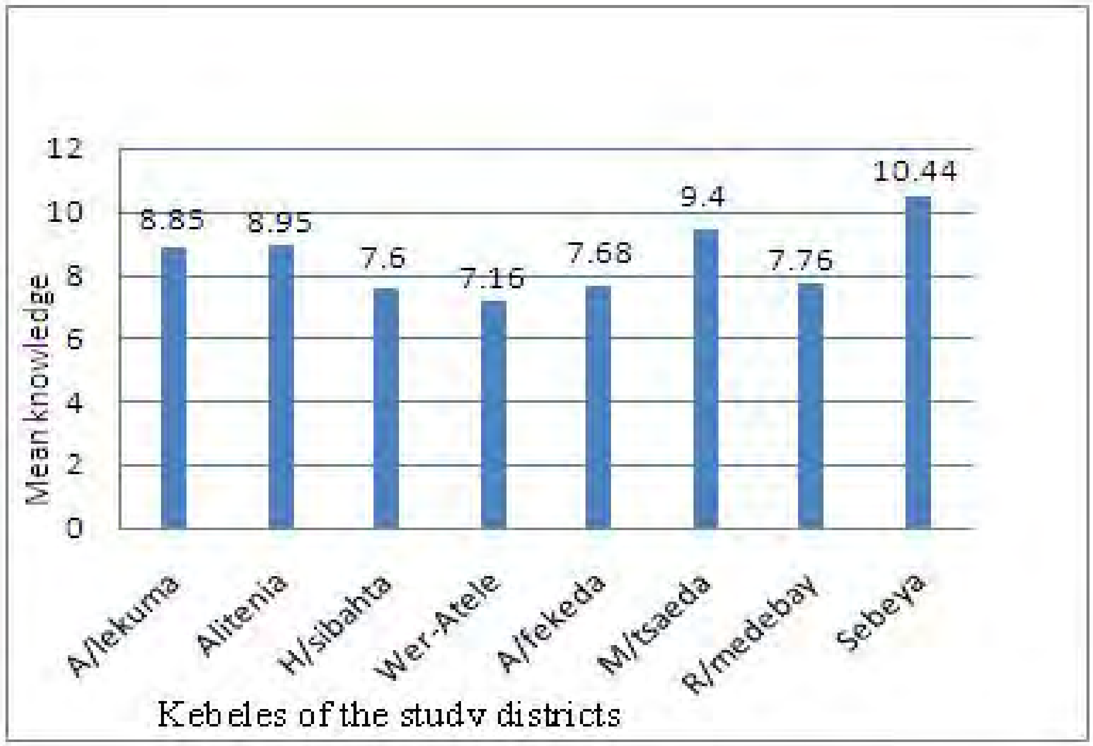


Figure 24 Mean knowledge comparison for the reported MPs among the people of eight kebeles

Significant difference for the mean knowledge of the reported medicinal plant species among the eight kebeles were obtained ($F (7,374) = 4.73$, $p (0.00) < 0.05$) (appendix 24)

Comparison of knowledge between Key and general informants

Significant mean knowledge difference was found between key informants (15.12 ± 0.62) with those of general informants (8.08 ± 0.17) in the reported TMPs ($t (380) = 11.87$, $p (0.00) < 0.05$) in the study area.

Comparison of MP knowledge among different ethnic groups and religion followers

a. It was found insignificant ethnobotanical mean knowledge difference on the reported TMPs between the local people of Erob ($8.31 \pm .27$) and Gulomahda (9.06 ± 0.29) at 0.05 level ($t(380) = -1.90$, $p(0.06) > 0.05$).

b. Significant mean knowledge difference was found between Saho speakers (8.67 ± 0.31) and Tigrigna speakers (7.18 ± 0.53) in Erob ($t(181) = 2.39$, $p(0.02) < 0.05$).

c. Significant differences of mean knowledge was found between Orthodox followers (7.22 ± 0.53) with those of Catholic followers (8.67 ± 0.31) in Erob where the two religion followers have been living together ($t(181) = 2.33$, $p(0.02) < 0.05$).

CHAPTER FIVE

5. DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5. 1. Discussion

5.1.1. Plant species used in herbal medicines

5.1.1.1. Diversity, growth forms and sources of MPs

The people in the study area have a rich tradition of using diverse medicinal plant species in their herbal medical system as shown by their report of 121 species in 100 genera and 52 families. The MPs reported from each district (85 species treating 82 ailments in Erob and 102 species treating 85 ailments in Gulomahda) showed that a considerable number of TMPs are used to treat human and livestock health problems in the study districts. In related studies, 33 MPs from Zay people, Lake Ziway (Mirutse Giday *et al*., 2003); 25 MPs from Butajira, Gurage Zone (Teferi Gedif and Hahn, 2003); 25 MPs from Shinasha and 20 MPs from Agew-Awie districts (Mirutse Giday *et al*., 2006); 80 MPs from Debrelibanos monastery (Tilahun Teklehaimanot *et al*., 2006); 27 MPs from Sekouru, Oromia Regional State (HaileYinger and Delenasaw Yewhalaw, 2007) and 67 MPs from Zegie Peninsula (Tilahun Teklehaimanot and Mirutse Giday, 2007) all in Ethiopia were reported.

In the local ethnoveterinary healing system, 23 plant species were used to treat 24 ailments of cattle, goat, sheep, donkey, horse and mule in Erob District and 30 plant species were used to treat 18 ailments of cattle, goat, sheep, donkey, horse and mule in Gulomahda District. Various studies undertaken within and outside Ethiopia showed the use of different plant species to treat different livestock ailments. In four districts of Jimma Zone

(Ethiopia), Yared Yigezu *et al*. (2014) reported the use of 74 plant species in the treatment of 22 different livestock ailments. Likewise, in Pakistan (Azam *et al*., 2012), 19 plant species used to treat 14 ailments were reported and in Tikamgarh District of Bundelkhand (India), Verma (2014) reported the use of 41 plant species to treat 36 livestock ailments. Most of the plant species documented from Erob and Gulomehda were used to treat ailments of cattle, goats and sheep in both districts. This clearly showed that the local people of the study area are concerned about the health of their livestock because their livelihoods depend on them and they obtain many benefits from them. In a related study that took place in Argentina, it was shown that veterinary ethnobotanical knowledge is specialized and restricted to cattle **(**Martínez and Luján**,** 2011). The people of Erob District were found treating more livestock ailments than those of Gulomahda District. This shows that livestock resources are playing very crucial role in the livelihoods of the people of the study area providing them with meat, milk and milk products, leather making and vending for cash to buy crops and other commodities as the land is poor for crop farming practice, particularly in Erob District (ARDOED, 2013). This is due to the prevailing erratic rainfall, poor soil fertility, serious soil erosion and the mountainous nature of the topography. Livestock production is crucial for smallholder farmers as in most developing countries like Ethiopia (Gebremedhin Gebrezgabiher *et al*., 2013). The major portion of the farmers in the villages of Ethiopia relies on traditional ethno-medicine knowledge and practices to treat human and livestock ailments (Mirutse Giday and Gobena Ameni, 2003).

Some TMPs were found introduced to Ethiopia from other parts of the world such as *Argemone mexicana* is originated in the western region of the USA-Mexico border and has spread to tropical and subtropical areas around the world (Pina and Flota, 2013). It had negative impacts on biodiversity and native plant species in Ethiopia (Kefyalew Alemayehu, 2012). *Opuntia ficus- indica* was also believed to be originated in Mexico (Griffith, 2004) and it was introduced to Ethiopia between 1848 and 1920 (Neumann, 1997; Habtu, 2005). The establishment and spread of such plant species can adversely impact other species, habitats and ecosystems (Burgiel *et al*., 2006). Nevertheless, these plant species were found used as a herbal medicine, which may developed as a result of trial and error.

Asteraceae, Fabaceae, Lamiaceae and Solanaceae had the highest number of genera used for herbal medicine in Erob District. The Asteraceae, Fabaceae and Lamiaceae also had the highest number of genera used for herbal medicine in Gulomahda District. Similar studies showed that some plant families contributed greater number of genera than others for traditional medicinal use to treat both human and livestock ailments. These plant families include Asteraceae, Fabaceae, Lamiaceae and Solanaceae in Seru District, Arsi Zone of Oromia Region (Mengistu Gebrehiwot, 2010); Asteraceae, Rubiaceae, Lamiaceae and Fabaceae in Bule Hora District, Southeren Oromia (Mersha Ashagre; 2011); Fabaceae, Asteraceae, Solanaceae and Euphorbiaceae in Debark District, North Gondar Zone, Amhara National Regional State, Ethiopia (Eskedar Abebe, 2011), all in Ethiopia. These are also among the families with higher numbers of species that also have wide geographical and habitat distribution in Ethiopia.

The study also revealed that the number of plant species that belong to each genus varies from genus to genus. The genus *Solanum* contributed the highest number of medicinal plant species both in Erob and Gulomahda districts while *Euphorbia* and *Rumex* contributed the highest number of medicinal plant species in Gulomahda District. Similar studies conducted in and outside of Ethiopia showed results in which the number of plant species that belong to each genus used for traditional medicinal purposes varied from genus to genus, and hence *Ficus* (Moraceae) had the highest number of medicinal species in Chelya District, West Shewa (Endalew Amenu, 2007); *Solanum* (Solanaceae) in Ofla District, Southern Zone of Tigray National Regional State (Nurya Abdurhman, 2010); *Euphorbia* (Euphorbiaceae) in Bule Hora District, Southeren Oromia (Mersha Ashagre, 2011) and in Gemad District, Eastern Zone of Tigray Regional State (Kalayu Mesfin *et al*., 2013), all in Ethiopia; *Artocarpus* (Moraceae) in Sabah, Malaysia (Kulip, 2003) and *Senecio* (Asteraceae) in La Paz and El Alto, Bolivia (Mac´ıaa *et al*., 2005) are the genera reported for contributing the highest number of medicinal plant species.

In terms of species composition also, the number of plant species used for medicinal purpose belonging to each family varied in the study districts. Solanaceae, Asteraceae and Lamiaceae had the highest number of plant species in Erob District used for herbal medicine. Among the plant families used in herbal medicine, the Asteraceae, Solanaceae and Lamiaceae also had the highest number of MP species each in Gulomahda District. This showed that some plant families contributed more plant species used for herbal medine than others. Like in this study, earlier researchers foundout that the Asteraceae is the most used plant family in Wenago District, southern Ethiopia (Fisseha Mesfin *et al*., 2009); in La Paz and El Alto, Bolivia (Mac´ıaa *et al*., 2005); in Pakistan (Qureshi *et al*., 2007) and in Turkey (Çakılcıoğlu *et al*., 2010).

Of the various growth forms of the reported MPs used to treat human ailments, herbaceous forms were dominant in Erob and Gulomahda districts. This may be due to the vegetation of the area in which trees and shrubs have been exploited in the study area and are then rare. This study agrees with similar studies conducted elsewhere in Ethiopia (Mirutse Giday *et al*., 2003; Gemedo Dalle *et al*., 2005; Etana Tolosa, 2007; Tilahun Teklehaymanot and Mirutse Giday, 2007; Tesfaye Awas and Sebsebe Demissew; 2009; Mengistu Gebrehiwot, 2010; Abraha Teklay *et al*., 2013). On the other hand, concerning growth forms of the medicinal plant species used to treat livestock ailments, shrubs were dominant among the reported medicinal plants in Erob and Gulomahda districts. The results of this study agrees with a similar study conducted in Poonch Valley Azad Kashmir, Pakistan (Azam, *et al*., 2012). However, some studies conducted elsewhere show that other growth forms were the most widely used for the treatment of livestock ailments. Trees in Tikamgarh District, India (Verma, 2014) and Jhargram division, India (Pandit, 2010); herbs in mountain Baffa Mansehra, Pakistan (Islam *et al*., 2012) and Tanqua-Abergele and Kolla-Tembien districts of Tigray Region, Ethiopia (Gebremedhin Gebrezgabiher *et al*., 2013) were the dominant growth forms used to treat livestock ailments. This show that the most used growth forms of plant species for traditional medicinal use varied from area to area. This is at least partly related to the floral composition of the area.

Regarding the source of the medicinal plant species, wild environments yielded more medicinal plant species. Some traditional medicinal plants were obtained from homegardens. The results of this study concur with other studies conducted within and outside Ethiopia (FAO, 1983; Frankel *et al*., 1995; Tizazu Gebre, 2005; Etana Tolassa, 2007; Ermias Lulekal *et al*., 2008; Fisseha Mesfin *et al*., 2009; Tesfaye Awas and Sebsebe Demissew, 2009; Giday Yirga, 2010; 2012 and Moa Megersa *et al*., 2013). According to the text, wild means occurring, growing, or living in a natural state which is not domesticated or cultivated by human. Wild plants are having grown in the wild with no human interference. Wild is used to describe all plant resources outside agricultural area that are not domesticated, but collected for the purpose of human use (Bell, 1995). Wild collection is almost the only source of medicinal plants in developing countries (Sher *et al*., 2014).

According to the key informants, the time required to collect plant species for medicinal use varies from plant to plant species as well as from place to place. Therefore, it is possible to say that the local people of the study districts spent plenty of time currently to collect some medicinal plant species for medicinal use than few years earlier. This indicated that some of the plant species used for herbal medicine are at risk at least in the study districts which needs attention and priority of conservation more so in the case of *Croton macrostachyus* and *Vernonia rueppellii*. Other studies also foundout that the time needed to collect MPs varied from species to species and from area to area (Mirutse Giday *et al*., 2009, 2010; Ngarivhume *et al*., 2015).

The local people were found using two endemic plant species of Ethiopia for the preparation of traditional herbal medicines. These are *Laggera tomentosa* (Hedberg *et al*., 2004) and *Urtica simensis* (Hedberg and Edwards, 1989). Endemism is a state in which a taxon is restricted to a particular area (Hiscock and Breckels, 2007; Young, 2007). Endemic species are not naturally found elsewhere, being found only in a particular area (Lamoreux *et al*., 2005). Of the endemic plant species from among the documented TMP species, one (1.18%) was in Erob District and two (1.96%) in Gulomahda District. According to the IBC (2009), 887 MPs are used by Ethiopians for medicinal purpose. Of which,, 24 (2.7%) are endemic to Ethiopia. Therefore, it is possible to conclude that the percentage of endemic plants used in traditional medicine in the study area is relatively low. Endemic plants are distributed unevenly across the land area of the world (Krukeberge and Rabinowitz, 1985).

In general, endemism is high on the plateaus, mountains, in the Ogaden region and in the western and southwestern woodlands of Ethiopia (P G R C, 1996). Some TMPs, which were documented from the study area are confined to Ethiopia and Eritrea such as *Becium grandiflorum,* which is near threatened and *Vernonia rueppellii* and *Leucas abyssinica* although given in the category of least concern (Vivero *et al.*, 2005) observations indicate that they are locally threatened. Endemic species require attention because of their limited distributions and consequent susceptibility to endangerment. If their habitat needs are not fulfilled where they occur, they will decline in number and ultimately disappear (Young, 2007).

5.1.1.2. Plant parts used and composition of herbal medicine

Different plant parts such as roots, bulbs, bark, latex, leaves, flowers, fruits and some others including seeds were used to treat human and livestock health problems in the study districts. Group discussion, field observation and guided field walk also all confirmed that different plant parts are used as herbal remedies in the study area. Leaves are the most highly used parts in Erob and Gulomahda districts to treat both human and livestock ailments. The frequent usage of leaves is also noted in other parts of the country as reported by; for example, Mirutse Giday *et al.* (2003, 2010); Endalew Amenu (2007); Etana Tolosa (2007); Haile Yinger and Delenasaw Yewhalaw (2007); Fisseha Mesfin *et al.* (2009); Gidey Yirga (2010); Mengistu Gebrehiwot (2010); Ayannar and Ignacimuthu

(2011); Offiah *et al*. (2011); Abraha Teklay *et al*. (2013); Kalayu Mesfin *et al*. (2013) and Moa Megersa *et al*. (2013). From this evidence, one can understand that the leaf is a very important part of plants in terms of medicinal value at least in the context of the local people because aerial parts of the plant are easy to collect as stated by other authors (Dawit Abebe and Estifanos Hagos, 1991; Mirutse Giday *et al*., 2009). Leaves are also known to contain many secondary compound, which are important as medicine. The plant parts that are used in the preparation of medicine include roots, stems, barks, leaves, flowers and seeds (Wondwosen Teshome, 1999). Usage of the leaf may not have negative impacts on the medicinal plant as compared to other parts such as root. Removal of leaves up to half of a tree does not affect the growth of the tree significantly (Poffenberger *et al*., 1992).

Most of the key informants in both districts agreed that the medicinal plants were harvested with no specific preference to any particular maturity level. However, some plants were reported to be harvested after parts were at their full maturity or at their young stage. Harvesting depends on the best possible quality of the plant part to be used (Singh, 2008). Most of key informants responded that they had no any special seasonal preference in collecting and using of herbal medicine. On the other hand, the work of Sharma *et al*. (2013) showed that seasonal variations affect the physico-chemical of plant species. This non-seasonal dependence is reflected by most of the informants who did not collect medicinal plant species for later use, i.e. they gather for immediate use when health problems are encountered. This harvesting method may reduce the efficacy of herbal medicine. Season has impact on availability of active principles in medicinal plants (Singh, 2008).

The findings showed that most of the herbal remedies have been prepared from fresh parts and in few cases from dry traditional medicinal plants in both districts to treat both human and livestock ailments. This indicates that people in the study area are highly dependent on fresh remedies and this may put medicinal plants under threat since there is no practice of collecting MP parts when they are plenty for preservation or storage for later use. Other studies conducted within and outside the country also indicated the wider use of fresh materials (Mirutse Giday *et al*., 2003; Mirutse Giday and Gobena Ameni, 2003; Tizazu Gebre, 2005; Ignacimuthu *et al*., 2006; Bussmann *et al*., 2006; Endalew Amenu, 2007, Mengistu Gebrehiwot, 2010; Mirutse Giday *et al*., 2010; Emiru Birhane *et al*., 2011; Mersha Ashagre, 2011; Kalayu Mesfin *et al*., 2013).

The local people including the healers reported that they prepare herbal medicine in different ways including by extracting the juice, crushing and pounding, burning to smoke and vapourize as fumigant, making concoction and decoction as well as using the plant part directly without much processing. Most of the collected traditional medicinal plants were used either in the unprocessed form or in crushed and pounded form to treat human ailments by the people of Erob District. On the other hand, most of the medicinal plant species were found to be used as concoction to treat livestock ailments by the people of the district. Similar mode of remedies was also reported by the people of Gulomahda District in which unprocessed was the highest followed by concoction form while concoction was the highest mode of preparation to treat livestock ailments. A similar research done in Bale Mountains National Park, Southeastern Ethiopia (Haile Yineger *et al*., 2008), shows that concoction, crushing and pounding, use of unprocessed form, fumigation, juice, decoction, powder, toasted form and soaked plant parts constituted most types of herbal preparation.. On the other hand, juice made from MPs was the most popular mode of preparation in Oromia Regional State, Southwestern Ethiopia (Haile Yinger and Delenasaw Yewhalaw, 2007); crushing the plant part and use as medicine was the most popular mode of preparation in Central Zone of Tigray, Northern Ethiopia (Giday Yirga, 2010) and crushed and pounded plant material in Seru Wereda, Arsi Zone of Oromia Region, Ethiopia (Mengistu Gebrehiwot, 2010). The findings showed that the most popular mode of preparation by the local people in some areas may not be popular as well somewhere else.

The local people reported preparing herbal remedies mostly by processing using local equipment such as grinder made from iron, wood, black stone, and by squeezing out the juice of the plant species with the palms and fingers of the hand to extract and force out the juice of the plant. Furthermore, the local people also prepared herbal medicines with or without diluents. According to Mirutse Giday *et al*. (2009), 50% of the remedies prepared by the Bench ethnic group of Ethiopia were without the use of diluent s, while 50% were prepared with the addition of diluents such as water, coffee, milk and human saliva.

Herbal preparations varied in their plant composition in the study area. Most herbal preparations were from single species in both districts. This is in agreement with the findings of Ragunathan and Solomon Maquanente (2009) around Bahirdar, Amhara Regional State (Ethiopia) where most of the herbal medicines were prepared from single plant species. The local people also prepared some herbal medicines by combing two or more medicinal plant species to treat both human and livestock ailments. These findings agreed with the work of Mersha Ashagre (2010) in Bule Hora Wereda, Oromia Regional State, Ethiopia. Different plant species were also combined together to improve the medical efficiency of the plant (Kumar and Shukla, 2003). Nearly 2000 different plant species are reported to be used in over 5000 combinations for women's healthcare in Southeast Asia (de Boer and Cotingting, 2014). The use of multiple species in the preparation of remedies could be attributed to perception by many practitioners on synergy of one 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).

5.1.1.3. Route of application and measurement of dose

Traditional herbal medicines were administered both internally (oral, nasal, ear, eye) and externally (dermal, fumigation and so on) in the study districts. In general, traditional medicines prepared from medicinal plant species were administered and applied in different ways to cure human beings and livestock from ailments. Oral and dermal applications were the dominant modes of application for human beings in the study districts. The results of this study agreed with those of Haile Yineger *et al*. (2008) and Ragunathan and Solomon Maquanente (2009). Most of the traditional medicines prepared for livestock from plants were applied dermally and orally in both districts. The results of this study agreed with similar studies undertaken elsewhere in Ethiopia (Dawit Abebe and Ahadu Ayehu, 1993; Tizazu Gebre, 2005; Tilahun Teklehaimanot and Mirutse Giday, 2007; Mengistu Gebrehiwot, 2010).

The local people also administered traditional medicine made from plants to patients in different ways such as drinking, poultices, chewing, ointment, rubbing, spraying and brushing in both districts to treat human and livestock ailments. This clearly indicates that the local people have been administering traditional herbal medicines in different ways to patients based on the type of ailment and part of the body where it has been applied for its effectiveness. Other studies showed that the routes of administration of remedies were oral and nasal based on effectiveness (Tesfaye Seifu *et al*., 2006); oral, dermal and ear (Haile Yineger and Delenasaw Yahalaw, 2007) and dermal and oral (Tantiado, 2012).

The local people of the study area also use smoke to control and eradicate external parasites and steam vapour to treat infection such as the smoke of *Otostegia integrifolia* to control and kill fleas, *Hordeum vulgare* to treat eye infection, the vapour (steam) of *Withania semiifera, Eucalyptus globules, Cynoglossum lanceolatum*, *Zehneria scabra* and *Hypoestes forskaolii* to treat febrile illness. Furthermore, the smoke of *Hypoestes forskaolii* also used to treat evil eye . Steam-bath herbs used to clean and tighten the vagina (van Andel, *et al*., 2008). About 800 TMPs are for uses in steam baths in Southeast Asia (de Boer and Cotingting, 014).

The people of both districts used different equipment to measure the amount of administered herbal medicine together with estimation. Most of the herbal medicines were administered to patients by estimation, i.e. without having proper dosage. Some herbal medicines were also administered using different devices to measure the amount including the traditional coffee cup, tin, palm of the hand, spoon, countinting plant parts, finger size, glass and drops by the people of both districts to treat human and livestock ailments. Inappropriate use of herbal medicine can lead to serious health problems to patients (Hillenbrand, 2006; Kitula, 2007). In general, the local people were seen using different equipment to measure the amount of remedies which lacked exactness. Thus, the findings showed that herbal administrations are not standardized as rightly described by

Haile Yineger *et al*. (2008) which measurement methods of traditional medicine lacked precision.

The findings revealed that the same types of medicinal remedies for the same types of ailments were given with different measurements in the same or different Kebeles of the study districts. This indicates the lack of uniformity in treatment of diseases through the traditional healthcare system. This study agreed with studies made by Abraha Teklay *et al*. (2013) in Kilte Awulaelo District, Eastern Zone of Tigray Region of Ethiopia showed no agreement in measurement or unit used among informants. Dosage is not always well measured in most of the traditional medicine practitioners (Mersha Ashagre, 2010). The works of Amare Getahun (1976); Dawit Abebe (1986) and Dawit Abebe and Ahadu Ayehu (1993) indicated that lack of accuracy and standardization are negative aspects for the use and recognition of traditional herbal medicine use. The finding also indicated that the local people including healers and knowledgeable elders did not have enough understanding about significance of the neatness and hygiene of the equipment used to prepare TM as also reported by Giday Yirga (2010). It was also obtained that healers and some knowledgeable elders stored drugs in local storage containers. Healers stored drugs in bottles, papers, pieces of cloth, leaves and horns and were kept anywhere at home (Dawit Abebe and Ahadu Ayehu, 1993).

At the time of group discussion almost all the informants agreed on the variation in dosage given by different healers and knowledgeable elders. Furthermore, the information gathered from the key informants and customers (the end users of the medicines) indicated that over dosage or under dosage has its own negative impact. That is, over dosage may lead to different health complications and even death and under dosage may not cure the disease under question. Age and stage of illness were also considered in the study area by some knowledgeable individuals and healers to determine the amount of the herbal remedies to be given. This finding is similar with the study by Dawit Abebe (1986).

5.1.1.4. Status, preservation and problems in collecting medicinal plants

Most of the informants agreed that the status of medicinal plants in the study area was taken to be medium. On the other hand, some informants said that medicinal plants are common especially during the rainy season and few said the traditional medicinal plants have become rare. The medium occurrence of medicinal plant in the study area may indicate the attempts made to conserve and protect plant communities which was also noted during field observation. Most of the local people in Erob and Gulomahda districts agreed that the abundance of medicinal plant species become limited during the dry season, especially the herbs and the leaves of some trees and shrubs also fall down. Herbs are plants with soft stems (non-woody) which die down after flowering (Chomchalow, 2002) and water shortage is one of the most adverse abiotic factors influencing their growth, physiological and biochemical aspects (Anjum *et al*., 2012).

It was foundout that most of the informants do not store and preserve traditional medicines. This was also confirmed by most of the key informants who did not preserve plant species for the purpose of medicinal use but for other uses such as food, fuelwood and shelter. Some, usually the key informants preserved some traditional medicines for later use by drying them as done in the case of the root bark of *Croton macrostachyus,* bark of *Ficus ingens* and leaves of *Justicia schimperiana*. Preservation of remedies was not reported by healers of the Oromo ethnic group in southwestern Ethiopia (Haile

Yineger *et al*., 2008), which may be due to having better vegetation cover and the higher rainfall over an extended period allowing year round growth of herbs and woody plants.

Some factors were seen in the study area which hindered the local people to collect and obtain herbal medicines from their environment. Most medicinal plant species are rare in nearby areas, become fewer in dry season and some educated people condemn traditional medicinal plant use. Furthermore, most of the key informants complained about criticisms by educated peoples who make it difficult to gather herbal medicines from the field. Negative attitudes of some literate people toward traditional medicine, lack of scientific confirmation, limited knowledge on safety measures such as appropriate dosages for patients in different age groups and weight classed have been limiting the use of traditional herbal medicines (Kayombo *et al*., 2013).

5.1.1.5. Back ground of informants, Emic categorization and associated indigenous knowledge

In general, the interviewed informants were included from different age groups, knowledgeable elders, women, youngsters, peoples of different educational level, Tigray and Saho language speaking ethnic groups, orthodox and catholic religion followers. This enabled the researcher to extract the ethnobotanical knowledge of the society from diverse groups. This was done in the manner recommended by earlier researchers such as Haile Yineger *et al*. (2008); Bharati and Sharma (2010).

The local people of the study area distinguished the environmental components of their surroundings, which are well reflected in their elaborate classification system of plants, soil type and land form. They classified the plant types of the area into four; soil into six and land forms into five in Saho and Tigrigna languages. This clearly showed that the 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 ways of classifying plants, soil and land topography. In a similar way, the local people in various parts of Ethiopia have been shown to classify plants, land form and soil into different categories (Tizazu Gebre, 2005; Endalew Amenu, 2007; Etana Tolasa, 2007; Mengistu Gebrehiwot, 2010; Mersha Ashagre, 2011). Aboriginal classifications are found throughout the world (Weinstock, 1984; Pawluk *et al*., 1992) and it depends on native categories (Zent, 1996). Indigenous classifications are drawn from the way people recognize things through their own eyes and classify objects in their own language (Martin, 1995) and such categorizations show certain similarities throughout the world (Cotton, 1996).

Information obtained from key informants showed the time needed to be cured varied from ailment to ailment. Similar results were obtained in the studies conducted by Etana Tolasa (2007); Mengistu Gebrehiwot (2010); Nurya Abdurhman (2010) and Mersha Ashagre, (2011).The span of time used by hypertensive patients vary from person to person for the same and different plant species in South African communities (Hughes et al., 2013).

The significant mean knowledge difference between key and general informants for the reported TMPs showed that the better knowledge on how to use herbal medicine is found accumulated in some members community. They have well developed knowledge on plant species used to treat ailments, ingredients and diluents used to prepare herbal medicine, the side effects and the antidotes that could be used. Key informants are the most knowledgeable about the subject (Lavrakas, 2008). However, it was also found that some of the key informants were not willing to mention all the ingredients used to prepare a particular herbal medicine. It was seen that the ingredient that couldn't be mentioned by one key informant was mentioned by another to prepare herbal medicine for the same ailment. Honey that mixed with *Olea europaea* as ingredient to prepare herbal medicine to treat heart failure and malaria was not mentioned by some key informants. Further more, one or both *Capsicum frutescens* and *Olea europaea* that were mixed with *Allium sativum* to prepare herbal medicines against malaria were not mentioned by some key informants. However, the significance of such ingredients and plant species as parts in the preparation of herbal medicine were confirmed during conduct other ethnobotanical works such as ranking.

The study revealed that all of the key informants from both districts are not interested to collaborate with other knowledgeable persons and healers. However, some of the key informants in Erob and Gulomahda districts showed some tendency to collaborate with their friends and neighbors especially in urgent situation due to lack of effectiveness when secrete is out. Studies conducted elsewhere in Ethiopia showed secrecy of traditional medical practice a common trend (Teferi Gedif *et al*., 2002; Mirutse Giday *et al*., 2003; Kebu Balemie *et al*., 2004).

All of the informants did not document any traditional medicinal practice in both districts. The knowledge sources on how to use herbal medicine, dosage and antidotes, especially traditional medicinal use vary from person to person. The findings showed that the source of ethnobotanical knowledge is the family members (father, mother, brothers, and sisters), friends and neighbors. Similarly, most of the informants around Gimbi town (western

Ethiopia) acquired traditional knowledge on medicinal plants from their parents and/or close relatives (Etana Tolasa, 2007).

The desire of the local people to transfer and share their knowledge vary from one to another in the study area such as most were interested to transfer their knowledge to all their children and others to the first son, brothers and sisters, all family members and friends. On the other hand, most of the key informants from both districts were willing to share their knowledge on use of TMP to the first son while few to all their children. In general, the tendency of the local people to transfer the traditional medicinal practice knowledge is mostly to a chosen person. According to Abbink (1995), traditional health professionals in Ethiopia believed that traditional medicine is effective if done within a family or close relatives and is disseminated through generations by family members and Abel and Busia (2005) showed that this is also true for Ghanians.

Inheritance (acquisition) and transfer of traditional medicinal practice knowledge is mainly done by a word of mouth mostly to a chosen person. Oral transfer of indigenous knowledge is likely to lead to attrition as elders die before the knowledge is transferred or during resettlements of individuals or communities (Getachew Addis *et al*., 2001; Haile Yineger *et al*., 2007, 2008, Azam *et al*., 2012). In Ethiopia, it was found very difficult to obtain the traditional medicinal information as they considered their indigenous knowledge as professional secret, only to be passed orally to their older son, at their oldest age (Jansen, 1981). On the other hand, there is a tendency of the local people especially the young generation to share and transfer their ethnobotanical knowledge to interested individual, indicating steps forward to share ethnobotanical knowledge at least in the study area, although most of them are poor in ethnomedicinal use knowledge.

5.1.1.6. Local knowledge on health and role of medicinal plants

The local community in the study area had their own perception of health and illness. The local people are wealthy to define the significant of traditional medicinal plants in the society where they live. They have folk lore on the traditional medicinal plants to explain their role in primary healthcare as well as their side effects if not used properly such as a drug can kill and a drug can save (Est y-Ketil We-Ets Yahyu). The relationship of the local people to the plant species is explained by how they have to use (Kottak, 2006).

5.1.1.7. Marketability and trade of medicinal plants

The findings indicated that there was no widely observed trade on medicinal plants in the markets of the study area. It was observed that medicinal plants were sold in the market mainly associated with other uses such as food, spices, firewood and fragrance. Markets are rich sources of ethnobotanical information, since they are sites at which medicinal, ornamental, edible and other useful plants are sold. Several authors have studied the useful plants of rural and urban markets, and have shown these places to be sources of valuable ethnobotanical information (Bye and Linares, 1983). This is also confirmed during market survey in the study districts as well as other markets including Zalanbessa, Adigrat and Wukro, Eastern Zone of Tigray Regional State, Ethiopia and group discussion. The results of this study are in line with studies made in Ethiopia by Etana Tolosa (2007); Mengistu Gebrehiwot (2010); Abraha Teklay *et al.* (2013). Direct observations, interviews, and surveys of both merchants and buyers can be used to obtain a broad range of qualitative and quantitative data concerning cultural, social, and economic aspects (Alexiades, 1996).

Market surveys give solutions regarding decisions on conservation (Gadgil *et al*., 1993; Turner, 2000).

5.1.2. Ailments treated by TMPs

The finding of 82 ailments treated by 85 traditional medicinal plant species and 85 ailments treated by 102 traditional medicinal plant species in Erob and Gulomahda districts, respectively, shows that the area is rich in medicinal plant resources. Diverse studies indicated that traditional medicinal plant species have been used to treat various human and livestock ailments. For example, 85 medicinal plants for 68 ailments (49 humans and 19 livestock ailments) by indigenous people in Gimbi District, Oromia Regional State (Etana Tolasa, 2007); 67 medicinal plants for 52 ailments in Zegie Peninsula, Northwestern Ethiopia (Tilahun Teklehaymanot and Mirutse Giday, 2007); 106 Medicinal plant species for 62 ailments (37 human and 25 livestock diseases) in Bule Hora Wereda, Oromia Regional State (Mersha Ashagre, 2010); 16 medicinal plant species for 16 human ailments in Mekele town, Tigray Regional State (Gidey Yirga, 2010); 31 medicinal plant species for 32 human ailments by Indigenous People of Gemad District, Tigray Regional State (Kalayu Mesfin *et al*., 2013); 114 medicinal plant species for 66 ailments (47 human and 19 livestock diseases) in Kilte Awulaelo District, Tigray Regional State, Ethiopia (Abraha Teklay *et al*., 2013). Medicinal plants are important for rural communities for the treatment of livestock Diseases (Berhane Kidane *et a*l., 2014).

The variation in the number of ailments treated by plant species from plant to plant is an indication that there is shared and locally restricted indigenous herbal medicine knowledge in the study districts. Some species are used for treating a large number of ailments as shown by *Aloe elegans* and *Meriandra dianthera* in both districts. The findings also showed that one type of human ailment is treated traditionally by one or more than one type of medicinal plants locally. The work of Verma (2014) in India showed that cough, diarrhea and fever were treated by greater numbers of plant species.

The number of livestock ailments treated by plant species also varies from plant to plant species in the study districts as *Calpurnia aurea* was used to treat the highest number of livestock ailments by the local people of the two districts. The type and number of medicinal plant species used to treat each livestock ailment also varied from ailment to ailment as leech and cough were treated by the highest various plant species in both districts. This showed that some livestock ailments have opportunities to be treated by more plant species in the study districts. The work of Masika and Afolayan (2003) in the Eastern Cape Province, South Africa; Chinsembu *et al*. (2014) in Onayena and Katima Mulilo, Namibia; Verma (2014) in Tikamgarh District of Bundelkhand, Central India showed few plant species were used to manage various livestock diseases

5.1.2.1. Main health problems, causes, symptoms and prevention of ailments

The most frequent human ailments were febrile illness, wound and tonsillitis in Erob District and febrile illness, wound and cough/ catarrh in Gulomahda District. Febrile illness is the most common ailment in developing tropical and subtropical countries (Abebe Animut *et al*., 2009) and wound infection continues to be a challenging problem and represents a considerable healthcare burden (Healy and Freedman, 2006).

The findings showed that the rise of temperature (hot time), injury, poor sanitation and poor living standard were the major causes of human ailments reported by the local people of the study area.

Visual symptoms such as weakness, fever, sweating, vomiting, poor appetite, shivering, sentiment of queasiness, frequent sleeping, itchy state, diarrhea, feeling of discomfort were the most frequently used symptoms by the local people to diagnose ailments. Herbal practitioners use different diagnostic doctrine to identify ailments (Kumar and Shukla, 2003). According to DHS (2012), headache, chills, muscle and joint pains are some symptoms of febrile illness.

The finding showed the local people have indigenous knowledge to understand the health condition of someone by touching certain part of the body such as the forehead of a patient for some ailments and visual symptoms. They also use some means to prevent health problems. Such preventive mechanisms of ailments before illness should be encouraged and supported by extension health workers. The most effective means for reducing a disease burden is through preventive strategies. Preventing disease is recognized as effective in avoiding ailments and would offers good economic value (Steven *et al*., 2009).

The study also revealed that itchy state was the most frequently occurring livestock ailments in the study districts. Poor sanitation and animal to animal transfer of the disease were the most important frequent causes and transfer routs of livestock ailments. The findings also showed that the local people have indigenous knowledge to understand the health condition of livestock by visualizing some symptoms such as sneezing, hair loss, inactive state and coughing. Fumigating, sanitation, washing and isolating the infected animal are the common methods that used by the local people of the study districts to prevent livestock ailments. Generally, the local people in the study area are familiar with the main health problems which have frequently occurred, the causes of most ailments and the symptoms of human and livestock ailments. The findings also showed that most of the local people agreed traditional medicinal plants are important in the primary healthcare system due to their effectiveness, being cheap and easily reached. The tendency to use traditional medicinal plant species in Ethiopia is high (Dawit Abebe, 2001) and is basic for the maintenance of good health especially for developing countries (UNESCO, 1996). On the other hand, some of the local people show medium and low tendency toward traditional medicinal plant use due to some reasons including lack of standardized dose as the consequence can harm the patient; sometimes it does not cure successfully and the infection reappear after sometimes; mostly when to take the TM is not known and preference of modern medicine. This is also confirmed during group discussion. The use of natural herbal medicines may not be without risk (Hussin, 2001; Samuels, 2005).

The study also revealed that beside herbal medicines the local people of the study districts used various options, including modern medicine, holy water, zoo-medicine and others including rubber to treat human and livestock health problems which are confirmed by the key informants and group discussion. This clearly indicated that the local people are using different options to prevent and control ailments before and after illness. According to Reniers and Rebbeca Tesfai (2009), holy water and herbal medicines are common healing and treatment alternatives in Addis Ababa. Patients get holy water treatment both at home and in selected monasteries/churches (Mengiste Mesfin *et al*., 2009). The work of Wudu

Temesgen *et al*. (2013) in North Gondar Zone, Ethiopia also showed that some people use holy water for the treatment of animal ailments including rabies. The study of Jaroli *et al.* (2010) showed that 24 animal species were used to treat 34 various ailments in the surroundings areas of mount Abu wildlife sanctuary, India including the flesh of bat (*Cynopterus sphinx*) to treat cough and fever, blood of pigeon (*Columba livia*) to treat paralysis and urine of cow (*Bos taurus*) to treat wound.

5.1.2.2. Side effects and antidotes of administered herbal medicines

Most of the herbal preparations used to treat human ailments had no reported side effects in both districts. Only some herbal preparations administered against few human ailments had side effects but antidotes were not needed as burning sensation, diarrhea, itch, plummeting fluid from nose and tearing but no antidotes are administered by the local traditional healers and knowledgeable elders because they believe that such changes are inherent in the nature of the plant and they are the signs of healing. In general, most of the remedies were reported to have no serious adverse effects. The majority of the remedies that were used to treat ailments had no adverse effects on patients (Haile Yinger and Delenasaw Yewhalaw, 2007; Haile Yineger *et al*., 2008).

Some herbal preparations administered against few human ailments had some side effects. These are indications for the working of the herbal medicine. Few herbal preparation were with side effects which needs antidotes such as milk and milk product. Milk is strong inhibitor of the highly toxic compound and neutralizing toxins (detoxicant) (Hollis, 2012). Similar results were observed studies made elsewhere in the country (Kebu Balemie *et al*., 2004; Ermias Lulekal *et al*., 2008).

Herbal medicines prepared from different plant species to treat the same ailments may or may not be with antidotes. Herbal medicine prepared from *Cucumis ficifolius* to treat abdominal pain may need coffee as an antidote but herbal medicine prepared from *Solanum incanum* to treat abdominal pain does not need antidotes. The wide variation in plant species used by traditional healers in the same area, the absence of standardized preparations and dosages are problems of African herbal medicine (Ngarivhume *et al*., 2015).

Side effects as well as antidotes to livestock in the study districts were not common to notice. Few herbal preparations administered against some ailments that are with side effects were mentioned but they did not mention antidotes. Such side effects were considered to be the indications for the working of the herbal medicine such as the dropping of leeches through the nostrils of the animal after some hours of applying crashed and filtered leaves of *Nicotina tabacum* and *Tarchonanthus camphoratus* as explained in both the study districts. It is possible to state that the local people of the study districts are familar with some side effects of herbal medicines as well as antidotes that should be administered to human patients. Unless the healers and knowlegeable elders take care while herbal medicines are administered, the patient may be harmed. Herbs that were used to shrink and dry vaginal tissue were observed facilitating the transmission of veneral diseases (van Andel *et al.,* 2008).

Healers and knowledgeable elders determine the dosages based on different aspects such as age, physical appearance and state of the patient such as pregnant. Children are given small doses of medicine as compared to adult patients for the same ailment treated by the same plant species. As a result, the local healers and knowledgeable elders simply recommend or prescribe small amount such as drops, hand palms, coffee cups and for larger dosages water glasses or other local materials that are used for drinking. Local healers and knowledgeable elders have special care for pregnant women and physically weak persons and mostly impose restrictions to prescribe traditional medicine. For example, pregnant women and physically weak persons are not given those medicines that have observable adverse effects such as vomiting and diarrhea which may lead to other side effects such as abortion. Over dose of some herbal medicines such as *phytolacca dodecandera* affect preganant mother (Ragunathan and Solomon Maquanente, 2009). Finally, when patients did not recover and show any sign of recuperation, their center of attention is to use modern health services. Similar results were obtained in studied made by Ermias Lulekal *et al* (2008); Haile Yineger and Delenasaw Yahalaw (2007); Mirutse Giday *et al*. (2009).

5.1.3. Threats and conservation attempt of MPs

Almost all of the informants are familiar with one or more threats to the medicinal plants in the study area. Scarcity of rain (drought) and cutting of plants for different reason were the major important threats in both districts. The principal threat of medicinal plants in Kilte Awulaelo District, Eastern Zone of Tigray (Abraha Teklay *et al*., 2013) and in and around Alamata, Southern Region of Tigray (Giday Yirga, 2010) of Ethiopia was drought. This work is also agreed with studies made in the country such as deforestation and drought (Haile Yineger *et al*., 2008). On the other hand the finding did not agree with other studies made in the country such as environmental degradation, fuel, construction materials and agricultural expansion (Endalew Amenu, 2007); agricultural expansion and overgrazing (Etana Tolosa, 2007; Mersh Ashagre, 2011) were the most threats of medicinal plants; agricultural expansion, urbanization, cutting for construction, fire wood and charcoal (Frankel *et al.*, 1995). Threats of biodiversity are increasing noticeably from time to time (CBD, 1998). Furthermore, Ensermu Kelbessa *et al*. (1992) showed that in Ethiopia where there are more environmental problems than any other country in the Sahel belt the situation is even worse.

In the study area, deforestation for agricultural expansion is not a serious current problems leading to the reduction of medicinal plants. This is usually due to firm stand and decision of Tigray Regional State Administration to conserve and protect vegetation. Furthermore, protecting and conserving of vegetation is mandatory in the region to reduce poverty and consequently works have been done to develop the significance of conserving and protecting vegetation. The finding in general showed the most threat of medicinal plant species in one area or district may not be in another area or district.

Some plants were also reported to have uses other than their medicinal values including fuel, edible (food, drink), fence (living and non-living), spice, shade and house construction. Of the total 85 medicinal plants documented in Erob District, 28 plant species were reported to have only medicinal use. On the other hand most of them (57 plant species) have additional uses such as fuel, edible, fence (living and non living fence) and fodder in Erob District. Of the total 102 medicinal plants documented in Gulomahda District, some of them (28 plant species) were reported to have only medicinal use. On the other hand, most of them (74 plant species) have additional uses as fuel, edible, fence (living and non living fence) and fodder. Medicinal plant species in both district used for different purposes other than medicinal uses. This indicated the over exploitation of medicinal plants for other uses other than traditional medicinal uses and the dependency of the local people on plants for different purposes. Ethobotanical study on 97 plant species from Ranyal Hills District Shangla, Pakistan showed many of these plants have more than one local use (Ibrar *et al*., 2007). This could be a good indication that these valuable resources are at conservation risk. Several combined factors have resulted in loss of medicinal plant species and associated knowledge inside and outside the country (kloos, 1976; Farnsworth *et al*., 1985; Cunningham, 1991; Odera, 1997; Seyani and Chikuni, 1997; WHO, 1998; Mirutse Giday *et al.*,2003; Kebu Balamie *et al*., 2004; Williams, 2004; Mersh Ashagre, 2011).

In general, different studies indicated plants used by the local people for traditional medicinal purpose also used by them for other purposes other than medicinal uses such as fire wood and charcoal, food, construction, fodder, spices, and forage, shade and many others such as ornamental and furniture's. For instance, one or more plants like *Allium sativum*, *Capsicum annum*, *Carissa spinarum*, *Citrus aurantifolia*, *Coffea arabica*, *Cordia africana*, *Dovyalis abyssinica*, *Embelia schimperi*, *Ensete ventricosum*, *Ficus sur*, *Linum usitatissimum*, *Trigonella foenum-graecum*, *Urtica simensis*, *Ximenia americana* were reported for other purposes other than medicinal use by Zemede Asfaw and Ayele Nigatu (1995); Zemede Asfaw (2001; Tigist Wondimu *et al*. (2007).

Direct matrix ranking showed that *Acacia etbaica, Olea europaea* and *Cordia africana* were MPs with multiple uses and hence the most preferred medicinal plants by the local people of the study area. This finding clearly indicates that some medicinal plants are harvested for multiple uses in the study area. Thus, sustainable use of these highly used and top-ranked species is under questions, as the pressure on their consumption is intensified and superimposed in the area. This is evidenced by the high rate of loss of the

Olea europaea in the area which is confirmed during field observation and group discussion. Direct matrix analysis was done in Ethiopia to identify the most used and treated plant species by different authors such as Ermias Lulekal *et al*. (2008); Mengistu Gebrehiwot (2010) and Mersha Ashagre (2011).

All of the key informants agreed that modernization such as expansion of education; health services such as hospitals, clinics, health posts, western cultural diffusion also affect the use of herbal medicines. According to Debela Hunde *et al*. (2004) and Mirutse Giday *et al*. (2009), the immediate and serious threat to the local medical practice and transfer in Ethiopia arise from the increasing influence of modernization such as increase of modern education; industrialization; changes in life style and migration from rural to urban areas. Modern medical care, occupation and modern education have a negative effect on ethnomedicine and associated knowledge (Kiringe, 2005). The role played by health workers to use TM for primary healthcare practice is insignificant (Albedah *et al*., 2012). To reduce this tendency, awareness has to be developed through different means among members of the communities' especially young generation, such as by health workers. youth associations, school clubs and mini media need to teach about the usefulness of the knowledge and practice of traditional medicinal plant use. Most young people showed a tendency of ignoring traditional medical practice (Mirutse Giday *et al*., 2010).

Group discussion, field observation and guided field walk confirmed that some traditional medicinal plants are becoming scarce from time to time due to natural and anthropogenic factors such as *Croton macrostachyus*. Many of the local people give priority to the immediate use of the plant species than to its sustainable future. As a result, their harvesting style is destructive. Sometimes it was difficult to get some medicinal plants in the dry season. In general, they agreed that the variety of plant species used for traditional medicinal plant are minimized even though there is an attempt and tendency of conserving and protecting plant community having traditional medicinal plants. Similar result was obtained by one or other ethnobotanical studies made in Ethiopia such as Aberha Tesfay (2008); Etana Tolosa (2007); Mengistu Gebrehiwot (2010); Mersha Ashagre (2010); Girmay Zenebe *et al*. (2012); Abraha Teklay *et al*. (2013). However, it was found that some of the participants have traditional medicinal plants in their homegardens and others said that they are planning to cultivate some.

Group discussion also confirmed that the knowledge of the local people especially the young generation has diminished from time to time. They also agreed that modernization affects the young generation not to be interested toward herbal remedies and mostly, knowledgeable individuals passed away before they transfer their knowledge to the young generation.

Most of the local people in Erob and Gulomahda districts have made no attempt to conserve the traditional medicinal plants they use. On the other hand, some local people from both districts made some attempts to conserve and protect plant species they used for medicinal purposes in their homegardens and other places as living fence. Therefore, the findings showed that the conservation action of most of the local people have not been encouraging in the past. The work of Emiru Birhane *et al*. (2011) in the degraded dry lands of Tigray, Northern Ethiopia showed that most of the local people did not give much attention for the management of the traditional medicinal plants. On the other hand, some informants made some attempt to conserve the plants they use for traditional medicinal practice in their homegardens and by avoiding the uprooting of the whole plant, keeping these as living fence and follow proper use.

Almost all of the local people were familiar with some methods to conserve and protect traditional medicinal plant species. Caring for and protecting plant communities having medicinal plants, replanting of plant species especially shrubs and trees having traditional medicinal use, planting homegarden and in nearby areas and using alternative energy sources and others including electrification and biogas were recommended by the local people of the districts. Allowing populations of species to continue to grow and evolve in their natural habitats is the best means of conservation (IUCN, 1993). The work of Kayombo *et al*. (2013) also showed that medicinal plants can be conserved through in-situ, ex-situ means and sustainable harvesting.

Group discussion and field observation proved that certain plant species were plenty in some areas which otherwise are rare or absent somewhere else such as in protected plant community, cultivated field and church compound. Holly places and sacred groves have preserved remnant forests, medicinal plants, a wide range of indigenous and botanical information and cultural diversity (Tamrat Bekele, 1994; Kebrom Tekle *et al*., 1997; Fisseha Mesfin *et al*., 2009; Ayyanar *et al*., 2010).

5.1.4. MP to be considered for candidacy in drug discovery

The informants consensus obtained during this study indicated that some medicinal plant species are more popular than others. It indicated that *Argemone mexicana, Nicotiana tabacum* and *Achyranthes aspera* were the three most cited medicinal plant species in Erob District and *Argemone mexicana, Cynoglossum lanceolatum* and *Nicotiana tabacum* were the most cited medicinal plant species in Gulomahda District. *Argemone mexicana*, *Achyranthes aspera* and *Cynoglossum lanceolatum* were cited by the highest number of informants in Erob and Gulomahda District to treat human ailments and *Nicotiana tabacum* and *Nicotiana glauca* were the most cited medicinal plant species treating livestock ailments in the study districts. The work of Gebremedhin Gebrezgabiher *et al*. (2013) in Tanqua-Abergele and Kolla-Tembien woredas of Tigray, Northern Ethiopia shows that *Nicotiana tabacum* is one of the most frequently reported plant species to treat livestock ailment

Febrile illness, wound, tonsillitis and abdominal pain were the most cited human ailment in Erob and Gulomahda districts. In addition, itch, external parasite/louse and leech infestation were found as the most cited livestock ailment in both districts. It found that the most cited human and livestock ailments were treated by the most cited plant species in both districts. This showed almost similar preference of medicinal plants by the local people to treat similar ailments because both districts are nighbour and diffusion of ethnobotanical knowledge is expected. In general, *Argemone mexicana*, *Nicotiana tabacum*, *Achyranthes aspera* and *Cynoglossum lanceolatum* were the four most cited medicinal plants by the local people of the study districts. *Argemone mexicana* grows in the dry field areas (Joshi, *et al*., 2013) and the fresh juice of the leaves and the latex have been reported to be used externally as a disinfectant for open wounds, cuts and extracts such as methanol and aqueous showed faster rate of wound healing (Dash and Murthy, 2011). *Nicotiana tabacum* is used as antispasmodics, diuretics, emetics, sialogogues, in rheumatic swellings, anaesthetics, antibacterials, anticonvulsants, anti-fungal, treatment of asthma, expectorants and treatment of worms in East Africa (Maxwell and Yusuf, 2010). *Achyranthes aspera* is a very important plant for its large number of medicinal use (Srivastav *et al*., 2011) and the plant is used in indigenous system of medicine as antiviral (Ratra and Misra, 1970). It has been used in different systems of medicine and has been used as antimicrobial, immune stimulant, anti-inflammatory and others such as anti snake venom (Dey, 2011). Studies indicated *Cynoglossum lanceolatum* has been used in folk medicine to treat acute nephritis, periodontitis, acute submandibular lymphadenitis and others such as snake bite with a chemical constituent of Pyrrolizidine alkaloids: cynaustralin and cynaustine (Singh, 2007). According to Macia *et al*. (2005), medicinal plants with higher informant consensus need to be seriously considered for further ethnopharmacological studies because they are species widely applied by many people and may have been utilized for a long time.

Some of the categories of diseases have high ICF than other categories. Plants used against illness category of problems of the respiratory system; febrile illness and head ache; oro-dental and pharyngeal disease; skeletal, muscle, and connective tissue; skin and subcutaneous tissues and problems of the digestive system have high ICF in Erob District. Plants used against febrile illness and head ache; problems of the respiratory system; oro-dental and pharyngeal disease; problems of the digestive system; skin and subcutaneous tissues and skeletal, muscle, and connective tissues have high ICF in Gulomahda District. A high value of ICF (close to 1) indicates that relatively few species are used by a large proportion of people, while a low value indicates that the informants disagree on the taxa to be used in the treatment within a category of illness (Canales *et al*., 2005). It is essential to estimate use variability of the medicinal plants and to determine which plants are particularly interesting in the search for bioactive compounds. ICF was determined in and outside of the country by different authors such as Tesfaye Seifu *et al*. (2006); Tilahun Teklehaymanot and Mirutse Giday (2007); Ragupathy *et al*. (2008); Fisseha Mesfin *et al*. (2009); Ragupathy and Newmaster (2009); Eskedar Abebe (2011).

Calculated FL value showed the most frequently utilize medicinal plants were *Achyranthes aspera, Argemone mexicana, Cordia africana, Nicotiana tabacum, Rhamnus prinoides, Verbena officinalis* and *Ziziphus mauritiana* in Erob District and *Argemone mexicana, Cordia africana, Lycopersicon esculentum. Nicotiana tabacum, Rhamnus prinoides* and *Ziziphus mauritiana* in Gulomahda District. The fact that these medicinal plants had the highest FL values which could be an indication of their good healing potential at least in the study area. According to Trotter and Logen (1998), plants that are used again and again are more likely to be biologically active. FL was calculated in and outside a country by different authors such as Endalew Amenu, 2007; Tilahun Teklehaymanot and Mirutse Giday, 2007; Haile Yineger, 2008; Tawfeeq, 2008; Mirutse Giday *et al*., 2009, 2010; Mersha Ashagre, 2011.

The finding showed some plants are with high UV and others are low UV in the study area. Calculated UV of MP species collected from Erob District showed *Cordia africana*, *Olea europaea* and *Maytenus arbutifolia* have the highest value ranked 1st, 2nd, and 3rd. UV of MP species collected from Gulomahda District showed *Olea europaea*, *Cordia africana* and *Carissa spinarum* have the highest UV value ranked 1st, 2nd, and 3rd. UV is a quantitative method that demonstrates the relative importance of species known locally, which reflects the importance of each species to the local people. According to Albuquerque *et al*., (2006) some plants are with high use value and relative importance than others.

The study also found some plants are with high RI and others are low which revealed the diversity of medicinal plant application. *Olea europaea, Cordia africana* and *Acacia etbaica* have the highest RI value and are plant species with highly diversified used plant by the local people of the study districts. The work of Almeida *et al*. (2006); Mirutse Giday *et al*. (2009) found some medicinal plant species was with high RI and others are low RI in their study. The most versatile plant species are those that have the utmost medicinal properties (El-Darier and El-Mogaspi, 2009). Ranking of traditional medicinal plant species based on several criteria help to establish their efficacy (Alexiades , 1999).

Medicinal plant species in the study districts were found distributed from 1000m-4000 m.a.s.l. with various growth forms that were obtained from different resources. Similar result was observed in the work of Haile Yineger *et al*. (2007, 2008) in the Oromo ethnic group, Southwestern Ethiopia; Mengistu Gebrehiwot (2010) in Seru District, Oromia Region, Ethiopia; Mirutse Giday *et al*. (2010) by Sheko ethnic group of Southwest Ethiopia; Eskedar Abebe (2011) in Debark District, North Gondar Zone, Amhara Regional State, Ethiopia.

Preferences of eight human ailments treated by *Aloe elegans* in Erob District and seven human ailments treated by *Schinus molle* in Gulomahda District following the approach of Martin (1995) by 10 key informants of each district was done and showed that *Aloe elegans* was more preferred to treat abdominal pain by the local people of Erob District and *Schinus molle* was the most preferred to treat abdominal pain in Gulomahda District. Furthermore, preferences of four and six medicinal plant species curing livestock from itchy state in Erob and Gulomahda districts respectively by eight key informants of each district showed that *Calpurnia aurea* was the most preferred in Erob District while

Nicotiana glauca in Gulomahda District. The results of preference ranking showed a particular medicinal plant is more preferred by the local people to treat a particular ailment. The most favored species to treat a particular disease reflects the most efficacious, at least in the local area of the people who use it. The finding also showed that the preference of a particular medicinal plant species against a particular ailment is not necessarily the same, it varied from district to district. Preference ranking was made in Ethiopia by many authors to see the choice of the local people as seen in Endalew Amenu (2007); Ermias Lulekal *et al*. (2008); Mersha Ashagre (2011).

Pair wise ranking of medicinal plants treating particular ailment showed that some medicinal plants was preferable than others. The finding indicated pair wise ranking of medicinal plants treating febrile showed *Cordia africana* obtained the most preferable plant species in Erob District, while *Cynoglossum lanceolatum* was the most preferable plant species in Gulomahda District. The preference of medicinal plant species of the local people to treat a particular human ailment shows variation. This showed that the preference of plant species against some human ailments varies from area to area.

Pair wise ranking of medicinal plants treating livestock from leech was also done and showed *Nicotiana tabacum* obtained the most preferable plant species in both districts. The results of paired comparison showed the preference of medicinal plant species of the local people of the two districts to treat a particular ailment to some extent is similar. The most favored species are usually the most efficacious, at least in the local area of the people who use them. Some studies made in Ethiopia pair wise ranking where informants made their choices on individual basis such as Gebremedhin Hadera (2000); Debela Hunde *et al*. (2004); Endalew Amenu (2007).

The results of triadic also showed some medicinal plants are more preferable than other medicinal plant species by the local people against same ailment. *Schinus molle* was the most preferable MP against abdominal pain in Erob District, while *Verbena officinalis* was the most preferable MP against Abdominal pain by the local people of Gulomahda District. This clearly signifies the local people preferred a particular plant species against a particular ailment but the medicinal plant species preferred 1st to treat a particular ailment may not be same by people of another district.

5.1.5. Comparison of TMPs in relation to treated ailments and knowledge among different groups

The JCS (0.55) of Erob and Gulomahda districts for the reported traditional medicinal plant indicated that since the two districts situated almost in close geographical settings and are neighbor, there is a cultural diffusion and sharing of experiences and knowledge between them. Thus, they commonly utilized mostly the same species for traditional medicinal purposes for the plant species. JCS is widely used in species association analyses and to compare similarity among them (Niwattanakul *et al*., 2013).

JCS also showed that some medicinal plants recorded in Erob and Gulomahda Districts were also used as herbal remedies in other parts of Ethiopia. The work of Tesfaye Hailemariam *et al*, (2009) showed that some of the reported plants having similar uses elsewhere can be considered as indication of their pharmacological effectiveness tested in different areas by different cultures. Similarities, in the cross-cultural use of the traditional plant remedies are a strong indication of the bioactivity potential of the documented plant species (Adnan *et al*., 2014).

The local people of Erob and Gulomahda Districts were used large number of plant species that used to treat human and livestock ailments. The ranges knowledge of the local people of Erob District for the reported traditional medicinal plants used as herbal remedies showed 3-18 i.e. 15; mean knowledge 8.3115; Standard deviations (SD) 3.65041 and Coefficient of variation (CV) 0.43920. The ranges knowledge of the local people of Gulomahda District for the reported traditional medicinal plants used as herbal remedies showed 3-22 i.e. 19; mean knowledge 9.0603; SD 4.01970 and CV 0.44366 in Gulomahda District on traditional medicinal plants used as herbal remedies

The insignificant difference on mean number of plant species used to treat human and livestock ailment showed that more or less the local people of the study districts were used similar number of plant species to treat each ailments.

The insignificant difference on the mean number of plant species belonging to the common plant families to both districts showed that the local people of the two districts use more or less similar plant species for traditional medicinal purpose by the local people.

A stronger positive (direct) linear relationship between the numbers of reported MPs with ailments being treated by them in the study districts reflected that as the reported number of medicinal plants increased, the chance of more ailments to be treated is greater.

The insignificant difference on the mean number of ailments treated by the reported TMPs that are common to both districts as well as mean number of ailments treated by all the reported MPs showed that almost similar number of ailments are treated by TMPs in the two districts and the presence of knowledge diffusion between the two districts.

The chi-square test shows no statistically significant relationship between gender and conservation of medicinal plants in the study area. Gender and conservation of medicinal plants are independent at least in the study districts and any differences are due to chance**.** This showed conservation of medicinal plant did not affected by sex difference. The majority of men and women herbalists supported the idea of conserving medicinal plants in Urban districts of Tanzania (Augustino and Gillah, 2005).

A positive (direct) linear relationship between age and knowledge in the study area indicates that knowledge on medicinal plant depends on age. Furthermore, r^2 showed that 70.56% and 59.29% ethnomedicinal knowledge of the local people is linked with age in Erob and Gulomahda districts respectively. On the other hand, the proportion of the unexplained variation (1-r $^{2)}$ x 100%) showed that 29.44% in Erob and 40.71% in Gulomahda knowledge of the local people is not linked with age rather by some other factors. These factors may knowledge which has been shared from knowledgeable persons, family members, friends as well as try and error. The significant mean knowledge difference that were obtained between married and those of single in the study area also showed that most married are aged and more responsible than single for their family members in case of primary healthcare practice. Furthermore, it is also seen that most of the married were aged which supports elders are knowledgeable than the young one in number of TMPs. In general, the knowledge of the local people on traditional medicinal plant varies in different age level. As the age of the people increased, they become more knowledgeable on TMPS use i.e. the knowledge of youngsters on traditional medicinal plant becomes less compare to the adults and older once. Medicinal plant knowledge and use increased with age (Pankhurst, 2001; Mirutse Giday *et al*. 2003; Hussien Adal, 2004;

Estomba *et al*., 2006; Acharya *et al*., 2009; Tesfaye Awas and Sebsebe Demissew, 2009; Mengstu G/hiwot, 2010; Badshah and Hussain, 2011; Mersha Ashgre, 2011).

A negative linear relationship between education and knowledge indicates that modern education affects the knowledge on medicinal plants in the study area. Most of the modern educated persons ignore the use of herbal medicine and focused toward modern health system. The knowledge of the illiteracy and lower grade of the local people on traditional medicinal plant have been found superior compare to the modern educated individuals i.e. weak association between education and knowledge. Furthermore, r^2 showed that only 19.50% and 21.80% ethnomedicinal knowledge of the local people is linked with education in Erob and Gulomahda districts respectively. The proportion of the unexplained variation ($1-r^{2)}$ x 100%) showed that 80.5% the local people ethnomedicinal knowledge in Erob and 78.2% informant's knowledge in Gulomahda is not linked with education rather by some other factors. The finding clearly indicated the knowledge on traditional medicinal plant is affected by different factors linked with modernization such as expansion of schools, cultural exchange. The study of Tesfaye Awas and Sebsebe Demissew (2009) and Mirutse Giday *et al*., (2010) indicated that illiterate ones had better knowledge of medicinal plants use as compared to literate ones. Medicinal plant knowledge and use was independent of the educational level (Haile Yinger and Delenasaw Yewhalaw, 2007; Haile Yineger *et al*., 2008).

The insignificant t-test on the reported mean knowledge of traditional medicinal plants between male and female in Erob District as well as in Gulomahda District shows that there is a diffusion of knowledge in the family members and females are just as males responsible for primary health care of the members of their family in these districts.

Women and men's ethnobotanical medicinal and ritual knowledge can overlap (Pfeiffer and. Butz, 2005). On the other hand, some studies showed that males are more knowledgeable than females (Berhane Kidane *et al*., 2014; Mirutse Giday *et al*., 2009). In general, indigenous knowledge of traditional medicine among the local people with regard to their sex and age were not similar even though it is insignificant in case of sex in the study area. In general, indigenous knowledge of traditional medicine among the local people with regard to their sex and age were not similar. This may show there is no equal access in the family to get indigenous knowledge of traditional medicine because mostly knowledge is transferred from father to the first born son or other well behaved son. This finding agrees with the findings of Tizazu Gebre (2005), Tilaun Teklehaymanot *et al*. (2006) and Mersha Ashgre (2011).

The significant difference of the F-test for the mean knowledge between groups for the reported medicinal plant species among the eight kebeles indicates variation of mean knowledge among the study kebeles. The knowledge difference among the local people of some kebeles may be due to different source of the medicinal plants in their vicinity, difference in the distribution and expansion of health services and variation of willingness of informants to share all their ethnobotanical knowledge to the researcher. The knowledge of a person on medicinal plants and the way how to use varies from person to person and from community to community (Quinlan and Quinlan, 2007).

The insignificant difference of ethnobotanical mean knowledge on the reported TMPs between the two districts showed that there is Knowledge diffusion among the people of the two districts. On the other hand, the significant mean knowledge difference between Saho and Tigrigna speakers in Erob District is an indication of the greater dependence of the ethnic group on TMP in meeting their basic health care needs. In addition, Language may also act as a barrier in ethnomedicinal knowledge use and exchange of associated knowledge with Tigrigna speakers at least in Erob District. The study conducted in Maale and Debub Ari districts of southern Ethiopia by Berhane Kidane *et a*l. (2014), where the two ethnic communities reside showed that the Maale ethnic community was more knowledgeable. Miruts Giday *et al*. (2010) also reported that the Sheko people were knowledgeable as compared with Meint and Bench ethinic groups in Southwest Ethiopia. Local knowledge on plant species is influenced by ethnic difference (Kourouma *et al*., 2011).The significant differences of mean knowledge reported TMPs between Catholic followers and Orthodox followers in Erob District showed that religion may hamper information exchange on medicinal plant use. Furthermore, most of the Catholic followers were obtained saho speakers in which language may also act as a barrier in ethnomedicinal knowledge use exchange. According to de Boer *et al*, (2012), sociocultural barriers including ethnicity, language and religion can impede information exchange on medicinal plant use.

5.2. Conclusion

The people in the study area reported using diverse plant species (121) in their herbal medical system that were used to treat 75 human and 27 livestock ailments clearly indicating their rich knowledge of medicinal plant use and ethnomedicinal practices. The local people of Erob District, on their part, reported 82 ailments that they treat with remedies from 85 MPs. In Gulomahda District, on the other hand, the study found 102 MPs used to treat 85 ailments. The low number of TMPs reported by the local people of

Erob District may be an indication how the plant community and associated knowledge is threated.

The medicinal species included two that are endemic to Ethiopia. The family Asteraceae had the highest number of genera in both districts; Solanaceae having the highest number of MP species in Erob District while both the Asteraceae and Solanaceae came up with the highest numbers in Gulomahda District. Most of the medicinal plants used in traditional medicine are herbs mainly harvested from the wild and some from homegardens and around farmlands. The number of ailments treated by a plant species varied. The number of medicinal plant species used to treat each human ailment also varied from ailment to ailment. Both human and livestock health problems were most frequently treated by fresh plant material. The findings also showed that most of the local people agreed on the importance of traditional medicinal plants since they consider them effective, cheap and easily reachable.

The local people of the study districts used some materials such as coffee cup, tin, hand palm, spoon and count for leaves, seed, fruits and finger size to measure dosage for the prescribed traditional medicines though most of these are usually taken by estimation. Age, gender and stage of illness were also considered by some healers to determine the amount of remedies to be given. There were variations also in the unit of measurement, duration and the prescription by healers for the same kind of health problems.

Of the different parts of medicinal plants, leaves were the most frequently used part, concoction was commonly used with both internal and external application to treat human and livestock health problems. Most of the remedies were reported to have no serious adverse effects while some cases of side effects such as vomiting, diarrhea, itchiness, sweating and temporary inflammations were recorded and in a few cases herbal remedies leading to some side effects are associated with antidotes such as coffee, milk and milk products. Herbal remedies were mostly processed using local materials, prepared in most cases without diluents and when used water was the most frequently used diluent.

Most of the local people were familiar with the main health problems as well as with the causes of most ailments and the symptoms of some human and livestock ailments. Moreover, the local people also used modern medicine and holy water to treat health problems in addition to the traditional medicinal plants. This clearly indicated that the local people have been using different options to prevent and control ailments before and after illness. However, they never document in writing any traditional medicinal practice. Inheritance (acquisition) and transfer of traditional knowledge and practice of herbal medicine is mainly done by a word of mouth mostly and demonstration in practice to trusted and favoured family members.

The time said to be required to collect plant material for medicinal use varied from plant to plant species and from place to place. Most of the medicinal plants were also harvested with no specific preference to any particular maturity level and no special seasonal preference. It was perceived by informants that the knowledge of the local people, especially of the young generation, has been declining from time to time.

Although most medicinal plant species were in short supply especially during the dry season, most of the local people did not report any practice of storing traditional medicines for later use. Informants explained that plant species used for traditional medicinal purposes are not sold in the market for medicinal use only but mostly sold associated with other uses which were also confirmed during market survey and group discussion. Most people did not make attempts to conserve the traditional medicinal plants they use. Scarcity of rain was perceived as a major threat to medicinal plants in both districts. Planting in homegardens and nearby areas of shrubs and trees known to be used in traditional medicine, caring and protecting plant communities that harbour medicinal plant species, use of alternative energy resources such as electrification and biogas were some of the measures recommended by the local people to conserve and protect traditional medicinal plant species.

Trees and shrubs were exploited by Eritrean and Ethiopian soldiers to build their cordons and for use as fuel sources. Many of the local people also gave priority to the immediate use than to its future sustainability. It was foundout that the medicinal plant species most preferred to treat a particular ailment in one district are not the same for the people of another district.

The values of JCS (0.55) for the reported traditional medicinal plants indicated the presence of a cultural diffusion and sharing of experiences and knowledge between the two districts. The knowledge on the reported medicinal plant species were found between 3 and 22. Insignificant difference was obtained on mean number of ailments treated by the reported MPs; plant species used to treat ailment; between gender and conservation; b/n male and female in the two districts.

Significant difference were found for the reported TMPs with the number of ailments being treated by them; between age and knowledge; between knowledge and educational levels; between married and single; between key informants and general informants for the reported TMPs in the study area. Furthermore, significant differences were found between Saho speakers and Tigrigna speakers, and between Orthodox and Catholic followers in Erob District.

Some plant species were reported to have uses other than their medicinal values which provided good indication about their over exploitation for uses other than medicine. Some of the major woody elements of the original vegetation types were observed from the remnants in certain areas such as in the church compounds. The study findout some MP that are highly considered candidacy in drug discovery. Popular medicinal species including *Aloe elegans, Verbena officinalis, Otostegia integrifolia, Schinus molle, Calpurnia aurea, Nicotiana glauca, Vernonia rueppellii, Meriandra dianthera, Tarchonanthus camphoratus, Olea europaea, Cordia africana* and *Rhamnus prinoides* are some of the good candidates for consideration in further phytochemical and pharmacological research to verify their efficacy

The combinations of many threats reduced the number of plants available and are also eroding the knowledge base about these plants in the study area. This calls for a serious attention to scale up conservation and management of the medicinal plants in the area. Hence, the following recommendations are forwarded to mitigate the risk of declining and may be ultimate extinction of some of the medicinal plants, and the associated indigenous medicinal knowledge:

5.3. Recommendations

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

1. Encouraging people so that people can full-heartedly grow and have medicinal plants in their homegardens, mixing them with crops in the farm lands and growing the woody species as live fence;
2. Disseminate appropriate information to the general public to empower them with knowledge and skills for the proper use to minimize and if possible to avoid wastage in the use of traditional plant medicines;
3. Educating and awareness raising activities should be undertaken to protect rare plants from reckless use including *Vernonia rueppellii, Leucas abyssinica, Olea europaea, Croton macrostachyus, Ficus ingens* for purposes like fuelwood, construction and the like that lead to their destruction;
4. Avoid uprooting of the plant species for medicinal purpose particularly before its flowering, fruiting and/seeding. If possible, it will be relatively better to use other parts of the medicinal plants such as leaves instead of root to protect from the risk of extinction and endangering the species by collecting the roots or barks of the plants. It is worth considering the alternatives to defray the damage due to the use of roots and barks: roots of *Verbena officinalis* and *Indigofera vicioides* for abdominal pain by the leaves of *Cynoglossum lanceolatum* and *Indigofera amorphoides;* the root of *Calpurnia aurea* for cough (livestock) by the leaves of *Leucas abyssinica*; the roots of *Commicarpus plumbagineus* and *Euclea racemosa* for snake venom by leaves of *Cyphostemma cyphopetalum*; the root bark of

Croton macrostachyus for Jaundice by leaves of *Hypoestes forskaolii* and the root bark of *Croton macrostachyus* for nephritis by leaves of *Dodonaea angustifolia*;

5. Establish a system of protecting the plant communities of the area in which most of the medicinal plants are found sheltered from human activities, grazing and browsing of domestic animals. The areas that deserve protecting in this way include Sibida, Giniato, Arer and As-aleta localities in Erob District where *J. procera, C. africana, O. europaea, M. arbutifolia, A. etbaica* and others such as *A. origena* species have been found and Sihurto, Alakima and Sebeya protected areas in Gulomahda District where *V. rueppellii, C. macrostachyus, D. angustifolia, O. europaea, N. glauca, Acacia etbaica, Acacia origena* and others such as *C. aurea* species have been documented;
6. The watershed conservation and revegetation efforts made by the community of the study districts should be encouraged and strengthened as well as the plant species which have been in the area and those which have been planted and will be planted need continuous follow-up and care for important species including *Olea europaea, D. angustifolia* and *Acacia* spp.
7. Promote and conduct relevant scientific research on medicinal plants in collaboration with traditional health practitioners to validate claims made on dosage, safety, efficacy and quality of traditional herbal medicines;
8. The concerned bodies, governmental and non-governmental organizations need to give emphasis to the proper management, conservation and replanting of medically used plants specially trees and shrubs through involving the local people

encouraging in-situ and ex-situ conservation including *C. macrostachyus*; *Olea europaea* and *D. angustifolia;*

9. Medicinal plants like *Olea europaea* subsp.*cuspidata, Juniperus procera, Cordia africana,* which are highly threatened in the study districts, should be given priority to conservation actions. Promoting the establishment of in–situ conservation measures is also one method of conservation especially for those medicinal plants which are only found growing wild, and this should be encouraged;
10. In the study area, the majority of the people use traditional medicinal plants especially as immediate remedies for primary healthcare system. However, some modern health professionals and some educated people continue to undermine them. This situation can be harmonized by integration of the traditional and modern health systems to remove or to minimize the negative attitudes and build good future for herbal medicine by narrowing the gap between the two health systems.
11. Based on the information provided by the researcher, further and relevant scientific research should be conducted on medicinal plants to dig out their quality, efficacy and safety. Furthermore, researches especially targeted to the identification and isolation of 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.

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APPENDICES

Appendix 1 Semi-structured interview employed in the research area

1. Facts about respondents
   1.1. Identification: Name: ---sex:--Age--Marital status---Educational status--- Ethnic group----Religion---
   1.2. Address: Region-----Zone-------District------Kebele----Locality-----
   1.3. History of Traditional Healer /informants
      1.3.1. Year of services
      1.3.2. From whom did you acquire the knowledge?
      1.3.3. To whom do you want to share your knowledge?
      1.3.4. What are the main types of health problems /ailments of human?
      1.3.5. What are the causes of human ailments?
      1.3.6. What are the main types livestock health problems / ailments?
      1.3.7. What are the causes livestock health problems / ailments?
      1.3.8. What are the symptoms of human and livestock ailments?
      1.3.9. How do you diagnose each ailments / health problems?
      1.3.10. How do you control /prevent health problems / ailments?
      1.3.11. How do you treat each human health problems / ailments?
      1.3.12. How do you treat livestock health problems / diseases?
      1.3.13. How plant parts are used (fresh only, dried only, both)?
      1.3.14. How do you measure amount/ dose?
      1.3.15. Acceptance of traditional medicine by the community you live in?
      1.3.16. If not accepted why?
      1.3.17. If it is accepted why?
      1.3.18. Do you collaborate with other traditional healers?
      1.3.19. If you do not collaborate, why?
      1.3.20. Do you document your traditional medicinal practice?
2. Concern of the informants to the medicinal plants
   2.1. How wide spread the medicinal plant/s in the area? (Common, scarce, absent)
   2.2. If disappeared, name the disappeared medicinal plants / local name or number of disappeared plants)
   2.3. How do you preserve the traditional medicine
   2.4. Any restriction or taboos in collecting medicinal plants?
   2.5. How do you conserve traditional medicinal plants?
   2.6. Are medicinal plants marketed or marketable?
   2.7. Are there any threats to the medicinal plant? (List them)
   2.8. What methods need to conserve the plants
   2.9. How is the knowledge on the traditional medicine passed to the family members or younger generation?
   2.10. How does modernization interfere with traditional medicinal knowledge?
3. About the traditional medicinal plant
   3.1. Common /vernacular name
   3.2. How wide spread is the medicinal plant?
   3.3. Location of the plant
   3.4. How plant parts used / fresh, dried, both)?
   3.5. Health problem for which the plant is used as a remedy
   3.6. Which plant part /s used
   3.7. Methods of preparation (Decoction, infusion etc.
   3.8. Are there any plant and /ingredient added? If yes what type
   3.9. Dose or amount and other determiner factors
   3.10. Method of usage
   3.11. Any noticeable adverse/ side effect /s
   3.12. Any anti dotes for adverse / side effect /s?
   3.13. Any other use of the medicinal plants?
4. Other additional information recorded
   4.1. Collection number
   4.2. Local name/vernacular name
   4.3. Scientific name
   4.4. Family name
   4.5. Brief description of the plant
   Habit: ------ Habitat: ------Distance:------Altitude:----- Latitude:------Long:-------
   4.6. Site /area name: ---------Date: -------Time: ------

Appendix 2 List of medicinal plant species in Saho and Tigrign names, habt and voucher numbers

(W=Wild, Hg=Homegarden, Cu=Cultivated), Er=Erob, H = herb, S =shrub, T=tree, CS=climber shrub, CH=climbing herb, WC=woody climber, G/f=growth form, T= Tigrigna, E = Erob (Saho), C = common name to both T and E), * confined to Ethiopia and Eritrea, ** endemic)
N.B. Endemic status checked by referring to the species accounts in the Flora of Ethiopia and Eritrea)

No	Scientific name	Family name	G/f	Local name in Saho and Tigrigna	Source	Coll. #
1	*Acacia etbaica* Schweinf.	Fabaceae	T	Siraw (C)	W, Hg	TB-60
2	*Acacia origena* Hunde	Fabaceae	T	Chi-A (C)	W, Hg	TB-78
3	*Achyranthes aspera* L.	Amaranthaceae	H	Mechelo (C)	W	TB-43
4	*Allium sativum* L.	Alliaceae	H	Tsaeda-shingurti (T), Ado shingurti (E)	Cu	TB-99
5	*Aloe elegans* Tod.	Aloaceae	S	Tselim-ere (T), Da ere (E)	W	TB-05
6	*Aloe macrocarpa* Tod.	Aloaceae	S	Tsaeda Ere (T), Ado ere (E)	W	TB-113
7	*Argemone mexicana* L.	Papaveraceae	H	Shanshul (T), deradir fre (E)	W	TB-49
8	*Artemisia absinthium* L.	Asteraceae	H	Rihan (T)	Hg	TB-84
9	*Asparagus africanus* Lam.	Asparagaceae	CS	Lubaktabeda (E)	W	TB-01
10	*Becium grandiflorum* (Lam.) Pic. Serm.*	Lamiaceae	S	Tebeb (T), Tkbi (E)	W	TB-86
11	*Beta vulgaris* L.	Chenopodiaceae	H	Ayh sur (T)	Cu	TB-98
12	*Brassica nigra* (L.) Koch	Brassicaceae	H	Senafich (T)	Hg, Cu	TB-103
13	*Buddleja polystachya* Fresen.	Loganiaceae	S	Metere (T)	W	TB-85
14	*Calotropis procera* (Ait.) Ait.f.	Asclepiadaceae	S	Ginda-E (T), Galae (E)	W	TB-11
15	*Calpurnia aurea* (Ait). Benth.	Fabaceae	S	Hetsawuts (C)	W	TB-83
16	*Capparis micrantha* A.Rich.	Cappardiaceae	H	Layno (E)	W	TB-17
17	*Capsicum annuum* L.	Solanaceae	H	Berbere (C)	Cu	TB-110
18	*Capsicum frutescens* L.	Solanaceae	H	Mitmita(T) , Dikus (E)	Cu	TB-111
19	*Carica papaya* L.	Caricaceae	T	Papaya (C)	Hg,Cu	TB-106
20	*Carissa spinarum* L.	Apocynaceae	S	Agam (T) , A'dala (E)	W, Hg	TB-88
21	*Chenopodium ambrosioides* L.	Chenopodiaceae	H	Hamli-kibo (T), Berhanu (E)	W	TB-44
22	*Citrus aurantifolia* (Christm.) Swingle	Rutaceae	S	Lomin (T), Metsits lemin (E)	Hg,Cu	TB-40
23	*Clutia abyssinica* Jaub. & Spach.	Euphorbiaceae	H	Tush-Bealalito (T), Etan Bialalti (E)	W	TB-91
24	*Coffea arabica* L.	Rubiaceae	T	Buna (T), Buni (E)	Hg, Cu	TB-67
25	*Commicarpus plumbagineus* (Cav.) Standley	Nyctaginaceae	H	Ezni-Taewa (T)	W	TB-21
26	*Cordia africana* Lam.	Boraginaceae	T	Awuhi (T), Aera (T)	Hg,Cu	TB-51
27	*Coronopus didymus* (L.) Smith	Brassicaceae	H	shinfa' (T), Shunfai (E)	Hg,Cu	TB-105
28	*Crinum ornatum* (Ait.) Bury	Amaryllidaceae	H	Shingurti Zibie (T)	W	TB-108
29	*Croton macrostachyus* Del.	Euphorbiaceae	T	Tanbuh (T), Tanbuhi (E)	W	TB-89

No	Scientific name	Family name	G/f	Local name in Saho and Tigrigna	Source	Coll. #
30	*Cucumis ficifolius* A. Rich.	Cucurbitaceae	CH	Sag-sago (T)	W	TB-19
31	*Cucurbita pepo* L.	Cucurbitaceae	CH	Duba (C)	Hg	TB-36
32	*Cynoglossum lanceolatum* Forssk.	Boraginaceae	H	Teneg (T), Atukaheda (E)	W	TB-10
33	*Cyphostemma cyphopetalum* (Fresen.) Descoings ex Wild & Drummond	Vitaceae	CH	Etse-Zawuye (T), Taseda hareg/ Ado haregi (E)	W	TB-116
34	*Datura stramonium* L.	Solanaceae	H	Mezerbae (C)	W	TB-35
35	*Dodonaea angustifolia* L.f.	Sapindaceae	S	Tahses (T), sasat (E)	W, Hg	TB-46
36	*Dovyalis abyssinica* (A.Rich.) Warb.	Flacourticaceae	S	Aikeda (C)	W	TB-117
37	*Echinops pappii* Chiov.	Asteraceae	H	Eshoh-Adgi (C)	W	TB-119
38	*Emex spinosa* (L.) Campd.	Polygonaceae	H	Shembobaeta (T)	W	TB-22
39	*Eragrostis tef* (Zucc.) Trotter	Poaceae	H	Keyh taf (T)	CU	TB-114
40	*Eucalyptus camaldulensis* Dehnh.	Myrtaceae	T	Keyh Beharzaf (T)	W, Hg	TB-72
41	*Eucalyptus globulus* Labill.	Myrtaceae	T	Tsaeda-kelamtos (T), Ado kelamitos (E)	W.Hg	TB-75
42	*Euclea racemosa* Murr. subsp. *schimperi* (A.DC.) White.	Ebenaceae	S	Kiliew (T)	W	TB-94
43	*Euphorbia abyssinica* Gmel.	Euphorbiaceae	T	Kulkal (T), Walali (E)	W	TB-14
44	*Euphorbia polyacantha* Boiss.	Euphorbiaceae	S	Mezbae (T), hagereseb (E)	W	TB-06
45	*Euphorbia tirucalli* L.	Euphorbiaceae	T	Kinchib (T)	W	TB-96
46	*Ficus ingens* (Miq.) Miq.	Moraceae	S	Tsekente (T)	W, Hg	TB-77
47	*Ficus palmata* Forssk.	Moraceae	S	Beles Adgi (T), Yangulu mada (E)	W	TB-66
48	*Foeniculum vulgare* Mill.	Apiaceae	H	Shilan (T)	Hg	TB-25
49	*Gomphocarpus fruticosus* (L.) Ait.f.	Asclepiadaceae	S	Demayto (T)	W	TB-68
50	*Gossypium hirsutum* L.	Malvaceae	S	Tute (T)	Hg, Cu	TB-63
51	*Heliotropium cinerascens* DC. & A.DC.	Boraginaceae	H	Tsaeda Enbeba (T), Ado enbeba (E)	W	TB-09
52	*Hordeum vulgare* L.	Poaceae	H	Sigem (C)	Cu	TB-39
53	*Hypoestes forskaolii* (Vahl) R.Br.	Acanthaceae	H	Girbia (T)	W	TB-93
54	*Indigofera amorphoide*s Joub.&Spach	Fabaceae	S	Hibet-Hala (E)	W	TB-16
55	*Indigofera vicioides* Jaub. & Spach	Fa baceae	H	Kurnba (T)	W, Hg	TB-115
56	*Juniperus procera* Hochst. ex.A.Rich.	Cuppressaceae	T	Tsihdi (T) , Sarida (E)	W	TB-76
57	*Justicia schimperiana* (Hochst. ex Nees) T. Anders.	Acanthaceae	S	Shimieja (T)	W	TB-27
58	*Kalanchoe marmorata* Bak.	Crassulaceae	S	Eture (E)	W	TB-120
59	*Kalanchoe laciniata* (L.) DC.	Crassulaceae	H	Shanbuta (T)	W	TB-97
60	*Lactuca sativa* L.	Asteraceae	H	Selata (T)	Hg, Cu	TB-121
61	*Lagenaria siceraria* (Molina) Standl.	Cucurbitaceae	CH	Hamham (T)	Hg,Cu,	TB-59
62	*Laggera tomentosa* (Sch. Bip. ex A.Rich.) Oliv &Hiern **	Asteraceae	H	Kancho-Kancho /Chenawi (T)	Hg, Cu	TB-74

No	Scientific name	Family name	G/f	Local name in Saho and Tigrigna	Source	Coll. #
63	*Lepidium sativum* L.	Brassicaceae	H	Shnfae (T)	W	TB-92
64	*Leptadenia arborea* (Forssk.) Schweinf.	Asclepiadaceae	WC	Malih (E)	Hg	TB-12
65	*Leucas abyssinica* (Benth.) Briq.*	Lamiaceae	S	Mesded (T)	W	TB-23
66	*Leucas martinicensis* (Jacq.) R.Br.	Lamiaceae	H	Tehetater (T)	W	TB-32
67	*Linum usitatissimum* L.	Linaceae	H	Entati-E' (T), Entatie (E)	Cu	TB-20
68	*Lobelia giberroa* Hemsl.	Lobeliaceae	T	Gurhan (T)	W	TB-107
69	*Lycopersicn esculentum* Mill.	Solanaceae	H	Komidere (C)	Hg, Cu	TB-58
70	*Malva parviflora* Hojer	Malvaceae	H	Enki-ftah (T)	W	TB-38
71	*Maytenus arbutifolia* (A.Rich.) Wilczek	Celastraceae	S	At-At (T)	W, Hg	TB-71
72	*Maytenus senegalensis* (Lam.) Exell	Celastraceae	S	Argudi (T)	W	TB-70
73	*Melia azedarach* L.	Meliaceae	T	Nim (C)	W, Hg	TB-56
74	*Mentha longifolia* (L.) Hudson	Lamiaceae	H	Senti-Semhal (T), Senti-Semhal i(E)	Hg	TB-54
75	*Mentha spicata* L.	Lamiaceae	H	Naenae (T)	Hg	TB-112
76	*Meriandra dianthera* (Roth ex Roem. & Schult.) Briq.	Lamiaceae	S	Meseguh (T), masaguh (E)	W	TB-18
77	*Myrica salicifolia* A.Rich.	Myricaceae	T	Nihibi (Niebi) (T)	W	TB-81
78	*Nicotiana glauca* Graham	Solanaceae	S	Kotsli-Asha, Amhari hada (E)	W	TB-52
79	*Nicotiana tabacum* L.	Solanaceae	H	Tinbaho (C)	W	TB-101
80	*Ocimum basilicum* L.	Lamiaceae	H	Seseg (C)	Hg, Cu	TB-29
81	*Ocimum lamiifolium* Hochst. ex Benth.	Lamiaceae	S	Damakasie (C)	Hg	TB-31
82	*Olea europaea* L. subsp. *cuspidata* (Wall. ex G.Don) Cif.	Oleaceae	T	Awulie (T), Wali-A (E)	W, Hg	TB-13
83	*Opuntia ficus-indica* L.	Cactaceae	S	Beles (C)	W, Hg	TB-118
84	*Otostegia integrifolia* Benth.	Lamiaceae	S	Chi-endog (C)	W	TB-65
85	*Otostegia minucii* Pic-Serm.	Lamiaceae	S	Digdegano (E)	W	TB-02
86	*Plectranthus ornatus* Codd.	Lamiaceae	H	Endifdif (T)	W	TB-62
87	*Phytolacca dodecandra* L'Herit.	Phytolaccaceae	S	Shfti (T)	W, Hg	TB-80
88	*Pollichia campestris* Ait.	Caryophyllaceae	H	Agoro bayta (T), Mdase (E)	W	TB-03
89	*Prunus persica* (L.) Batsch.	Rosaceae	T	Kuh (T)	Hg, Cu	TB-102
90	*Psiadia punctulata* (DC.) Vatke	Asteraceae	S	Alahit (T), Alahi (E)	W	TB-08
91	*Psidium guajava* L.	Myrtaceae	S	Zeithun (C)	Hg, Cu	TB-26
92	*Rhamnus prinoides* L'Herit.	Rhamnaceae	S	Gesho (T), Geso (E)	Hg, Cu	TB-33
93	*Ricinus communis* L.	Euphorbiaceae	S	Gulie (T), Gumubu ele (E)	W, Hg	TB-42
94	*Rosa abyssinica* Lindley	Rosaceae	CS	Kega (T)	W	TB69
95	*Rumex abyssinicus* Jacq.	*Polygonaceae*	H	Meqmoqo (T)	Hg	TB-104
96	*Rumex nepalensis* Spreng.	Polygonaceae	H	Dingle (T)	W	TB-82
97	*Rumex nervosus* Vahl	Polygonaceae	S	Hohot (T), Gali Mulihe (E)	W	TB-48

No	Scientific name	Family name	G/f	Local name in Saho and Tigrigna	Source	Coll. #
98	*Ruta chalepensis* L.	Rutaceae	S	Chena-Adam (C)	Hg	TB-55
99	*Schinus molle* L.	Anacardaceae	T	Tselim-berbere (T), Dari berbere (E)	Hg, Cu	TB-41
100	*Sida schimperiana* Hochst. ex A.Rich.	Malvaceae	S	Tifrarya (T)	W	TB-73
101	*Sideroxylon oxyacanthum* Baill.	Sapotaceae	S	Seroro (T)	W	TB-79
102	*Solanum adoense* Hochst. ex A.Rich.	Solanaceae	S	Enqi-enqui kelbi (T)	W	TB-87
103	*Solanum incanum* L.	Solanaceae	S	Dekik-engule (T)	W	TB-47
104	*Solanum schimperianum* Hochst. ex A. Rich.	Solanaceae	S	Korenet (T), Orenot (E)	W	TB-07
105	*Solanum villosum* Mill.	Solanaceae	H	Alalimo (T)	W	TB-24
106	*Tagetes minuta* L.	Asteraceae	H	Kotsli-Abate (T), Atkahala (E)	W	TB-15
107	*Taraxacum* sp. agg. Webber ex Wigg	Asteraceae	H	Tseba-dimu (T), dumu han (E)	W	TB-37
108	*Tarchonanthus camphoratus* L.	Asteraceae	T	Ebuh (T)	W	TB-64
109	*Trigonella foenum-graecum* L.	Fabaceae	H	Aba-ehe (C)	Cu	TB-53
110	*Triticum aestivum* L.	Poaceae	H	Sernay (T)	Cu	TB-100
111	*Urtica simensis* Steudel **	Urticaceae	H	Amea (T)	W	TB-57
112	*Verbena officinalis* L.	Verbenaceae	H	Atuch (T)	W, Hg	TB-28
113	*Vernonia amygdalina* Del.	Asteraceae	T	Grawa (T)	Hg	TB-45
114	*Vernonia rueppellii* Sch. Bip. ex Walp.*	Asteraceae	S	Sorya (T)	W	TB-95
115	*Vicia faba* L.	Fabaceae	H	Alquay (T)	Cu	TB-04
116	*Vitis vinifera* L.	Vitaceae	WC	Weini (T)	Hg	TB-34
117	*Withania somnifera* (L.) Dunal	Solanaceae	S	Agol (T), Oronati (E)	W	TB-30
118	*Xanthium strumarium* L.	Asteraceae	H	Nay kakush (T)	W	TB-50
119	*Zehneria scabra* (L.f.) Sonder	Cucurbitaceae	HC	Hafaflo (T)	W	TB-90
120	*Zingiber officinale* Roscoe	Zingiberaceae	H	Zingible (T), Shinzbil (E)	Cu	TB-109
121	*Ziziphus mauritiana* Lam.	Rhamnaceae	T	Gaba (T), Kusra (E)	W, Hg	TB-61

Appendix 3 Location and habitat of medicinal plant species

Scientific name	**Alt. (a.s.l.)**	**Latitude (North)**	**Longitude (East)**	**Habitat**
Acacia etbaica	2468 m	14° 28' 48.9" N	39° 34' 38.9" E	Protected vegetation dominated by *Euphorbia spp*. and *Dodonaea angustifolia*
Acacia origena	2468 m	14° 28' 48.9" N	39° 34' 38.9" E	Protected vegetation dominated by *Euphorbia spp*. and *Dodonaea angustifolia*
Achyranthes aspera	2455 m	14° 20' 22.5" N	39° 27' 47.0" E	Near a farm land
Allium sativum	2115 m	14° 27' 55.8" N	39° 29' 55.0" E	Farm land
Aloe elegans	1997 m	14° 29' 57.4" N	39° 32' 07.0" E	Disturbed vegetation dominated by *Opuntia ficus-indica* and *Acacia* spp.
Aloe macrocarpa	2569 m	14° 34' 24.2" N	39° 32' 21.4" E	Near a road
Argemone mexicana	2115 m	14° 27' 55.8" N	39° 29' 55.0" E	Near a farm land
Artemisia absinthium	2078 m	14° 28' 29.5" N	39° 30' 50.3" E	Home garden
Asparagus africanus	1997 m	14° 29' 57.4" N	39° 32' 07.0" E	Disturbed vegetation dominated by scattered *Acacia* and *Opuntia ficus-indica*
Becium grandiflorum	2712 m	14° 28' 28.8" N	39° 34' 38.9" E	Protected vegetation dominated by *Dodonaea angustifolia*
Beta vulgaris	2115 m	14° 27' 55.8" N	39° 29' 55.0" E	Farm land
Brassica nigra	2078 m	14° 28' 29.5" N	39° 30' 50.3" E	Farm land.
Buddleja polystachya	2146 m	14° 26' 34.2" N	39° 29' 43.0" E	Protected vegetation dominated by *Dodonaea angustifolia*
Calotropis procera	2569 m	14° 34' 24.2" N	39° 32' 21.4" E	Near a road
Calpurnia aurea	2146 m	14° 26' 34.2" N	39° 29' 43.0" E	Protected vegetation dominated by *D.angustifolia*
Capparis micrantha	2016 m	14° 30' 24.0" N	39° 33' 39.3" E	Scattered vegetation dominated by *Acacia* spp. and *Opuntia ficus-indica*
Capsicum annuum	2078 m	14° 28' 29.5" N	39° 30' 50.3" E	Farm land
Capsicum frutescens	2078 m	14° 28' 29.5" N	39° 30' 50.3" E	Farm land
Carica papaya	2078 m	14° 28' 29.5" N	39° 30' 50.3" E	Farm land
Carissa spinarum	2455 m	14° 20' 22.5" N	39° 27' 47.0" E	Near a farm land as a fence
Chenopodium ambrosioides	2181 m	14° 24' 01.3" N	39° 21' 28.9" E	Edge of a farm land
Citrus aurantifolia	2196 m	14° 23' 14.0" N	39° 21' 29.1" E	Home garden
Clutia abyssinica	2513 m	14° 23' 39" N	39° 24' 14.1" E	Church forest
Coffea arabica	2236 m	14° 23' 14" N	39° 241 29.1"E	Farm land
Commicarpus plumbagineus	2181 m	14° 29' 42.0" N	39° 21' 27.0" E	In a farm land as a weed
Cordia africana	2513 m	14° 23' 39" N	39° 24' 14.1" E	Church forest
Coronopus didymus	2510 m	14° 24' 18.8" N	39° 23' 40.4" E	Home garden
Crinum ornatum	2468 m	14° 28' 48.9" N	39° 34' 38.9" E	Protected vegetation dominated by *Euphorbia spp* and *Dodonaea angustifolia*

Scientific name	**Alt. (a.s.l.)**	**Latitude (North)**	**Longitude (East)**	**Habitat**
Croton macrostachyus	2146 m	14^{o} 26’ 34.2" N	39^{o} 29' 43.0" E	Protected vegetation dominated by *Dodonaea angustifolia*
Cucumis ficifolius	2196 m	14^{o} 23' 14.0" N	39^{o} 21' 29.1" E	Around a border of a farm land.
Cucurbita pepo	2455 m	14^{o} 20’ 11.7" N	39^{o} 27' 38.0" E	Home garden
Cynoglossum lanceolatum	1940 m	14^{o} 31' 03.2" N	39^{o} 33' 11.9" E	Disturbed vegetation dominated by scattered *Acacia* spp
Cyphostemma cyphopetalum	2078 m	14^{o} 28’ 29.5" N	39^{o} 30' 50.3" E	Fence in cultivated land.
Datura stramonium	2453 m	14^{o} 20’ 11.7" N	39^{o} 27' 38.0" E	Farm land as a weed
Dodonaea angustifolia	2468 m	14^{o} 28’ 48.9" N	39^{o} 34' 38.9" E	Protected vegetation dominated by *Euphorbia spp*. and *Dodonaea angustifolia*
Dovyalis abyssinica	2016 m	14^{o} 30' 24.0" N	39^{o} 33' 39.3" E	Scattered vegetation dominated by *Acacia* spp. and *Opuntia ficus-indica*
Echinops pappii	2569 m	14^{o} 34' 24.2" N	39^{o} 32' 21.4" E	Near a road
Emex spinosa	2198 m	14^{o} 24’ 01.2" N	39^{o} 21' 28.9" E	Near a road
Eragrostis tef	2196 m	14^{o} 23' 14.0" N	39^{o} 21' 29.1" E	Farm land
Eucalyptus camaldulensis	2453 m	14^{o} 20’ 11.7" N	39^{o} 27' 38.0" E	Near a Farm land
Eucalyptus globulus	2510 m	14^{o} 23’ 39.4" N	39^{o} 24' 14.2" E	Living fence of a house
Euclea racemosa	2649 m	14^{o} 26’ 20.1" N	39^{o} 35' 02.3" E	Protected vegetation dominated by *Euphorbia spp.*
Euphorbia abyssinica	3125 m	14^{o} 33' 21.3" N	39^{o} 32' 21.4" E	Scattered vegetation dominated by *Acacia* spp
Euphorbia polyacantha	2016 m	14^{o} 30' 24.0" N	39^{o} 33' 39.3" E	Hill with disturbed vegetation dominated by scattered *Acacia* and *Opuntia ficus-indica*
Euphorbia tirucalli	2712 m	14^{o} 28' 26.5" N	39^{o} 34' 33.3" E	Near a house as a fence
Ficus ingens	2513 m	14^{o} 23’ 39" N	39^{o} 24' 14.1" E	Church forest
Ficus palmata	2078 m	14^{o} 28’ 29.5" N	39^{o} 30' 50.3" E	Protected vegetation dominated by *Eucalyptus spp.*
Foeniculum vulgare	2510 m	14^{o} 24’ 18.8" N	39^{o} 23' 40.4" E	Home garden
Gomphocarpus fruticosus	2455 m	14^{o} 20’ 22.5" N	39^{o} 27' 47.0" E	Farm land
Gossypium hirsutum	2198 m	14^{o} 24’ 01.2" N	39^{o} 21' 28.9" E	Living house fence
Heliotropium cinerascens	1946 m	14^{o} 31' 03.2" N	39^{o} 33' 11.9" E	Near a road in a farm land as weed
Hordeum vulgare	2455 m	14^{o} 20’ 22.5" N	39^{o} 27' 47.0" E	Farm land
Hypoestes forskaolii	2712 m	14^{o} 28' 26.5" N	39^{o} 34' 33.3" E	Protected vegetation dominated by *Euphorbia spp.*
Indigofera amorphoide	2016 m	14^{o} 30' 24.0" N	39^{o} 33' 39.3" E	Scattered vegetation dominated by *Acacia* spp. and *Opuntia ficus-indica*
Indigofera vicioides	2102m	14^{o} 28' 12.0" N	39^{o} 29' 58.8" E	Near a farm land
Juniperus procera	2468 m	14^{o} 28' 48.9" N	39^{o} 34' 38.9" E	Protected vegetation dominated by *Euphorbia spp*. and *Dodonaea angustifolia*
Justicia schimperiana	2102m	14^{o} 28' 12.0" N	39^{o} 29' 58.8" E	Protected vegetation dominated by *Eucalyptus spp.* and *Acacia* spp
Kalanchoe laciniata	2198 m	14^{o} 14' 01.3" N	39^{o} 21' 28.9" E	Near a river

Scientific name	Alt. (a.s.l.)	Latitude (North)	Longitude (East)	Habitat
Kalanchoe marmorata	2468 m	14° 28' 48.9" N	39° 34' 38.9" E	Protected vegetation dominated by *Euphorbia spp* and *Dodonaea angustifolia*
Lactuca sativa	2115 m	14° 27' 55.8" N	39° 29' 55.0" E	Cultivated
Lagenaria siceraria	2455 m	14° 20' 22.5" N	39° 27' 47.0" E	scrambled on a house fence
Laggera tomentosa	2453 m	14° 20' 11.7" N	39° 27' 38.0" E	Farm land
Lepidium sativum	2513 m	14° 23' 39" N	39° 24' 14.1" E	Farm land
Leptadenia arborea	2569 m	14° 34' 24.2" N	39° 32' 21.4" E	In a farm land as weed
Leucas abyssinica	2236 m	14° 23' 14.0" N	39° 21' 29.1" E	Near a farm land
Leucas martinicensis	2510 m	14° 24' 18.8" N	39° 23' 40.4" E	Farm land
Linum usitatissimum	2196 m	14° 23' 14.0" N	39° 21' 29.1" E	Cultivated in the farm land.
Lobelia giberroa	2146 m	14° 26' 34.2" N	39° 29'' 43.0"E	Protected vegetation dominated by *B. grandiflorum*.
Lycopersicon esculentum	2510 m	14° 24' 18.8" N	39° 23' 40.4" E	Home garden
Malva parviflora	2236 m	14° 23' 29.8" N	39° 21' 49.4" E	Edge of a farm land
Maytenus arbutifolia	2510 m	14° 24' 18.8" N	39° 23' 40.4" E	Living house fence
Maytenus senegalensis	2510 m	14° 24' 18.8" N	39° 23' 40.4" E	Living house fence
Melia azedarach	1946 m	14° 31' 03.2" N	39° 33' 11.9" E	Scattered vegetation dominated by *Rumex* spp. and *Maytenus spp.*
Mentha longifolia	2198 m	14° 24' 01.2" N	39° 21' 28.9" E	Home garden
Mentha spicata	2198 m	14° 24' 01.2" N	39° 21' 28.9" E	Homegarden
Meriandra dianthera	2236 m	14° 23' 29.8" N	39° 21' 49.4" E	Scattered vegetation dominated by *Rumex* spp. and *Becium grandiflorum*.
Myrica salicifolia	2146 m	14° 26' 34.2" N	39° 29'' 43.0"E	Protected vegetation dominated by *B. grandiflorum* and *Dodonaea angustifolia*
Nicotiana glauca	2102 m	14° 28' 12.0" N	39° 21' 49.4" E	Near a stream
Nicotiana tabacum	2146 m	14° 26' 34.2" N	39° 29' 43.0" E	Protected vegetation dominated by *Dodonaea angustifolia* and *Acacia spp.*
Ocimum basilicum	2196 m	14° 23' 14.0" N	39° 21' 29.1" E	Homegarden
Ocimum lamiifolium	2510 m	14° 24' 18.5" N	39° 23' 40.4" E	Homegarden
Olea europaea	2569 m	14° 34' 24.2" N	39° 29' 58.8" E	Homegarden
Opuntia ficus-indica	2649 m	14° 26' 20.1" N	39° 35' 02.3" E	Protected vegetation dominated by *Euphorbia spp* and *Dodonaea angustifolia*
Otostegia integrifolia	2175 m	14° 27' 50.8" N	39° 29' 55.0" E	Near the main road
Otostegia minucii	1997 m	14° 29' 57.4" N	39° 32' 07.0" E	Disturbed vegetation dominated by scattered *Acacia* and *Opuntia ficus-indica*
Plectranthus ornatus	2453 m	14° 20' 11.7" N	39° 27' 38.0" E	Near a farm land
Phytolacca dodecandra	2146 m	14° 26' 34.2" N	39° 29' 43.0" E	Protected vegetation dominated by *D. angustifolia* and *Acacia spp.*
Pollichia campestris	1997 m	14° 29' 57.4" N	39° 32' 07.0" E	Disturbed vegetation dominated by *O. ficus-indica*

Scientific name	**Alt. (a.s.l.)**	**Latitude (North)**	**Longitude (East)**	**Habitat**
Prunus persica	1971 m	14° 30’ 34.0" N	39° 33' 41.5" E	Homegarden
Psiadia punctulata	2016 m	14° 30' 24.0" N	39° 32' 39.3" E	Disturbed vegetation dominated by *Opuntia ficus-indica* and *Acacia* spp.
Psidium guajava	2102 m	14° 28' 12.0" N	39° 20' 53.8" E	Cultivated land
Rhamnus prinoides	2453 m	14° 20’ 11.7" N	39° 27' 36.0" E	Homegarden
Ricinus communis	2510 m	14° 23’ 39.4" N	39° 24' 14.2" E	Near a road
Rosa abyssinica	2453 m	14° 20’ 11.7" N	39° 27' 38.0" E	Living house fence
Rumex abyssinicus	2453 m	14° 20’ 11.7" N	39° 27' 36.0" E	Homegarden
Rumex nepalensis	2236 m	14° 23’ 14.0" N	39° 21' 29.1" E	Near a stream /river
Rumex nervosus	2115 m	14° 27’ 50.8" N	39° 29’ 55.0"E	Near a road
Ruta chalepensis	2198 m	14° 24’ 01.2" N	39° 21' 28.9" E	Homegarden
Schinus molle	2102m	14° 28' 12.0" N	39° 29' 58.8" E	Protected vegetation dominated by *Eucalyptus spp. and Acacia* spp
Sida schimperiana	2510 m	14° 24’ 18.8" N	39° 23' 40.4" E	Near a farm land
Sideroxylon oxyacanthum	2468 m	14° 28' 48.9" N	39° 34' 38.9" E	Protected vegetation dominated by *Euphorbia spp* and *Dodonaea angustifolia*
Solanum adoense	2455 m	14° 20’ 22.5" N	39° 27' 47.0" E	Farm land
Solanum incanum	2102m	14° 28' 12.0" N	39° 29' 58.8" E	Near a farm land
Solanum schimperianum	2016 m	14° 30' 24.0" N	39° 33' 39.3" E	Hill with disturbed vegetation dominated by scattered *Acacia* and *Opuntia ficus-indica*
Solanum villosum	2196 m	14° 23' 14.0" N	39° 21' 29.1" E	Near a farm land
Tagetes minuta	1907 m	14° 30' 43.3" N	39° 33' 15.2" E	Near a small river
Taraxacum sp. agg.	2016 m	14° 30' 24.0" N	39° 33' 39.3" E	Near a farm land
Tarchonanthus camphoratus	2078 m	14° 28’ 29.5" N	39° 30' 50.3" E	Protected vegetation dominated by *Dodonaea angustifolia* and *Eucalyptus spp.*
Trigonella foenum-graecum	2078 m	14° 28’ 29.5" N	39° 30' 50.3" E	Farm land
Triticum aestivum	2181 m	14° 29' 42.0" N	39° 21' 27.0" E	Farm land
Urtica simensis	2198 m	14° 24’ 01.2" N	39° 21' 28.9" E	Near a river
Verbena officinalis	2453 m	14° 20’ 11.7" N	39° 27' 38.0" E	Farm land
Vernonia amygdalina	2287 m	14° 24' 15.9" N	39° 21' 34.2" E	Homegarden
Vernonia rueppellii	2146 m	14° 26' 34.2" N	39° 29’’ 43.0"E	Protected vegetation dominated by *B. grandiflorum*
Vicia faba	2078 m	14° 28’ 29.5" N	39° 30' 50.3" E	Cultivated land.
Vitis vinifera	2196 m	14° 23' 14.0" N	39° 21' 29.1" E	Homegarden
Withania somnifera	2510 m	14° 24’ 18.8" N	39° 23' 40.4" E	Near a farm land
Xanthium strumarium	2510 m	14° 24’ 18.8" N	39° 23' 40.4" E	Near a farm land
Zehneria scabra	2455 m	14° 20’ 23.5" N	39° 27' 47.0" E	Near a house in b/n *Opuntia ficus-indica*
Zingiber officinale	2102 m	14° 28' 12.0" N	39° 20' 53.8" E	Farm land
Ziziphus mauritiana	2198 m	14° 24’ 01.2" N	39° 21' 28.9" E	Living house fence

Appendix 4 List of plant species and methods of preparation to treat human and livestock ailments in Erob and Gulomahda districts

.(PU=part used; L=leaves; ,R=root; S=stem; Fr=flower; B=bud; A/G=Above ground; Fr=fruit; Sd=Seed, La=latex; Rb=root bark; Bu=bulb, Ba=bark; Br=branch; A=Application; E=External; O=oral; Na=nasal; Ch=chewing; CP=Condition of Preparation; F=fresh; D=dried; F/D= Fresh or dried)

List of common plant species and methods of preparation to treat human and livestock ailments in Erob and Gulomahda districts (Dt =District, CM = Common to both districts, ER = Erob only, GM = Gulomahda only)							
Scientific Name	**Dt**	**PU**	**A**	**CP**	**Disease**	**Preparation and application**	**Other uses**
Acacia etbaica	CM	L	E	F	Wound	Some crushed leaves were mixed with fresh butter as that used for hair, placed on the wound for 3 or more consecutive days (until treated)	Fire wood, charcoal, house construction, fence, fumigation. shade, equipment (CM), feed for goat (ER)
		S	E	D	Ring worm	The infected part of the body was smeared by the fluid released when the stem burnt up every dayfor 3 consecutive days	
		L	I	F	Leech (cattle)	Some crushed leaves were filtered, half of a coffee cup of it mixed with little water and applied through nasal cavity once every day for 3-7 consecutive days	
	ER	L	I	F	Tooth pain	Some leaves were chewed during tooth pain	
Acacia origena	CM	L	E	F	Itchy (cattle, goat, sheep)	Some leaves were crushed and placed on the infected skin once every day for 3-5 consecutive days	Fire wood, fence, forage of goat (CM)
		L	E	F	Hang nil	Some leaves were crushed and placed on the infected nail once every day for 7 consecutive days	
		L	E	F	Dandruff	Some leaves were crushed and placed on the shaved head once every day for 3 consecutive days.	
Achyranthes aspera	CM	L	E	F	Tonsillitis	Some leaves were crushed and placed on the shaved head of a child once or twice every day for 3 consecutive days	As broom: place where grain separated from hay (GM)
		R	E	F&D	Fracture (cattle, goat, sheep)	Finger sized root was tied on the opposite side of the damaged part until it heals	
		R	C h	F	Poison of scorpion /Snake venom	One to two finger sized root was chewed, expelled the roughage by taking in the fluid for once or twice every day for4-5 consecutive days.	
		L, R	I	F	Eye infection (cattle, goat sheep, donkey, horse, mule)	Some leaves were crushed, filter and add 2-3 drops once or twice every day for 3 consecutive days	
	G M	R	E	F	Wound	Some leaves were crushed and placed on the wounded part once every day for three to five consecutive days by removing the prior one.	
		R	I	F	Stomach pain	Finger sized root was chewed, taking in the fluid during illness	

Scientific Name	Dt	PU	A	CP	Disease	Preparation and application	Other uses
Allium sativum	CM	Bu	I	F	Cough	About half of a bulb was eaten with injera until the patient is free of cough for adult or mixed and crushed with *Ruta chalepensis* to smell for 3-5 consecutive days for infants	Stew making, spices of *SHRO* and *Capsicum annum* (CM)
		Bu	E	F	Troma	Some crushed bulb were placed on fresh injured head soon	
	GM	Bu	I	F	Malaria	About 5 bulbs of *Allium sativum* were crushed together with some *Capsicum frutescens*, some leaves of *Olea europaea* and consumed 2-3 spoons every morning for 5 consecutive days.	
		Bu	I	F	Asthma	About 7 bulbs were crushed, mixed with a beaker of honey and tea glass of butter and consumed one cup every morning for 7 consecutive days.	
	ER	Bu	I	F	Heart disease	About 5 bulbs were crushed and mixed with a beaker of honey and consumed one cup of it every morning for 12 consecutive days	
Aloe elegans	CM	La	I	F	Infection of eye	Add one drop of it into the infected eye every day for 5 consecutive days	Root used as fodder, fire wood, sugary when sucked by children (CM)
		La	E	F	House fly on the wound	The wound is smeared until it heals	
	ER	La	I	F	Malaria	About a palm of hand was crushed, filtered, mixed with a beaker of honey and added a spoon to a coffee cup and taken every day for 7 consecutive days	
		Bu	I	F	Jaundice	Some were crushed, filter and drunken 1-2 spoon of a coffee cup. Subsequently 2 spoon of a crushed and filtered bud of *Cordia africana* was taken for 7 consecutive days.	
		La	E	F	Hemorrhoids	The infected site was smeared once every day for 7 consecutive days	
		R	E	F	Fracture (cattle)	The damaged part was tied alone or together with the root of *Achyranthes aspera*	
		Bu	I	F	Stomach pain	One piece bud was crushed and taken with a coffee cup during stomach pain	
		La	I	F	Stomach pain	Drunk one spoon fluid with a of coffee during stomach pain	

Scientific Name	Dt	PU	A	CP	Disease	Preparation and application	Other uses
Aloe elegans	Er	La	I	F	Head ache	The head was smeared with latex during head ache	
		La	E	F	Arthritis /rheumatism	Some crushed and filtered latex was mixed with water and washed by the mixed fluid once every dayfor 3-5 consecutive days.	
		La	I	F	Liver disease (cattle, sheep, goat)	One fourth of a coffee cup was given the animal followed by one tin cane water soon	
	G M	R	E	F	Fracture (cattle)	The opposite side of the damaged part was tied by the root until treated	
		La	E	F	Scorpion bit	The bitten part of the body was smeared by the latex soon.	
Aloe macrocarpa	ER	La	I	F	Jaundice	Crushed, squeezed, mixed with some amount of water and drunk one coffee cup every morning for 3-5 consecutive days.	Sucked by children for sugary taste, fire wood (CM)
		La	E	F	Head ache	Warmed part was placed on the head part every day for 3 consecutive days	
		La	E	F	Paralyze	Fleshy part was placed on fire to be warm and immediately removed and placed on the paralyzed or infected part of the bodyevery day for 5-7 consecutive days.	
		La	I	F	Abdominal/Stomach parasite	Crushed and filtered some amount of latex was mixed with some amount of water and drunken one coffee cup every morning for 3 consecutive days.	
	G M	La	I	F	Malaria	Crushed, squeezed, mixed with little water and drunk a coffee cup every day for 5-7 consecutive days	
		La	E	F	Infection of eye	A drop of latex was added into the infected eye for 3-5 consecutive days	
	CM	La	I	F	Cough (cattle)	Crushed, mixed with some amount of water, filtered and drunken one tin cane every morning for 3-5 consecutive days.	
		R	I	F	Bleeding During delivery	Boiled with water, cooled, filtered and drunk a tea cup one to three times as necessary at the interval of 2-3 hours	
Argemone mexicana	CM	La	E	F	Wound	The wound was smeared by the latex for 3-5 consecutive days by washing the previous one	Baking injera and bread
	ER	R	I	F	Tooth infection	A piece of root was chewed during tooth pain	
	G M	La	E	F	Ring worm	The wound was smeared by the latex for 3-5 consecutive days by washing the previous one	

Scientific Name	Dt	PU	A	CP	Disease	Preparation and application	Other uses
Becium grandiflorum	CM	L	E	D	Fire burn	Dried leaves were crushed, powdered, a beaker of it was mixed with almost half kg of hair butter and 2 bulb of *Allium sativum* and finally placing on the sore for 7 consecutive days by washing the previous one.	Bee forage, fire wood
	GM	R	E	F/D	Paralyse	A palm of roots were mixed with the same amount of root of *Hypoestes forskaolii* and 5-7 tin cane of water, boiled, cooled, filtered and washed the body every morning for 7 consecutive days.	
Calotropis procera	ER	La	E	F	Cutaneous leshimeniasis	The infected site was smeared every day for 7 consecutive days	Fire wood (ER)
		La	E	F	Itchy	The infected site was smeared every day for 3 consecutive days by washing the previous one	
	GM	L	I	F	Rat killer	Milky latex was mixed with ingera and *Linum usitatissimum* and given to rat	
		La	E	F	Tinia scaplis	The infected site was smeared every day for 3 consecutive days	
		La	E	F	Wound	The infected site was smeared by the milky latex every day for 3 consecutive days	
		L	I	F	Malaria	Some leaves were crushed, mixed with little water, squeezed and drunk a coffee cup every morning for 5 consecutive days.	
Calpurnia aurea	ER	L	I	F	Jaundice	A bunch of leaves were crushed, mixed with little water, squeezed, filtered, stored and drunk one glass every morning for 7 consecutive days	Fire wood (CM). fence (ER), stick, farm equipments (GM)
	CM	L	E	F	Dandruff	Some leaves were crushed and placed on a shaved head once at the interval of two days for 3 consecutive times	
		L	E	F	Louse (cattle, goat, sheep)	A bunch of leaves were crushed and placed on the dermis of the animal every day for 5 consecutive days	
		L	E	F	Itchy (cattle, goat, sheep)	A bunch of leaves were crushed, mixed with little water and washed the dermis of the animal every day for 3-5 consecutive days	
		R	I	F	Cough (cattle, goat, sheep)	A bunch of leaves were crushed, mixed with little water, squeezed and added one coffee cup through the nasal cavity for cattle and half of it for goat and sheep every day for 3 consecutive days	
		L	E	F	Wound (cattle, goat, sheep)	A bunch of leaves were crushed and placed on the dermis of the animal every day for 3 consecutive days	

Scientific Name	Dt	PU	A	CP	Disease	Preparation and application	Other uses
Carica papaya	CM	Fr	I	F	Amoeba and other internal parasites	A coffee cup seeds were chewed and swallowed	Edible fruit
Carissa spinarum	CM	B	E	F	Spine /thorn	Some buds were crushed, mixed with white butter or alone and placed on the site	Fire wood, fence, edible fruit, feed of goat and sheep CM),
		S	E	D	Ring worm	The infected site was smeared evey dayfor 3 consecutive days by the fluid released when the stem burnt.	
		R	E	F	Fracture (cattle, goat, sheep)	A piece of root was tied on the opposite part of the injured body until treated	
Chenopodium ambrosioides	ER	L	E	F	Wound	Some leaves were crushed, mixed with same amount *Datura stramonium* and placed on the wound every day for 3 consecutive days	
	GM	L	I	F	Abortion	Some leaves were crushed, mixed with water, filtered and drunk one beaker (for 3 consecutive days if the required outcome is not observed)	
Citrus aurantifolia	*CM*	Fr	E	F	Pimple	The infected site was rubbed every day for 3-5 consecutive days	Edible fruit, fire wood, fence (CM)
	GM	L	E	F	Tinia scaplis	The infected site was rubbed every day for 3 consecutive days by fresh leaves	
Clutia abyssinica	CM	Fr	E	F&D	Tinia scaplis	Half of a coffee cup powder of it was mixed with 2 spoon of salt and gasoline until it form paste, smeared the infected part every day for 3 consecutive days by exposing to the sun light	Fire wood (ER)
		R	E	F&D	Evil eye	Few roots were placed on fire and fumigated by the smoke for few minutes	
	ER	R	I	F	Stomach pain	Half finger sized root was chewed by taking in the fluid part during stomach pain	
	GM	L	I	F	Snake venom	Some leaes were crushed, squeezed and drunk one coffee cup immediately	
		L	E	F	Acne	The infected part was fumigated evey dayfor 3 consecutive days by adding some leave on fire or the infected site was smeared by crushed leaves for three consecutive days	
Coffea arabica	CM	Sd	E	D	Wound	Powder of roasted seeds were sprayed on the wound every day for 3 consecutive days.	Coffee drink, fire wood
	GM	Sd	E	D	Fire burn	Powder of roasted seeds were sprayed on the burned body every day for 5-7 consecutive days	

Scientific Name	Dt	PU	A	CP	Disease	Preparation and application	Other uses
Cordia africana	CM	L	I	F	Febrile	Some leaves were crushed, filter and drunk one spoon with a cup of coffee or alone until treated	Fire wood, Edible fruit, fire wood, furniture,shade, fodder, bee forrage and hanging of hive (CM), house construction (ER)
		L	E	F	Febrile	It was mixed and boiled with *Withania semiifera*, *Eucalyptus globules*, *Cynoglossum lanceolatum*, *Zehneria scabra* and water and fumigated by the smoke every night for 3 consecutive days	
	ER	Fr	I	F&D	Amoeba	A beaker of fleshy seeds were consumed	
	G M	L	I	F	Jaundice	Some leaves were crushed, squeezed and added 2 spoon of it to a coffee cup or alone and drunk every day one to three times for 7 consecutive days	
Croton macrostachyus	CM	Rb	I	D	Nephritis	A bunch of root barks were crushed, powdered, mixed with litre of MES, boiled, cooled, filter and drunk one coffee cup every morning for 7 consecutive days	Fire wood, fence, CM), shade (GM)
	Er	Ba	I	D	Worm (cattle, goat, sheep)	A bunch of barks were crushed, mixed with water, boiled and one tin cane was given to cattle and half of tin cane to goat and sheep every day for 3 -5 consecutive days	
	G M	R	I	F	Stomach parasite	Finger sized root was washed, chewed and take in the fluid part	
		Rb	I	D	Jaundice	Crushed, powdered and one spoon of it added to a glass of milk and drunk one glass for 3 consecutive days	
		Br	E	F&D	Prevent pre-birth	It was tied with the cloth of the mother	
Cucurbita pepo	CM	Sd	I	D	Tape worm	About a coffee cup of seeds were roasted and consumed	Stew (CM)
Cynoglossum lanceolatum	CM	L	I	F	Febrile	3-5 leaves were added into coffee and drunk until free at any time	
		L	I	F	Febrile	Some leaves were crushed, squeezed and drunk by adding 2-3 tea spoon for 3 days with cup of coffee	
		L	E	F	Febrile	A bunch of leaves were boiled with *Withania semiifera*, *Eucalyptus globules*, *Cordia africana*, *Zehneria scabra* and water and fumigated by the smoke every night for 3 consecutive days	
	ER	R, L	I	F	Febrile	Some leaves were crushed, squeezed and drunk by adding 2-3 tea spoon for 3 days with cup of coffee or milk	
		L&R	E	F	Hangnail	Some leaves were crushed and placed on the wound every day until treated	

	Dt	PU	A	CP	Disease	Preparation and application	Other uses
	G M	L	E	F	Wound (Troma)	Some leaves were crushed and placed on the wound for 3-5 consecutive days	
		L	I	F	Abdominal pain	Some leaves were crushed, squeezed and drunk half of a coffee cup during abdominal pain or for 3 consecutive days if not treated.	
		L	E	F	Eye infection	A bunch of leave were boiled with *Withania semiifera*, *Eucalyptus globules*, *Cordia africana* , *Zehneria scabra*, *Dodonaea angustifolia*, water and fumigated by the smoke every night for 5 consecutive days	
Cyphostemma cyphopetalum	*CM*	L	I	F	Snake bite	two-three leaves were chewed and taken in the fluid part soon	
	GM	R	I	F	Snake bite	Figure sized root was chewed and taken in the fluid soon	
		L	E	F	Liver fluke	Some leaves were crushed and smeared the infected part for 5 consecutive days	
Datura stramonium	*CM*	L	E	F	Wound (Head)	Some leaves were crushed and placed on the wound every day for 3 consecutive days and 1-2 hours on the head (As the kept time of the herbal medicine on the head extended, the chance of the patient to be harmed is high even can die)	
		L	E	F	Louse	Some leaves were crushed and placed on the shaved head or as its for one or two hours	
	ER	L	E	F	Swelling	Some leaves were crushed and placed on the swollen part every day for 3 consecutive days	
		L	I	F	Blotting (cattle)	Some leaves were crushed, squeezed, mixed with little water and drunk one beaker.	
		L	I	F	Rabies (cattle, donkey, horse, mule)	Some leaves were pounded and 1-2 coffee cup for a bitten cattle; half of it for calves and one tin cane to donkey, horse and mule was given	
		L	I	F	Diarrhea (cattle)	Some leaves were crushed, squeezed, mixed with little water and drunk one coffee cup every day for 3 consecutive days	
	GM	Sd	E	D	Tooth pain	Some seeds were roasted with hair butter for 1-2 minutes and immediately the seeds placed in between the infected teeth	
Dodonaea angustifolia	CM	L, S	E	F, D	Arthritis /rheumatism	It was placed on fire and fumigated 5-10 minutes for 5consecutive days	Fire wood, to fumigate milk containers (CM), Fence, tooth brush (medicinal and shining) (GM)
	ER	S	E	D	Allergic	The infected site was smeared by the fluid released while it burn up.	
		L, S	E	F, D	Womb infection and Arthritis	A bunch of it was placed on fire and fumigated every day for 7 consecutive days	

	Dt	PU	A	CP	Disease	Preparation and application	Other uses
	G	L, B	E	F,D	Herpes zoster	A bunch of it was crushed, filtered, a glass of it was mixed with about 2 coffee cup of hair butter and smeared the infected site for 12 consecutive days	
		L	E	F	Polio	Some leaves were crushed and placed on the infected site every day for 3 consecutive days	
		Fr, L	I	F, D	Malaria	A tin cane of fruit or a bunch of leaves were crushed, filtered, a glass of it was mixed with same amount of honey and consumed 3- 4 spoons evey dayfor 3 consecutive days	
Eucalyptus globulus	CM	L	E	F	Feberile	A bunch of leaves were mixed with *Zehneria scabra*, *Withania semnifera*, *Laggera tomentosa*, *Cordia africana* and water, boiled and fumigated by the vapor every night for three consecutive days	House construction, firewood, shade, mat
	G M	Bu	E	F	Cough	About hand palm of it was boiled with water and fumigated by the vapor every night until treated.	
		L	E	F	Malaria	A bunch of leaves were boiled with water, fumigated for 2-5 minutes, placed the residue leaves under the sleeping mat and slept soon every night at least for 7 consecutive days or until recovery	
Euphorbia abyssinica	CM	La	E	F	Thorn	The infeted site was smeared until the thorn was out	Fence including living fence, fire wood (CM), as glue (GM)
	ER	La	I	F	Gonerrhea	Very small amount of the milky latex, about 2 spoon was mixed with a tin cane red flour of *Eragrostis tef*, mixed with water, baked and eaten half to one injera for every day3-5 consecutive days.	
		La	E	F	Liver fluke (cattle)	The swollen part was lined by the fluid to protect expansion	
		La	I	F	Abdominal parasite	1-2 spoon was added to a cup coffee and taken in	
Euphorbia polyacantha	CM	La	E	F	Leshimeniasis Coetaneous	Half of a coffee cup was mixed with same amount of honey or alone and smeared the infected site for 7-10 consecutive days	
		La	I	F	Rat killer	Some latex was mixed with injera and *Linum usitatissimum* and given to rats to eat	
	ER	La	E	F	Hemorrhoids	The infected site was smeared by the milky latex every dayfor 7 consecutive days	
		La	E	F	Tinia scaplis	The infected site was smeared every day for 3-5 consecutive days	
Ficus palmata	CM	La	E	F	Hemorrhoids	The infected site was smeared by the milky latex for 10 consecutive days at the interval of one day	Fire wood, edible fruit (CM)
		La	E	F	Wart	The infected site was smeared until treated	

	Dt	PU	A	CP	Disease	Preparation and application	Other uses
	GM	La	I	F	Ear pain	One drop was added into the infected ear	
		La	E	F	Allergic dermitis	The infected site was smeared once	
		La	E	F	Wound	The infected site was smeared every day for 3 consecutive days	
		La	E	F	Cutaneous leshimeniasis	The infected site was smeared every day for 3 consecutive days	
Hordeum vulgare	CM	Sd	E	D	Head ache	Half of a coffee cup was roasted and fumigated by the smoke during pain.	Food (Injera, roasted grain (Kello), Local beer (SEWA), hay, sprout (CM)
	ER	Sd	I	D	Broken bones (Cattle, Donkey, Mule or Horse)	Some amount of grains were given daily until treated	
	GM	Sd	I	D	Blotting	Two cup sprout *Hordeum vulgare* were dried, powdered, mixed with a beaker of water and drunk	
		Sd	E	D	Eye infection	The infected eyes were fumigated by the roasted seed. Next the roased seeds were dispersed by three men on the suspected area for the infection of the eye	
		Sd	I	D	Cough	The powder of *Hordeum vulgare, Eragrostis tef, and Triticum aestivum* were mixed, roasted for 2-3 minutes, mixed with water, boiled 5-7 minutes to form soup and drunk a beaker every morning until free.	
Hypoestes forskaolii	CM	L	E	F	Feberile	A bunch of leaves were boiled with water, fumigated once every day for three consecutive days	Fire wood (ER), nectar for honey bees (GM)
	ER	L	E	F&D	Evil eye	Small powder was added on a fire and fumigated by the smoke.	
		R	I	F	Vomiting	A piece root was chewed and swallowed	
		L	E	F	Bleeding (cattle, goat, sheep, donkey)	The infected site was rubbed daily until bleeding stopped.	
	GM	R	E	F	Abdominal pain	Finger sized root was chewed and drunk the fluid part by vomiting the roughage	
						Some roots were crushed, mixed with 1-2 spoon of water, filtered and drunk one spoon during pain	
		L	E	F	Jaundice	About 10 hand full leaves were soaked for 7 days in 20 tin cane of water and washed every morning for 7 consecutive days	
		L	E	F	Herpes zoster	A bunch of leaves were collected from 7 different sites, mixed with 10 tin can of water, stored for 7 days and washed for 7 consecutive days	

		PU	A	CP	Disease	Preparation and application	Other uses
		L	I	F&D	Delivery	Half of a handful crushed, squeezed, mixed with a glass of water and drunk the fluid during delivery	
		R	E	F&D	Fracture (Man)	Some roots were enclosed by cloth which never in contact water and tied on the injured site until delight	
		R	E	F&D	Evil eye	Small powder of crushed root was added on a fire and fumigated by the smoke.	
Indigofera vicioides	*CM*	R	I	F&D	Abdominal pain	A piece of root was chewed and drunk the fluid	Fire wood, fence (ER), broom , fodder (GM)
	ER	R	I	F&D	Snake bite (venom)	Fingure sized root was chewed soon and drunk the fluid	
Juniperus procera	CM	Br	E	D	Evil eye (*Ganen*)	Compound of the house was smoked every morning by adding the branch on the fire before leaving	Fire wood, charcoal, house construction, shade (CM)
		L	E	F	Dandruff	Some leaves were crushed and placed on a shaved head every day for 5 consecutive days	
Justicia shimperiana	CM	L	I	D	Jaundce	A bunch of leaves were crushed, mixed with half tin cane of water, two coffee cup of honey and drunken 1-2 spoons (young) or tea glass (Adult) every day for 5-7 consecutive days.	Fire wood (CM)
		L	E	F	Paralyze	A bunch of leaves were boiled with 10 tin cane of water, cooled, filtered and washed every day for 7 consecutive days	
		L	I	F	Blotting (cattle, goat, sheep)	A bunch of leaves were crushed, squeezed, mixed with tin cane of water and drunk one tin cane for cattle and half for goat and sheep every day for 3-5 consecutive days	
Laggera tomentosa	CM	R	E	F	Feberile	Some roots were mixed with the root of *Aloe spp.* , tin cane of water, boiled and fumigated by the vapor every day for three consecutive nights	
		L	I	F	Leech (cattle)	Some leaves were crushed, mixed with a beaker of water filtered and added half of a tin cane of through the nasal cavity	
		L	E	F	Swelling of the hooves (horse, mule, donkey)	Some leaves were crushed, warmed and placed on the infected hooves every night for 3 conscutive days	
	GM	L	I	F	Cough (cattle)	A bunch of leaves were crushed, squeezed, filtered and coffee cup was added a through the nasal cavity every day for three consecutive days	
Leucas martinicensis	CM	A/G	E	F	Feberile	A bunch of branch was mixed with some leaves of *Zehneria scabra*, *Withania somnifera*, *Laggera tomentosa* and two tin cane of water, boiled and fumigated by the vapor for 3 consecutive days every night.	

Scientific name	Dt	PU	A	CP	Disease	Preparation and application	Other uses
Linum usitatissimum	CM	Sd	I	D	Constipation due to eating of *Opuntia ficus-indica*	A cup of roasted powder was mixed with half of a tin cane of water and drunk	Edible as stew, leather making, injera baking (CM)
	ER	Sd	I	D	Amoeba	Powder of roasted one killo was mixed with three tin cane of water and half of a tin cane was taken every morning for 5-7 consecutive days	
	GM	Sd	E	D	Wound	Roasted seeds of *Linum usitatissimum* were placed soon on the swollen wound to burst	
		Sd	I	D	Delay of placenta (cattle, goat, sheep)	Powder of roasted two cup of *Linum usitatissimum* were mixed with a beaker of water and drunk	
Lycopersicon esculentum	CM	Fr	E	F	Wound	The splitted fruit was placed soon on the fresh cut	Edible, stew (CM)
		L	E	F	Wound	Some leaves were crushed and placed on the wound every day for 3-5 consecutive days	
	GM	L	I	F	Leech (cattle)	A bunch of leaves were crushed, mixed with a cup of water, filtered and added through the nasal cavity	
Maytenus arbtifolia	CM	Rb	E	F&D	Arthritis	Some root bark were placed on fire and fumigated every night for 5 consecutive days	Fire wood, fence, fodder (CM)
Maytenus senegalensis	CM	L	I	F	Stomach pain	Few leaves were crushed, squeezed, filtered and add to glass yogurt and drunk	Fire wood, fence, fodder, Bread baking (CM)
		L	I	F	Diarrhea	Few leaves were crushed, squeezed, filtered and add to glass yogurt and drunk every day for three consecutive days	
	GM	L	I	F	Leech (cattle)	Two handfuls leaves were crushed, mixed with a beaker of water, filtered and added half of a tin cane through nasal cavity	
		L	I	F	Diarrhea (cattle, goat, sheep)	Two handfuls leaves were crushed, mixed with a beaker of water, filtered and drunk one beaker for cattle and half it for goat and sheep until free	
		L	I	F	Stomach parasite (cattle, goat, sheep)	A bunch of leaves were crushed, mixed with tin cane of water, squeezed, filtered and drunk one tin cane for cattle and half of it for goat and sheep every day for 3 consecutive days	
		L	E	F	Wound (head)	Some leaves were crushed and placed on the shaved head for 3-5 consecutive days	

Scientific name	Dt	PU	A	CP	Disease	Preparation and application	Other uses
Melia azedarach	CM	L	E	F	Tinia scaplis	The infected site was rubbed for 3-5 consecutive days	Fire wood, shade, as mat (CM) house fly discharge (ER)
		L	I	F	Abortion	A bunch of leaves were crushed, squeezed, filtered and one cup drunk	
	ER	S	I	F	Gum bleeding	Fresh was chewed during gum bledding	
Meriandra dianthera	CM	L	I	F	Amoeba	One handful was crushed, mixed with a beaker of water, filtered, stored in a bottle alone or mixed with a 2 cup of honey for 5 days and drunk half of a coffee cup for child and two coffee cup for adult every morning for 5-7 consecutive days	Fire wood (CM), Consumed by goat (ER)
		L	I	F	Stomach parasites	One handful was crushed, mixed with a beaker of water, filtered, stored in a bottle or pot alone or mixed with a 2 cup of honey for 5 days and drunk half of a coffee cup (child) and two coffee cup (adult) every morning for 5-7 consecutive days	
		L	I	F	Tape worm	Handful was crushed, mixed with a beaker of water, filtered and drunk one beaker (adult) or coffee cup (Young) every morning for 3- 5 consecutive days	
		L	I	F	Low appetite	Handful was crushed, mixed with a beaker of water, filtered, mixed with 3 coffee cup of honey, stored for 7 days and drunk one to twocoffee cup during discomfort	
	GM	L	I	F	Hypertension	Two handful leaves were boiled with two tin cane of water, cooled, filtered and drunk one glass every morning for 7 consecutive days.	
		L	I	F	Stomach pain	Some leaves were crushed, filtered and drunk half of coffee cup during illness	
		L	I	F	Jaundice	Handful leaves were crushed, mixed with a tin cane of water, filtered and drunk one tea glass (adult) or coffee cup (Young) every morning for 3- 5 consecutive days	
		L	I	F	Cough (cattle, goat, sheep)	A bunch leaves were crushed, squeezed, filtered and one tin cane for cattle and half of it for goat and sheep for 3-5 consecutive days	
	ER	L	I	F	Leech (cattle)	Handful leaves were crushed, mixed with a beaker of water, filtered and one beaker was added through the nasal cavity1-3 consecutive days	
		L	I	F	Malaria	Two handful leaves were crushed, filtered, mixed with one glass of honey and two bottle of water, stored for 5 days and drunk one tin cane every morning for 7 consecutive days	
		L	I	F	Vomiting	Handful leaves were crushed, mixed with a beaker of water, filtered and stored for 3-7 days and drunk a coffee cup for adult and 1-2 spoon to young during discomfort	

Scientific name	Dt	**PU**	**A**	**CP**	**Disease**	**Preparation and application**	**Other uses**
Nicotiana glauca	CM	L	E	F	Exto-parasite including lice (cattle, goat, sheep)	Some leaves were crushed and placed on the dermis of the animal for one to three consecutive days	Fire wood (CM)
		L	E	F	Itchy (cattle, goat, sheep)	Some leaves were crushed and placed on the dermis of the animal for 1-3days	
	ER	L	E	F	Tick (cattle, goat, sheep)	Some leaves were crushed and washed for three consecutive days	
		L	I	F	Frothy blottis (cattle, goat, sheep)	Bunched leaves were crushed, squeezed, mixed with tin cane of water and drunk	
	G M	Br	E	F&D	Termite	Some branch were placed on the floor where termites are found such during house construction and on the floor whrere wood, hay etc piled up	
Nicotiana tabacum	CM	L	I	F	Leech (cattle)	Handful leaves were crushed, mixed with a tin cane of water, filtered and added through the nasal cavity for 1-3 cons. days	Leaves chewed as stimulant (ER)
Ocimum lamiifolium	CM	L	I	F	Feberile	5-7 leaves were crushed, squeezed or with out processing was added to coffee cup and drunk with coffee one to three times every day for 3 consecutive days	
Olea europaea	CM	L	I	F	Abdominal pain	Some leaves were added into tea and drunk during stomach pain	House construction, fence, firewood, charcoal, fodder, furniture, shade, tooth brush (medicinal and shining) (CM), stick, farming utensils, container fumigation, tea spice (GM)
		L	I	F	Tooth pain	Some leaves were chewed and placed in b/n the infected teeth during tooth pain	
	ER	L	I	F	Amoeba	Handful fresh leaves were crushed, mixed with a glass of water, filtered and drunk one coffee cup every dayfor 3 consecutive days	
		S	I	F & D	Malaria	Some pieces of stems were boiled with two beaker of water, filtered, mixed with a glass of honey and stored in pot or bottles and drunk one glass every morning for 7 consecutive days	
		S	I	F & D	Heart failure	Some pieces of stems were mixed and boiled with two beaker of water, filtered, mixed with a glass of honey and stored in pot or bottles and drunk one glass every morning for 5 consecutive days	
	G M	S	E	F	Tooth parasite	The teeth were brushed by tooth brush stick	
		Bu	I	F	Tonsillitis	Some buds were chewed until treated	
Otostegia integrifolia	CM	L &Br	E	F&D	Fleas	A bunch of branch was burned and fumigated the room for 3-5 consecutive hours	Fence, fire wood (CM)
	G M	L &Br	E	F&D	Itchy (cattle, goat, sheep)	A bunch of branch was burned and fumigated the animals for few minutes for 3 consecutive days	
		L	I	F	Cough (cattle, goat, sheep)	A bunch of crushed leaves were mixed with a tin cane of water, filtered and given to cattle and half of it for goat and sheep (until free off)	

Scientific name	Dt	PU	A	CP	Disease	Preparation and application	Other uses
Pollichia campestris	CM	R&L	I	F&D	Tooth pain	One piece of root or some leaves were chewed during teeth pain	
	ER	L&R	E	F&D	Evil eye	Some roots or leaves were added on fire and fumigated during discomfort.	
		R	I	F&D	Tonsillitis	Some roots were crushed and placed on the shaved head of a child or one piece of root was chewed and taken in the fluid part (Adult)	
	G M	R	E	F	Tonsillitis	A piece of root was chewed and taken in the fluid part one to three times every day for 3 consecutive days	
		L	I	F&D	Anthrax (cattle)	Some keaves were crushed, mixed with little water, squeezed and drunk one tin cane every day for 3-5 consecutive days	
Prunus persica	CM	L	E	F	Tonsillitis	Some leaves were crushed and placed on the shaved head of a child for 3 consecutive days by replaced it by fresh every day	Edible fruit, fire wood (CM)
Psiadia punctulata	CM	L	E	D	Scar	Some dried leaves were crushed, powdered and sprayed on the scar every day for 7 consecutive days	
	ER	L	E	F&D	Arthritis	Some leaves were burned and fumigated by its smoke every night for 5 consecutive days	
	G M	L	E	F	Fracture	A bunch of leaves were crushed, mixed with hair butter and the injured part was tied for 7-9 consecutive days at the interval of three days for fresh	
Rhamnus prinoides	CM	B	E	F	Tonsillitis	Some leaves were crushed and placed on the shaved head of a child (young) every day for 3 consecutive days	To make local beer (SEWA), MES and sometimes as tooth brush (medicinal and shining) (CM)
		B	I	F	Tonsillitis	Some leaves were chewed and the fluid was banished three times to the tonsil of the child every day for 1-3 consecutive days	
	ER	B	I	F	Tonsillitis	2-3 buds were chewed, placed it on the tonsils region and taken in the fluid part by expelled the roughage	
		F	E	F	Tinia scaplis	Some fruits were crushed and smeared the infected site every morning for 3-5 consecutive days	
Rosa abyssinica	CM	R	E	F	Mich	Some leaves were boiled with water and fumigated by its smoke every night for 3 consecutive days	Living and non-living fence, edible fruit (CM)
	G M	L	E	F	Vitiligo	Handful leaves were crushed, mixed with a coffee cup of hair butter and placed on the infected site for 14 consecutive days.	
Rumex nepalensis	CM	L	E	F	Tinia scaplis	The infected site was rubbed every day for 3-5 consecutive days	
	G M	L	I	F	Black leg (cattle)	Two leaves were crushed, mixed with half of a coffee cup of hair butter and consumed by the animal	
		R	I	F	Snake venom	A piece of root was chewed soon	

Scientific name	Dt	PU	A	CP	Disease	Preparation and application	Other uses
Rumex nervosus	CM	L	E	F	Itchy (cattle, goat, sheep)	a bunch of leaves were crushed, mixed with tin cane of water, squeezed and washed every day for 3 consecutive days	Fire wood (CM), Edible bud region (ER)
		L	E	E	Paralyze	A bunch of leaves were boiled with about 5 tin cane of water, filter, mixed with two cuo of *Lepidium sativum*, crushed one bulb of *Allium sativum*, two fruits of *Citrus lemon* cut in to piecies and washed every morning for 7 consecutive days	
		L	E	F	Dandruff	Some leaves were crushed and placed on the shaved head for 5 consecutive days by replacing new every day	
	ER	L	E	F	Wound (cattle, goat, sheep)	Some leaves were crushed and placed on the wound for 3-5 consecutive days	
		L	I	F	Blotting (cattle, goat, sheep)	Some leaves were crushed, squeezed, mixed with little water and drunk one tin cane for cattle and half of it for goat and sheep every morning for 3 consecutive days	
	G M	L	E	F	Michi	Some leaves were crushed and placed on the shaved head of a child until treated replaced by fresh every day	
Ruta chalepensis	CM	L	E	F	Cough	Some leaves were crushed with 2 slices of *Allium sativum*, enclosed by plastic materials or cloth and tied on the neck region of a young to smell it	Used as spices such as shro, milk and *Capsicum annum* (CM)
						Some fresh leaves were added to tea, coffee or milk and adult drunk until delight	
	G M	L	I	F	Abdominal pain	About 6 leaves were added to coffee and drunk during stomach pain	
		L	E	F	Evil eye	Some leaves were crushed with some sliced *Allium sativum*, enclosed by plastic and tied on the neck region	
		L	E	F	Tonsillitis	Some leaves were crushed and placed on the shaved head until treated replaced by fresh every day	
Schinus molle	CM	L	I	F	Abdominal pain	Crushed about 6 leaves and mixed with a coffee cup of water and drunk during stomach pain with coffee or alone.	Fire wood, shade, mat (CM)
		L	E	F	Fever	Soaked in a pot of water with root and branch of *Aloe elegans*, branch of *Withania somnifera*, leaves of *Olea europaea*, *Pollichia campestris* for some time and washed the body for 2-3 consecutive days.	
	G M	L	E	F	Wound (Head)	Crushed some leaves and put on the wound of the head for 5 consecutive days	
		L	I	F	Mich	Crushed some leaves, squeezed and take 2-3 tea spoons during infirmity	

		PU	A	CP	Disease	Preparation and application	Other uses
		L	I	F	Abortion	A bunch of leaves were crushed, mixed with some water, squeezed and taken in one tin cane. Same technique was applied for 3 consecutive days if the expected result was not observed in the first attempt.	
		L	I	F	Vomiting	Some leaves were crushed, squeezed and 1-2 spoons were taken to prevent or stop vomiting.	
		L	I	F	Tonsillitis	Some leaves were crushed and placed on the head of a child	
						Some leaves were chewed and drunk the fluid part by adult	
	ER	L	I	F	Diarrhea	A small number of leaves were crushed, mixed with two cup of water and drunk half of a coffee cup during illness	
		L	I	F	Stomach parasite	Some leaves were crushed, mixed with little water and drunk half of a coffee cup for 3-4 consecutive days	
Solanum adoense	ER	R	I	D	Rabies	A bumch of roots were powdered, mixed with some yogurt and drunk a cup of tea every mornig for 7-10 consecutive days.	
		R	E	F&D	Prevent abortion (cattle,)	A piece of root was tied on the body of the cattle	
	GM	R	E	F	Infection of ear / Otitis	Some roots were placed on the infected ear by hanging out part	
		R	I	F&D	Cancer	2 pieces of roots were chewed and taken in the fluid every dayfor 7 consecutive days	
		R	E	F&D	Wound	Some pieces of roots were crushed. powdered , mixed with some powder of *Vicia faba* and placed on the surface of the wound for 5 consecutive days at the interval of one day	
		Fr	E	F	Infection of ear / Otitis	One to three drops were added to the infected ear by squeezing the fruit	
Solanum schimperianum	CM	L	E	F	Common cold	Some leaves were crushed and smell it or added to fire and fumigated by the smoke for 3 consecutive days	Fumigate and wash milk container (CM), Fire wood (GM)
		L	I	F	Tooth pain	Some leaves were chewed during tooth pain	
	ER	L	E	F	Belching	Some leaves were crushed and smelt	
		R	I	F	Abdominal pain	One finger sized was chewed and drunk the fluid during pain	
		R,L	I	F	Ulcer (Gastric)	Some leaves were crushed, squeezed, filtered and one coffee cup was taken by adult or coffee cup by achild.	
		R	I	F	Blotting	A bunch of root was crushed, mixed with a tine cane of water, filtered and taken in half of a tin cane (adult) or coffee cup (child).	

		PU	A	CP	Disease	Preparation and application	Other uses
		L	E	F	Arthritis /rheumatism	A branch of it was placed on fire and fumigated by its smoke	
	GM	L	E	F	Head ache	Some leaves were crushed with some leaves of *Withania somnifera* and placed on the head during illness	
		L,Br	D	F,D	Evil eye	A branch of it was placed on fire and fumigated by its smoke	
Tagetes minuta	ER	L	E	F	Tinia scaplis	The infected site was rubbed every day for 3-5 consecutive days	
	GM	L	E	F	Jaundice	Handful leaves were mixed with some roots of *Aloe elegan*, leaves of *Zehneria scabra, Laggera tomentosa, Olea europaea, Withania somnifera, Eucalyptus globulus*, boiled with two tin cane of water, fumigated by the smoke and subsequently washed by the fluid every day for 5 consecutive days	
		L	E	F	Evil eye	Some leaves were crushed and smelt during illness	
Tarchonanthus camphorates	CM	L	I	F	Cough (cattle, goat, sheep)	A bunch of leaves were mixed with a tin cane of water, filtered and given one tin cane every day for 3 consecutive days.	Fire wood (CM)
	ER	L	I	F	Leech and cough (cattle, goat, sheep)	A bunch of leaves were crushed, mixed with a tin cane of water, filtered and one half of a tin cane was added through nasal cavity for cattle and half of it for sheep and goat.	
Trigonella foenum-graecum	CM	Sd	I	D	Stomach pain	Powder of three spoon were mixed with one coffee cup of water and drunk during stomach pain	Used as spice in injera, bread and milk (CM)
Verbena officinalis	CM	L & R	I	F	Abdominal pain	Some fresh leaves or a piece of roots were chewed take in the fluid part during abdominal pain	
	GM	L	E	F	Tonsillitis	Some crushed leaves were placed on the shaved head of a child for three consecutive days replaced by fresh every day.	
		R	E	F	Infection of ear/otits	Some roots were crushed, squeezed and add one-three drops in to the infected ear every day for 3-5 consecutive days	
Vitis vinifera	CM	L	E	F\	Hang nil	Some leaves were crushed and enfolded the infected site for three consecutive days replaced fresh every day	Edible fruit, fodder, shade
Withania somnifera	CM	L	E	F	Mich and/ paralyze	A bunch of *Eucalyptus globulus* were mixed with some *Cynoglossum lanceolatum, Tagetes minuta Dodonaea angustifolia*, tin cane of water, boiled and fumigated by the vapor every night for three consecutive days	Fire wood (CM)
	ER	L	E	F	Evil eye	Some leaves were placed on fire and fumigated by its smoke during illness	

		PU	A	CP	Disease	Preparation and application	Other uses
	GM	R	I	F	Stomach pain	A piece of root was chewed and taken in the fluid during stomach pain	
		L	E	F	Wound (cattle, goat, sheep)	Some leaves were crushed and placed on the infected site for three consecutive days replaced fresh every day	
Xanthium strumarium	CM	L	E	F	Tinia scaplis	The infected site was rubbed every day for 5-7 consecutive days	
Zehneria scabra	ER	L	E	F	Mich	A bunch of keaves were mixed with some branches of *Dodonaea angustifolia*, *Withania semnifera*, *Eucalyptus globule*, *Cynoglossum lanceolatum, Cordia africana*,, tin cane of water and fumigated by every day for 3 consecutive days	
	GM	R	I	F	Stomach pain	A finger sized root was chewed and drunk the fliud part during stomach pain	
		L	E	F	Herpes zoster	A bunch of leaves were mixed with 5 tin cane of water, bunch of *Withania somnifera* and *Olea europaea*, stored for 10 days and washed the infeted part (body) every day for 5 consecutive days	
		L	E	F	Jaundice	A bunch of leaves were mixed with water, bunch *Withania somnifera* and *Olea europaea*, stored for 10 days and washed the body for 7 consecutive days	
Zingiber officinale	CM	Rhizom	E	F&D	Tooth pain	A piece of rhizome was chewed during tooth pain	Spices of Shro and *Capsicum annum* (CM)
		Rhizom	I	F&D	Abdominal pain	Some fragments were boiled and taken with tea	
	ER	Rhizom	I	F&D	Cough	Some fragments were added and taken with tea every day for 3-5 consecutive days	
Ziziphus mauritiana	CM	L	E	F	Dandruff	Some leaves were crushed and placed on a shaved head every night for 7 consecutive days	Fire wood, living fence, forage, edible fruit (CM)

List of plant species and methods of preparation to treat human and livestock ailments obtained from Erob District only

Scientific name	PU	A	CP	Disease	Preparation and application	Other uses
Asparagus africanus	Br	I	F	Urination problem (Cattle, goat, sheep)	A bunch of branches were crushed, mixed with tin cane of water, squeezed and drunk one tin cane for cattle and half for goat and sheep (if not treated it conyinue for three consecutive days	
	Br	I	F	Placenta-retention (Cattle, goat, sheep)	A bunch of branches were crushed mixed with water and given one tin cane	
	L	I	F	Worms (Cattle, goat, sheep)	A bunch of branches were crushed, mixed with water and given one tin cane every dayfor 3 consecutive days	

Scientific name	PU	A	CP	Disease	Preparation and application	Other uses
Capparis micrantha	L	I	F	Malaria	A bunch of leaves were crushed, squeezed, mixed with two tin cane or one littre of MES and drunk half to one beaker every morning for 7 consecutive days.	Fire wood
	L	I	F	Tooth pain	Some leaves were chewed during teeth pain	
	L	I	F	Jaundice	A bunch of leaves were mixed with tin cane of water, boiled, filtered, stored in a small pots or bottle and drunk half cane every morning for 7 consecutive days.	
Capsicum annuum	Fr	I	F & D	Tendency of vomiting	3-5 fruits were consumed with ingera for temporarily relief	Give good taste to stew
				Stomach parasites	Some fruits were consumed with injera as necessary	
Capsicum frutescens	Fr	I	F & D	Stomach pain	Half of a tea spoon was added to a coffee cup of water and drunk	As flavor to eat raw meat
Coronopus didymus	Sd	E	D	Wound	Some seeds were powdered, sprayed on the infected site for 3 consecutive days	
	R	I	F&D	Tooth infection	Some roots were chewed every day for 3-5 consequative days	
	R	I	F	Somach pain	Some roots were chewed and taken in the fluid part during stomach pain	
Dovyalis abyssinica	Br	E	F, D	Evil eye	Some branches were placed on fire and fumigated during illness	
Echinops pappii	L	E	F	Tinia scaplis	The infected site was rubbed by the crushed leaves every day for 3 - 5 consecutive days	
Heliotropium cinerascens	L	E	F	Wound	Some leaves were crushed and placed it on the infected site every day for 3-5 consecutive days	
Indigofera amorphoide	L	I	F	Stomach pain	One-two finger sized roots were chewed and taken in the fluid during stomach pain	Fodder
Kalanchoe marmorata	L	E	F	Swelling (Cattle, goat, sheep)	Some leaves were crushed and placed on the infected site for 3 consecutive days at the interval of one day	
	L	E	F	General health problem	A handful leaves were crushed, squeezed, add 10 tin cane of water and washed every morning for 3 consecutive days	
	L	I	F	Anthrax (cattle)	A bunch of leaves were crushed, mixed with two tin cane of water and drunk one tine cane every day for 3-5 consecutive days	
Leptadenia arborea	L	E	F	Cutaneous leshimeniasis	Some leaves were crushed and placed on the infected site for 7-10 consecutivly day at the interval of two days	
Malva parviflora	L	E	F	Hang nil	Some leaves were crushed and placed on the wound for 3 consecutive days	
Mentha longifolia	L	Ch	F	Tooth infection	Some leaves were chewed during tooth pain	Marvelous odor, as mat

Scientific name	PU	A	CP	Disease	Preparation and application	Other uses
Mentha spicata	L	I	F	Stress	5-6 leaves were added and drunk with tea	Spice for tea, scent
Ocimum basilicum	L	E	F	Wound	Some leaves were crushed and consigned on the wound for 3-5 consecutive days at the interval of one day	Spice
Opuntia ficus-indica	R	I	F	Snake and scorpion poison	Two finger sized roots were washed, chewed and drunk the fluid immediately	Edible fruit, fodder, living and non living fence
Otostegia minucii	L	E	F	Flea (Goat and sheep)	Some leaves were crushed and consigned on the infected site for 3 consecutive days	Fire wood
Solanum villosum	L	E	F	Wound	Some leaves were crushed and consignrd on the wound for 3 consecutive days	Edible fruit
	L	E	F	Hang nil	Some leaves were crushed and placed on the wound for 3 consecutive days	
Taraxacum sp.agg.	L	E	F	Tinia scaplis	The infected site was rubbed every day for 5 consecutive days.	
	L	E	F	Allergic dermitis	Some leaves were crushed and rubbed the site	
	R	I	E,D	Tooth pain	A piece of root was chewed during tooth pain (don't drunk the fluid part)	
List of plant species and methods of preparation to treat human and livestock ailments obtained from Gulumrheda District only						
Scientific name	**PU**	**A**	**CP**	**Disease**	**Preparation and application**	**Other uses**
Artemisia absinthium	L	E	F&D	Tooth pain	Some leaves were placed on fire and fumigated the infected teeth during pain	Ornamental
Beta vulgaris	Bu	I	F	Anemia	Raw or as stew was consumed with injera at least once per day until treated	Edible
Brassica nigra	Sd	I	D	Cancer	About ¼ kg powder was mixed with almost the same amount of *Vicia faba* powder, some water and 3 tea spoon consumed every morning for 5 consecutive days.	As spice to eat bean sprout
	Sd	I	D	Abortion	A cup of powder was mixed with half of a tin cane of water and drunk (6-7 consecutive days if the required out come is not observed)	
	Sd	I	D	Amoeba	A cup of powder was mixed with 5 spoon of *Capsicum annum* and consumed with injera or sprout bean for 5 consecutive days	
Buddleja polystachya	L	E	D	Fire burn	Some leaves were dried, crushed, powdered and sprayed on the burned body for 7-10 days or until healing	Fire wood
	B	I	F&D	Cancer	A cup of bud was crushed, mixed with 3-4 spoon of honey and inserted in the infected body for 7-12 consecutive days	
	R,B	E	D	Snake prevention	Part of the plant was placed it in the compound of the house	

	PU	A	CP	Disease	Preparation and application	Other uses
	L	I	F	Leech and cough (Cattle, goat, sheep)	A bunch of leaves were crushed, mixed with a tin cane of water, squeezed and added through the nasal cavity (repeated if not cure)	
Commicarpus plumbagineus	R	I	F	Snake venom	Some roots were crushed, mixed with some water filtered and drunk half of a coffee cup immediately, followed for 3 consecutive days. The bitten site was also rubbed by the root.	
					1-3 pieces of roots was chewed and drunk its fluid immediately	
Crinum ornatum	Bu	E	F	Tinia scaplis	The infected site was rubbed once every dayfor 3 consecutive days	
Cucumis ficifolius	R	I	F	Stomach pain	Two finger sized roots were chewed by taken in the fluid during stomach pain	Consumed by goat and sheep
Emex spinosa	R	I	F	Snake bite (Venom)	One piece of root was chewed and subsequently drunk the fluid soon	
Eragrostis tef	Sd	I	D	Cough (febrile)	Half of a tin cane powder was mixed with some amount ofwater, boiled and drunk the broth every day for 3-5 consequative days	Edible (food), hay
Eucalyptus camaldulensis	L	E	F	Febrile	A bunch of leaves were mixed with *Zehneria scabra*, *Withania somnifera*, *Laggera tomentosa*, *C. africana*, tin of water, boiled and fumigated by the vapor every night for 3 consecutive days.	House construction, firewood, shade, mat
Euclea racemose	Rb	I	F&D	Amoeba	Handful root bark was mixed with two tin cane of water, boiled, cooled, filtered and drunk half of a tin cane every morning for 3 consecutive days	Fence including living fence, Fire wood, edible fruit
	R	I	F	Snake venom	Few roots were chewed and drunk the fluid for 3-5 cons. days	
	R	I	F,D	Gonerrhea	Hand palm of fresh or dried roots were pounded, boiled in tine cane of water and drunk it with yoghurt or crushed roots were boiled and drunk half of a tin can with sugar for 5 consecutive days	
	R	E	F	Tonsillitis	Some crushed leaves were placed on the shaved head of a child for 3-5 consecutive day replaced by fresh every day	
Euphorbia tirucalli	La	E	F	Hemorrhoids	The infected site was smeared by the milky latex for 5-10 consecutive days or until treated	Fence, fire wood, as glue
Ficus ingens	Ba	E	F,D	Delay of infant to upright and stiff	The infant was tied by the bark	Edible fruit, fire wood, fodder
Foeniculum vulgare	L	I	F	Amoeba	A handful leaves were crushed, mixed with a bottle (two tin cane) of water, stored for 7 days and drunk one coffee cup every day for 4-5 consecutive days	Fodder
	L	I	F	Urine retention	Handful leaves were mixed with two tine cane (bottle) of water, boiled, filtered, cooled and drunk one tea cup every dayfor 3 consecutive days	
	L,S	I	F	Cough	Some leaves or roots were chewed to receive relieve during illness	

	PU	A	CP	Disease	Preparation and application	Other uses
	L	I	F	Urine retention (cattle, goat, sheep)	Two handfuls were mixed with a bottle (two tin cane) of water boiled, filtered, cooled and drunk one two tin cane once for cattle, horse, mule, donkey and one tin cane for sheep and goat)	
Gomphocarpus fruticosus	La	E	F	Swelling	The swelled part was smeared every day for 4-5 consecutive days until it ruptured	
	La	E	F	Cutaneous leshimeniasis	the infected part was smeared every morning for 7 consecutive days	
Gossypium hirsutum	Sd	E	F, D	Snake repellent	The suspected area was fumigated to drive out the snake	Cloth
Kalanchoe laciniata	L	I	F	Frothy glottis (cattle)	A bunch of leaves were crushed, squeezed, mixed with a tin cane of water and drunk one tin cane every morning for 3 consecutive days	
	L	E	F	Allergic dermitis	Some crushed leaves were placed on the scratched body every dayfor 3-5 consecutive days	
Lactuca sativa	L	I	F	Anemia	Raw leaves of *Lactuca sativa* was eaten with fruits of *Lycopersicon esculentum,* bulb of *Allium sativum* and injera at least once per day until treated	Edible
Lagenaria siceraria	L	E	F	Wound	Some leaves were crushed, mixed with hair butter and placed on the wound every day for 5 consecutive days after removed the previous one	Container (Water, Tela, milk)
Lepidium sativum	Sd	I	D	Stomach pain (Child)	One coffee cup was crushed, powdered, mixed with 2 coffee cup of water and drunk one spoon every day for 3 consecutive days,	Mixed with water and spray during the first day of the month
	Sd	I	D	Stomach parasite	Two coffee cup of water was added to a coffee cup of powder, mixed, fermented and consumed with sprout *Vicia faba* until treated.	
	Sd	I	D	Arthritis	A glass of it was mixed with two litter (four tin cane) of water, kept for 7 days and washed by the fluid for 7 consecutive days (same steps for the next day)	
	Sd	I	D	Wound	Half coffee cup of seeds were powdered, mixed with water and added on the wound. for 1-3 consecutive days,	
	Sd	E	D	Arthritis	One coffee cup was powdered, mixed with 2 coffee cup of honey and consumed one spoon .for 7 consecutive days,	
	Sd	E	D	Tonsillitis	Powder of some roasted seeds were mixed with water and kept on the region of tonsil.	
	Sd	E	D	Evil eye	A cup of powder was mixed with water and sprayed in and around the house at the first day of the month	

Scientific name	PU	A	CP	Disease	Preparation and application	Other uses
Leucas abyssinica	L	I	F	Cough (sheep, goat, cattle)	Some leaves were crushed, mixed with little water, filtered, mixed with *Allium sativum* and added three to four tea spoon through nasal cavity for cattle and two tea spoon for sheep and goat for 3 consecutive days	
					Handful leaves were crushed, mixed with a tin cane of water, filtered and drunk for 3 consecutive days for cattle and half of it for sheep and goat.	
Lobelia giberroa	L	E	F	Swelling in the neck region (sheep, goat, cattle)	Some leaves were crush, squeezed and smeared until treated	Fire wood
Myrica salicifolia	L	I	F	Cancer of nose (cattle, goat, sheep)	Some leaves were crushed, add little water, squeezed and add one tea cup through the nasal cavity for cattle and half of it for goat and sheep until free	Fire wood
Plectranthus ornatus	L	E	D	Evil eye	Some leaves were added to fireand Fumigated	
Phytolacca dodecandra	R	I	D	Tapeworm	Two pieces of roots were chewed and drunk the fluid every day for 3 consecutive days	Detergent
	L	I	F	Abortion	Handful leaves were crushed, addedin to a tin cane of water, squeezed and drunk it	
Psidium guajava	F	I	F	Ulcer (Gastric)	2-4fruits were consumed during discomfort for temporary relief	Edible fruit, fire wood
Ricinus communis	L	E	F	Wound	Some leaves were crushed and placed on the wound for 3 consecutive days at the interval of one day	Injera making
Rumex abyssinicus	L	E	F	Eye infection	Some leaves were boiled with water and fumigated every night for 3 consecutive days	Spices for tea, shro and *Capsicum annum*
	Bu	I	F,D	Head ache	Few pieces were added and drunk with tea until treated	
Sida schimperiana	R	I	F&D	Stomach pain	Some pieces of roots were chewed and drunk the fluid during stomach pain	Washing pot of local beer, tooth brush (medicinal and shining), broom, fodder
	R	E	F&D	Bad mouth smell	The teeth were brushrd every morning until bad mouth smell avoided	
	R	E	F	Fracture (cattle)	Hair from the tail of the infected animal was tied with the rooted plant	
	R	I	F	Horse disease	A bunh of root was grounded, mixed with a tin cane of water, filtered and drunk one tin cane or half of a tin cane was applied through the nostrils for 3 consecutive days	
Sideroxylon oxyacanthum	L	I	F	Leech and cough (cattle, goat, sheep)	Some leaves were crushed, mixed with little water, filtered and added one coffee cup for cattle and ½ of a coffee cup for goat and sheep through nasal cavity	

	PU	A	CP	Disease	Preparation and application	
	L	I	F	Cough (cattle, goat, sheep)	Some leaves were crushed, mixed with little water, filtered and added ½ of a coffee cup through nasal cavity	
	L	I	F	Parasite (human)	A bunch of leaves were crushed, mixed with a tine cane of water, filtered and stored in a pot (bottle) and drunk a coffee cup every morning for 3 consecutive days	
Solanum incanum	R	E	F	Damaged joint /Fracture (cattle, goat, sheep)	Some roots was tied on the opposite side of the damaged part of the body	Leather making
	R	E	F	Fresh wound (head)	Some leaves were crushed and placed on troma for 5 consecutive days replaced the previous one	
	R	I	F,D	Abdominal pain	A finger sized root was chewed, subsequently taken in the fluid during abdominal pain	
	R	I	F	Tooth pain	A pieces of root was chewed during teeth pain	
Triticum aestivum	Sd	I	D	Cough	Half of a tin cane or a tea cup of powder was warmed, mixed with about a tine cane of water, boiled for half of an hour and druk for 3 consecutive water night on the same way	Food, hay
Urtica simensis	R	I	F	Scorpion venom	A finger sized root was chewed and drunk the fluid for three to five consecutive days	Food (stew)
Vernonia amygdalina	L	I	F	Amoeba	Some leaves were crushed , mixed with little water, squeezed and drunk half of a coffee cup for 5 consecutive days	Fire wood, to wash pot of local beer
	L	I	F	Stomach pain	Some leaves were crushed, mixed with little water, squeezed and drunk half of a coffee cup during illness	
	L	E	F	Wound	Some leaves were crushed and placed on the wound for 3 consecutive days replaced the previous one	
	L	E	F	Paralyze	A bunch of leaves were crushed, mixed with 5 tin cane of water, squeezed, filtered, stored and washed every morning for 5 consecutive days.	
Vernonia rueppellii	L	E	F	Swelling in the neck (cattle)	A bunch of leaves were crushed, mixed with tin cane of water, squeezed and half tin cane for 7 consecutive days	Fire wood
	L	E	F	Louse and itchy (cattle, goat, sheep)	Some leaves were crushed and placed on the infected site until treated	
	L	E	F	Itchy (Human)	Some leaves were crushed and smeared the infected site until treated	
Vicia faba	S	E	D	Wound	Some seeds were powdered, mixed with some crushed and powdered root of *Solanum adoense* and added on the surface of the wound 3-5 consecutive days replaced the previous one	Food (edible)

Appendix 5 List of families with number of genera and species and rank of the total

(G=Genera number; R=Rank)

Erob District					Gulomahda District				Total					
Scientific name	**G**	**%**	**Spp.**	**%**	**G**	**%**	**Spp.**	**%**	**G**	**%**	**R**	**Spp.**	**%**	**R**
Acanthaceae	2	2.70	2	2.35	1	1.14	2	1.96	2	2.00	10	2	1.65	15
Alliaceae	1	1.35	1	1.18	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Aloaceae	1	1.35	2	2.35	1	1.14	2	1.96	1	1.00	19	2	1.65	15
Amaranthaceae	1	1.35	1	1.18	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Amaryllidaceae	-	-	-		1	1.14	1	0.98	1	1.00	19	1	0.83	24
Anacardaceae	1	1.35	1	1.18	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Apiaceae	-	-	-		1	1.14	1	0.98	1	1.00	19	1	0.83	24
Apocynaceae	1	1.35	1	1.18	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Asclepiadaceae	2	2.70	2	2.35	2	2.27	2	1.96	3	3.00	7	3	2.48	8
Asparagaceae	1	1.35	1	1.18	-	-	-	-	1	1.00	19	1	0.83	24
Asteraceae	7	9.46	7	8.24	8	9.09	9	8.82	10	10.00	1	11	9.09	1
Boraginaceae	3	4.05	3	3.53	2	2.27	2	1.96	3	3.00	7	3	2.48	8
Brassicaceae	1	1.35	1	1.18	2	2.27	2	1.96	2	2.00	10	3	2.48	8
Cactaceae	1	1.35	1	1.18	-	-	-	-	1	1.00	19	1	0.83	24
Cappardiaceae	1	1.35	1	1.18	-	-	-	-	1	1.00	19	1	0.83	24
Caricaceae	1	1.35	1	1.18	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Caryophyllaceae	1	1.35	1	1.18	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Celastraceae	1	1.35	2	2.35	1	1.14	2	1.96	1	1.00	19	2	1.65	15
Chenopodiaceae	1	1.35	1	1.18	2	2.27	2	1.96	2	2.00	10	2	1.65	15
Crassulaceae	1	1.35	1	1.18	1	1.14	-	-	1	1.00	19	2	1.65	15
Cucurbitaceae	2	2.70	3	3.53	4	4.55	4	3.92	4	4.00	5	4	3.31	6
Cuppressaceae	1	1.35	1	1.18	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Ebenaceae	-	-	-	-	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Euphorbiaceae	3	4.05	5	5.88	4	4.55	6	5.88	4	4.00	5	6	4.96	5
Fabaceae	4	5.55	4	4.71	6	6.82	6	5.88	6	6.00	3	7	5.79	4
Flacourticaceae	1	1.35	1	1.18	-	-	-	-	1	1.00	19	1	0.83	24
Lamiaceae	6	8.11	7	8.24	6	6.82	8	7.84	7	8.00	2	11	9.09	1
Linaceae	1	1.35	1	1.18	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Lobeliaceae	-	-	-	-	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Loganiaceae	-	-	-	-	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Malvaceae	1	1.35	1	1.18	2	2.27	2	1.96	3	3.00	7	3	2.48	8
Meliaceae	1	1.35	1	1.18	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Moraceae	1	1.35	1	1.18	1	1.14	1	0.98	1	1.00	19	2	1.65	15
Myricaceae	-	-	-	-	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Myrtaceae	1	1.35	2	2.35	2	2.27	3	2.94	2	2.00	10	3	2.48	8
Nyctaginaceae	-	-	-	-	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Oleaceae	1	1.35	1	1.18	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Papaveraceae	1	1.35	1	1.18	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Phytolaccaceae	-	-	-	-	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Poaceae	1	1.35	1	1.18	3	3.41	3	2.94	3	3.00	7	3	2.48	8
Polygonaceae	1	1.35	3	3.53	2	2.27	4	3.92	2	2.00	10	4	3.31	6
Rhamnaceae	2	2.70	2	2.35	2	2.27	2	1.96	2	2.00	10	2	1.65	15
Rosaceae	2	2.70	2	2.35	2	2.27	2	1.96	2	2.00	10	2	1.65	15

Scientific name	G	%	Spp.	%	G	%	Spp.	%	G	%	R	Spp.	%	R
Rubiaceae	1	1.35	1	1.18	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Rutaceae	2	2.70	2	2.35	2	2.27	2	1.96	2	2.00	10	2	1.65	15
Sapindaceae	1	1.35	1	1.18	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Sapotaceae	-	-	-	-	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Solanaceae	6	8.11	10	11.77	5	5.68	9	8.82	6	6.00	3	11	9.09	1
Urticaceae	-	-	-	-	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Verbenaceae	1	1.35	1	1.18	1	1.14	1	0.98	1	1.00	19	1	0.83	24
Vitaceae	2	2.70	2	2.35	2	2.27	2	1.96	2	2.00	10	2	1.65	8
Zingiberaceae	1	1.35	1	1.18	1	1.14	1	0.98	1	1.00	19	1	0.83	24
	72	-	85	-	88	-	102	-	100	-	-	121	-	-

Appendix 6 List of genera with their species number

Scientific name	No. of plant species belonging to each genera								
	Erob District			Gulomahda District			Both districts		
	spp.	%	R	spp.	%	R	spp.	%	R
Acacia	2	2.35	2	2	1.96	4	2	1.65	4
Achyranthes	1	1.18	14	1	0.98	11	1	0.83	18
Allium	1	1.18	14	1	0.98	11	1	0.83	18
Aloe	2	2.35	2	2	1.96	4	2	1.65	4
Argemone	1	1.18	14	1	0.98	11	1	0.83	18
Artemisia	-	-	-	1	0.98	11	1	0.83	18
Asparagus	1	1.18	14	-	-	-	1	0.83	18
Becium	1	1.18	14	1	0.98	11	1	0.83	18
Beta	-	-	-	1	0.98	11	1	0.83	18
Brassica	-	-	-	1	0.98	11	1	0.83	18
Buddleja	-	-	-	1	0.98	11	1	0.83	18
Calotropis	1	1.18	14	1	0.98	11	1	0.83	18
Calpurnia	1	1.18	14	1	0.98	11	1	0.83	18
Capparis	1	1.18	14	-	-	-	1	0.83	18
Capsicum	2	2.35	2	-	-	-	2	1.65	4
Carica	1	1.18	14	1	0.98	11	1	0.83	18
Carissa	1	1.18	14	1	0.98	11	1	0.83	18
Chenopodium	1	1.18	14	1	0.98	11	1	0.83	18
Citrus	1	1.18	14	1	0.98	11	1	0.83	18
Clutia	1	1.18	14	1	0.98	11	1	0.83	18
Coffea	1	1.18	14	1	0.98	11	1	0.83	18
Commicarpus	-	-	-	1	0.98	11	1	0.83	18
Cordia	1	1.18	14	1	0.98	11	1	0.83	18
Crinum	-	-	-	1	0.98	11	1	0.83	18
Coronopus	1	1.18	14	-	-	-	1	0.83	18
Croton	1	1.18	14	1	0.98	11	1	0.83	18
Cucumis	-	-	-	1	0.98	11	1	0.83	18
Cucurbita	1	1.18	14	1	0.98	11	1	0.83	18
Cynoglossum	1	1.18	14	1	0.98	11	1	0.83	18
Cyphostemma	1	1.18	14	1	0.98	11	1	0.83	18
Datura	1	1.18	14	1	0.98	11	1	0.83	18
Dodonaea	1	1.18	14	1	0.98	11	1	0.83	18
Dovyalis	1	1.18	14	-	-	-	1	0.83	18
Echinops	1	1.18	14	-	-	-	1	0.83	18
Emex	-	-	-	1	0.98	11	1	0.83	18
Eragrostis	-	-	-	1	0.98	11	1	0.83	18
Eucalyptus	1	1.18	14	2	1.96	4	2	1.65	4
Euclea	-	-	-	1	0.98	11	1	0.83	18
Euphorbia	2	2.35	2	3	2.94	1	3	2.48	2
Ficus	1	1.18	14	2	1.96	4	2	1.65	4
Foeniculum	-	-	-	1	0.98	11	1	0.83	18
Gomphocarpus	-	-	-	1	0.98	11	1	0.83	18
Gossypium	-	-	-	1	0.98	4	1	0.83	18
Heliotropium	1	1.18	14				1	0.83	18

Scientific name	spp.	%	R	spp.	%	R	spp.	%	R
Hordeum	1	1.18	14	1	0.98	11	1	0.83	18
Hypoestes	1	1.18	14	1	0.98	11	1	0.83	18
Indigofera	2	2.35	2	1	0.98	11	2	1.65	4
Juniperus	1	1.18	14	1	0.98	11	1	0.83	18
Justicia	1	1.18	14	1	0.98	11	1	0.83	18
Kalanchoe	1	1.18	14	1	0.98	11	2	1.65	4
Lactuca	-	-	-	1	0.98	11	1	0.83	18
Lagenaria	-	-	-	1	0.98	11	1	0.83	18
Laggera	1	1.18	14	1	0.98	11	1	0.83	18
Lepidium	-	-	-	1	0.98	11	1	0.83	18
Leptadenia	1	1.18	14	-	-	-	1	0.83	18
Leucas	1	1.18	14	2	1.96	4	2	1.65	4
Linum	1	1.18	14	1	0.98	11	1	0.83	18
Lobelia	-	-	-	1	0.98	11	1	0.83	18
Lycopersicon	1	1.18	14	1	0.98	11	1	0.83	18
Malva	1	1.18	14	-	-	-	1	0.83	18
Maytenus	2	2.35	2	2	1.96	4	2	1.65	4
Melia	1	1.18	14	1	0.98	11	1	0.83	18
Mentha	2	2.35	2	-	-	-	2	1.65	4
Meriandra	1	1.18	14	1	0.98	11	1	0.83	18
Myrica	-	-	-	1	0.98	11	1	0.83	18
Nicotiana	2	2.35	2	2	1.96	4	2	1.65	4
Ocimum	2	2.35	2	1	0.98	11	2	1.65	4
Olea	1	1.18	14	1	0.98	11	1	0.83	18
Opuntia	1	1.18	14	-	-	-	1	0.83	18
Otostegia	2	2.35	2	1	0.98	11	2	1.65	4
Phytolacca	-	-	-	1	0.98	11	1	0.83	18
Plectranthus	-	-	-	1	0.98	4	1	0.83	18
Pollichia	1	1.18	14	1	0.98	11	1	0.83	18
Prunus	1	1.18	14	1	0.98	11	1	0.83	18
Psiadia	1	1.18	14	1	0.98	11	1	0.83	18
Psidium	-	-	-	1	0.98	11	1	0.83	18
Rhamnus	1	1.18	14	1	0.98	11	1	0.83	18
Ricinus	-	-	-	1	0.98	11	1	0.83	18
Rosa	1	1.18	14	1	0.98	11	1	0.83	18
R*umex*	2	2.35	2	3	2.94	1	3	2.48	2
Ruta	1	1.18	14	1	0.98	11	1	0.83	18
Schinus	1	1.18	14	1	0.98	11	1	0.83	18
Sida	-	-	-	1	0.98	11	1	0.83	18
Sideroxylon	-	-	-	1	0.98	11	1	0.83	18
Solanum	3	3.53	1	3	2.94	1	4	3.31	1
Tagetes	1	1.18	14	1	0.98	11	1	0.83	18
Taraxacum sp.	1	1.18	14	-	-	-	1	0.83	18
Tarchonanthus	1	1.18	14	1	0.98	11	1	0.83	18
Trigonella	1	1.18	14	1	0.98	11	1	0.83	18
Triticum	-	-	-	1	0.98	11	1	0.83	18
Urtica	-	-	-	1	0.98	11	1	0.83	18
Verbena	1	1.18	14	1	0.98	1	1	0.83	18
Vernonia	-	-	-	2	1.96	4	2	1.65	4

Scientific names	**spp.**	**%**	**R**	**spp.**	**%**	**R**	**spp.**	**%**	**R**
Vicia	-	-	-	1	0.98	11	1	0.83	18
Vitis	1	1.18	14	1	0.98	11	1	0.83	18
Withania	1	1.18	14	1	0.98	11	1	0.83	18
Xanthium	1	1.18	14	1	0.98	1	1	0.83	18
Zehneria	1	1.18	14	1	0.98	11	1	0.83	18
Zingiber	1	1.18	14	1	0.98	11	1	0.83	18
Ziziphus	1	1.18	14	1	0.98	11	1	0.83	18
Total	85	100.00	-	102	100.00	-	121	100.00	-

Appendix 7 List of plant species and number of ailments treated by each plant species

(One plant species may treat one or more than one ailment)

Plant species	Erob District						Gulomahda District					
	Treated human ailments			Treated livestock ailments			Treated human ailments			Treated livestock ailments		
	No.	%	Rank	No.	%	Rank	No.	%	Rank	No.	%	Rank
Acacia etbaica.	3	1.92	8	1	2.50	11	2	0.92	33	1	2.33	10
Acacia origena	2	1.28	20	1	2.50	11	2	0.92	33	1	2.33	10
Achyranthes aspera	2	1.28	20	2	5.00	5	4	1.83	6	2	4.65	4
Allium sativum	3	1.92	8	-	-	-	4	1.83	6	-	-	-
Aloe elegans	8	5.13	1	2	5.00	5	3	1.38	21	2	4.65	4
Aloe macrocarpa	5	3.21	4	1	2.50	11	3	1.38	21	1	2.33	10
Argemone mexicana	2	1.28	20	-	-	-	2	0.92	33	-	-	-
Artemisia absinthium	-	-	-	-	-	-	1	0.46	57	-	-	-
Asparagus africanus	-	-	-	2	5.00	5	-	-	-	-	-	-
Becium grandiflorum	1	0.64	39	-	-	-	2	0.92	33	-	-	-
Beta vulgaris		-	-	-	-	-	1	0.46	57	-	-	-
Brassica nigra		-	-	-	-	-	3	1.38	21	-	-	-
Buddleja polystachya	-	-	-	-	-	-	3	1.38	21	1	2.33	10
Calotropis procera	2	1.28	20	-	-	-	4	1.83	6	-	-	-
Calpurnia aurea	2	1.28	20	4	10.00	1	1	0.46	57	4	9.30	1
Capparis micrantha	3	1.92	8	-	-	-	-	-	-	-	-	-
Capsicum annum	2	1.28	20	-	-	-	-	-	-	-	-	-
Capsicum frutescens	1	0.64	39	-	-	-	-	-	-	-	-	-
Carica papaya	1	0.64	39	-	-	-	1	0.46	57	-	-	-
Carissa spinarum	2	1.28	20	1	2.50	11	2	0.92	33	1	2.33	10
Chenopodium ambrosioides	1	0.64	39	-	-	-	1	0.46	57	-	-	-
Citrus aurantifolia	1	0.64	39	-	-	-	2	0.92	33	-	-	-
Clutia abyssinica	3	1.92	8	-	-	-	4	1.83	6	-	-	-
Coffea arabica	1	0.64	39	-	-	-	2	0.92	33	-	-	-
Commicarpus plumbagineus	-	-	-	-	-	-	1	0.46	57	-	-	-
Cordia africana	2	1.28	20	-	-	-	2	0.92	33	-	-	-
Coronopus didymus	3	1.92	8	-	-	-	-	-	-	-	-	-
Crinum ornatum	-	-	-	-	-	-	1	0.46	57	-	-	-
Croton macrostachyus	1	0.64	39	1	2.50	11	4	1.83	6	-	-	-
Cucumis ficifolius	-	-	-	-	-	-	1	0.46	57	-	-	-
Cucurbita pepo	1	0.64	39	-	-	-	1	0.46	57	-	-	-
Cynoglossum lanceolatum	2	1.28	20	-	-	-	4	1.83	6	-	-	-
Cyphostemma cyphopetalum	1	0.64	39	-	-	-	2	0.92	33	-	-	-
Datura stramonium	2	1.28	20	3	7.50	3	3	1.38	21	-	-	-
Dodonaea angustifolia	3	1.92	8	-	-	-	3	1.38	21	-	-	-
Dovyalis abyssinica	1	0.64	39	-	-	-	-	-	-	-	-	-
Echinops pappii	1	0.64	39	-	-	-	-	-	-	-	-	-
Emex spinosa	-	-	-	-	-	-	1	0.46	57	-	-	-

Scientific name	No.	%	Rank	No.	%	Rank	No.	%	Rank	No.	%	Rank
Eragrostis tef	-	-	-	-	-	-	1	0.46	57	-	-	-
Eucalyptus camaldulensis	-	-	-	-	-	-	1	0.46	57	-	-	-
Eucalyptus globulus	1	0.64	39	-	-	-	3	1.38	21	-	-	-
Euclea racemosa	-	-	-	-	-	-	4	1.83	6	-	-	-
Euphorbia abyssinica	3	1.92	8	1	2.50	11	1	0.46	57	-	-	-
Euphorbia polyacantha	4	2.56	6	-	-	-	2	0.92	21	-	-	-
Euphorbia tirucalli	-	-	-	-	-	-	1	0.46	57	-	-	-
Ficus ingens	-	-	-	-	-	-	1	0.46	57	-	-	-
Ficus palmata	2	1.28	20	-	-	-	6	2.75	4	-	-	-
Foeniculum vulgare	-	-	-	-	-	-	3	1.38	21	1	2.33	10
Gomphocarpus fruticosus	-	-	-	-	-	-	2	0.92	33	-	-	-
Gossypium hirsutum	-	-	-	-	-	-	1	0.46	57	-	-	-
Heliotropium cinerascens	1	0.64	39	-	-	-	-	-	-	-	-	-
Hordeum vulgare	1	0.64	39	1	2.50	11	4	1.83	6	-	-	-
Hypoestes forskaolii	3	1.92	8	1	2.50	11	7	3.21	1	-	-	-
Indigofera amorphoide	1	0.64	39	-	-	-	-	-	-	-	-	-
Indigofera vicioides	1	0.64	39	-	-	-	1	0.46	57	-	-	-
Juniperus procera	2	1.28	20	-	-	-	2	0.92	*21*	-	-	-
Justicia schimperiana	2	1.28	20	1	2.50	11	2	0.92	21	1	2.33	10
Kalanchoe laciniata	-	-	-	-	-	-	1	0.46	57	1	2.33	19
Kalanchoe marmorata	1	0.64	39	2	5.00	5	1	0.46	57	-	-	-
Lactuca sativa	-	-	-	-	-	-	1	0.46	57	-	-	-
Lagenaria siceraria	-	-	-	-	-	-	1	0.46	57	-	-	-
Laggera tomentosa	1	0.64	39	2	5.00	5	1	0.46	57	3	6.98	2
Lepidium sativum	-	-	-	-	-	-	6	2.75	4	-	-	-
Leptadenia arborea	1	0.64	39	-	-	-	-	-	-	-	-	-
Leucas abyssinica	-	-	-	-	-	-	-	-	-	1	2.33	10
Leucas martinicensis	1	0.64	39	-	-	-	1	0.46	57	-	-	-
Linum usitatissimum	2	1.28	20	-	-	-	2	0.92	33	1	2.33	10
Lobelia giberroa	-	-	-	-	-	-	-	-	-	1	2.33	10
Lycopersicon esculentum	1	0.64	39	-	-	-	1	0.46	57	1	2.33	10
Malva parviflora	1	0.64	39	-	-	-	-	-	-	-	-	-
Maytenus arbutifolia	1	0.64	39	-	-	-	1	0.46	57	-	-	-
Maytenus senegalensis	2	1.28	20	-	-	-	3	1.38	21	3	6.98	2
Melia azedarach	3	1.92	8	-	-	-	2	0.92	33	-	-	-
Mentha longifolia	1	0.64	39	-	-	-	-	-	-	-	-	-
Mentha spicata	1	0.64	39	-	-	-	-	-	-	-	-	-
Meriandra dianthera	6	3.85	6	1	2.50	11	7	3.21	1	1	2.33	10
Myrica salicifolia	-	-	-		-	-	-	-	-	1	2.33	10
Nicotiana glauca	-	-	-	4	10.00	1	1	0.46	57	2	4.65	4
Nicotina tabacum	-	-	-	1	2.50	11	-	-	-	1	2.33	10
Ocimum basilicum	1	0.64	39	-	-	-	-	-	-	-	-	-
Ocimum lamiifolium	1	0.64	39	-	-	-	1	0.46	57	-	-	-
Olea europaea	5	1.92	4	-	-	-	4	1.83	6	-	-	-

Scientific names	No.	%	Rank	No.	%	Rank	No.	%	Rank	No.	%	Rank
Opuntia ficus-indica	1	0.64	39	-	-	-	-	-	-	-	-	-
Otostegia integrifolia	1	0.64	39	-	-	-	1	0.46	57	2	4.65	4
Otostegia minucii	1	0.64	39	1	2.50	11	-	-	-	-	-	-
Phytolacca dodecandra	-	-	-	-	-	-	2	0.92	33	-	-	-
Plectranthus ornatus	-	-	-	-	-	-	1	0.46	57	-	-	-
Pollichia campestris	3	1.92	8	-	-	-	2	0.92	33	1	2.33	10
Prunus persica	1	0.64	39	-	-	-	1	0.46	57	-	-	-
Psiadia punctulata	2	1.28	20	-	-	-	2	0.92	33	-	-	-
Psidium guajava	-	-	-	-	-	-	1	0.46	57	-	-	-
Rhamnus prinoides	2	1.28	20	-	-	-	1	0.46	57	-	-	-
Ricinus communis	-	-	-	-	-	-	1	0.46	57	-	-	-
Rosa abyssinica	1	0.64	39	-	-	-	2	0.92	33	-	-	-
Rumex abyssinicus	-	-	-	-	-	-	2	0.92	33	-	-	-
Ru*mex nepalensis*	1	0.64	39	-	-	-	2	0.92	33	1	2.33	10
Rumex nervosus	2	1.28	20	3	7.50	3	3	1.38	21	1	2.33	10
Ruta chalepensis	1	0.64	39	-	-	-	4	1.83	6	-	-	-
Schinus molle	4	2.56	6	-	-	-	7	3.21	1	-	-	-
Sida schimperiana	-	-	-	-	-	-	3	1.35	21	1	2.33	10
Sideroxylon oxyacanthum	-	-	-	-	-	-	1	0.46	57	2	4.65	4
Solanum adoense	1	0.64	39	1	2.50	11	4	1.83	6	-	-	-
Solanum incanum	-	-	-	-	-	-	3	1.38	21	1	2.33	10
Solanum schimperianum	7	4.49	2	-	-	-	4	1.83	6	-	-	-
Solanum villosum	1	0.64	39	-	-	-	-	-	-	-	-	-
Tagetes minuta	1	0.64	39	-	-	-	2	0.92	33	-	-	-
Taraxacum sp. agg.	3	1.92	8	-	-	-	-	-	-	-	-	-
Tarchonanthus camphoratus	-	-	-	2	5.00	5	1	0.46	57	-	-	-
Trigonella foenum-graecum	1	0.64	39	-	-	-	1	0.46	57	-	-	-
Triticum aestivum	-	-	-	-	-	-	1	0.46	57	-	-	-
Urtica simensis	-	-	-	-	-	-	1	0.46	57	-	-	-
Verbena officinalis	1	0.64	39	-	-	-	3	1.38	21	-	-	-
Vernonia amygdalina	-	-	-	-	-	-	4	1.83	6	-	-	-
Vernonia rueppellii	-	-	-	-	-	-	1	0.46	57	2	4.65	4
Vicia faba	-	-	-	-	-	-	1	0.46	57	-	-	-
Vitis vinifera	1	0.64	39	-	-	-	1	0.46	57	-	-	-
Withania somnifera	2	1.28	20	-	-	-	2	0.92	33	1	2.33	10
Xanthium strumarium	1	0.64	39	-	-	-	1	0.46	57	-	-	-
Zehneria scabra	1	0.64	39	-	-	-	3	1.35	21	-	-	-
Zingiber officinale	3	1.92	8	-	-	-	2	0.92	33	-	-	-
Ziziphus mauritiana	1	0.64	39	-	-	-	1	0.46	57	-	-	-
Total	156	100	-	40	-	-	218	100	-	43	100	-

Appendix 8 List of human and livestock ailments and number of plant species used to treat each disease

(N.B. one plant may be used to treat two and more than two ailments. Moreover, one informant can mentioned two and more than two ailments)

Health problems	**Erob District**			**Gulomahda District**		
	No.	**%**	**Rank**	**No.**	**%**	**Rank**
Abdominal pain	14	8.64	1	19	8.79	1
Abdominal parasite	4	2.47	12	5	2.32	12
Abortion	1	0.62	30	5	2.32	12
Abortion avoidance	-	-	-	1	0.46	37
Acne	-	-	-	1	0.46	*37*
Allergic dermitis	2	1.24	21	2	0.93	27
Amoeba	-	-	-	6	2.78	11
Anemia	5	3.09	6	2	0.93	27
Arthritis	5	3.09	6	2	0.93	27
Asthma	-	-	-	2	0.93	27
Bad mouth odor	-	-	-	1	0.46	37
Belching	1	0.62	30	-	-	-
Bleeding During delivery	1	0.62	30	1	0.46	37
Blotting	1	0.62	30	1	0.46	37
Cancer	-	-	-	3	1.39	18
Common cold	1	0.62	30	1	0.46	37
Constipation	1	0.62	30	1	0.46	37
Cough/ Catarrh	4	2.47		7	3.24	7
Cutaneous leshimeniasis	3	1.85	18	3	1.39	18
Dandruff	5	3.09	6	5	2.32	12
Delay of infant to upright and stiff	-	-	-	1	0.46	37
Delivery	-	-	-	1	0.46	37
Diahrrea	2	1.24		1	0.46	37
Ear infection /Otits	-	-	-	4	1.85	17
Evil eye	5	3.09	6	8	3.70	5
Eye infection	1	0.62	30	3	1.39	18
Febrile	10	6.17	2	12	5.56	3
Fever	1	0.62	30	1	0.46	37
Fire burn	1	0.62	30	3	1.39	18
Fleas	1	0.62	30	1	0.46	37
Fracture	-	-	-	2	0.93	27
Ganen	-	-	-	1	0.46	37
General health problem	1	0.62	30	-	-	-
Gonorrhea	1	0.62	30	1	0.46	37
Gum bleeding	1	0.62	30	-	-	-
Hang nil	5	3.09		2	0.93	27
Head ache	3	1.85	18	3	1.39	18
Heart disease	2	1.24	21	-	-	-
Hemorrhoids	3	1.85	18	2	0.93	27
Herpes zoster	-	-	-	3	1.39	18
House fly on the wound	1	0.62	30	1	0.46	37
Hypertension	-	-	-	1	0.46	37

Health problems	No.	%	Rank	No.	%	Rank
Itchiness	1	0.62	30	1	0.46	37
Jaundice	5	3.09	6	*7*	3.24	7
Louse	1	0.62	30	1	0.46	37
Low appetite	1	0.62	30	1	0.46	37
Malaria	4	2.47	12	5	2.32	12
Nephritis	1	0.62	30	1	0.46	37
Paralyze	4	2.47	12	*5*	2.32	12
Pimple	1	0.62	30	1	0.46	37
Polio	1	0.62	30	1	0.46	37
Rabies	1	0.62	30	-	-	-
Rat killer	1	0.62	30	2	0.93	27
Ring worm	2	1.24	21	3	1.39	18
Scar	1	0.62	30	1	0.46	37
Scorpion poisons	2	1.24		3	1.39	18
Snake prevention	-	-	-	2	0.93	27
Snake venom	4	2.47	12	8	3.70	5
Spine /thorn	2	1.24	21	2	0.93	27
Stress	1	0.62	30	-	-	-
Swelling	1	0.62	30	1	0.46	37
Tape worm	2	1.24	21	3	1.39	18
Tendency of vomiting	1	0.62	30	-	-	-
Termites	-	-	-	1	0.46	37
Tinia scaplis	9	5.56	4	7	3.24	7
Tonsillitis	4	2.47	12	10	4.63	4
Tooth infection/pain	10	6.17	2	7	3.24	7
Troma	2	1.24	21	1	0.46	37
Ulcer (Gastric)	1	0.62	30	1	0.46	37
Urine retention	-	-	-	1	0.46	37
Vitiligo	-	-	-	1	0.46	37
Vomiting	2	1.24	21	1	0.46	37
Wart	1	0.62	30	1	0.46	37
Womb infection and Arthritis	1	0.62	30	-	-	-
Wound	9	5.56	4	18	8.33	2
Total	162	100		216	100	

List of livestock ailments and number of plant species used to treat each ailment

Health problems	No.	%	Rank	No.	%	Rank
Anthrax	1	2.50	9	1	2.33	8
Black leg	-	-	-	1	2.33	8
Bleeding	1	2.50	9	1	2.33	8
Blotting	3	7.50	3	-	-	-
Broken bones	1	2.50	9	-	-	-
Cough	3	7.50	3	8	18.61	1
Diarrhea	1	2.50	9	1	2.33	8
Exto-parasite including lice	2	5.00	6	4	9.30	4
Eye infection	1	2.50	9	1	2.33	8

Health problems	No.	%	Rank	No.	%	Rank
Flea	1	2.50	9	-	-	-
Fracture	3	7.50	3	4	9.30	4
Frothy blottis	1	2.50	9	2	4.65	6
Itchy	4	10.00	2	6	13.95	2
Leech	5	12.50	1	6	13.95	2
Liver disease	1	2.50	9	-	-	-
Liver fluke	1	2.50	9	-	-	-
Nose cancer	-	-	-	1	2.33	8
Placenta- retention	1	2.50	9	1	2.33	8
Prevent abortion	1	2.50	9	-	-	-
Rabies	1	2.50	9	-	-	-
Stomach parasite	-	-	-	1	2.33	8
Swelling in the neck region	1	2.50	9	1	2.33	8
Swelling of the hooves	1	2.50	9	1	2.33	8
Tick	1	2.50	9	-	-	-
Urination problem	1	2.50	9	1	2.33	8
Worms	2	5.00	9	-	-	-
Wound	2	5.00	6	2	4.65	6
	40	100	-	43	100	-

Appendix 9 Number and percentage of plant part used in the study districts

Erob District				Gulomahda District			
Plant part used	**No.**	**%**	**R**	**Plant part used**	**No.**	**%**	**R**
Leaves	37	43.53	1	Leaves	33	32.35	1
Leaves and Root	10	11.77	2	Leaves and root	13	12.75	2
Latex	5	5.88	3	Seed and fruit	12	11.77	3
Fruit	5	5.88	3	Latex	8	7.84	4
Leaves and stem	4	4.71	5	Root	8	7.84	4
Root	4	4.71	5	Leaves and branch	3	2.94	6
Branch	3	3.53	7	Bulb	3	2.94	6
Leaves and fruit	2	2.35	8	Above ground	2	1.96	8
Leaves and branch	2	2.35	8	Leaves and fruit	2	1.96	8
Root bark	2	2.35	8	Leaves and bud	2	1.96	8
Above ground	1	1.18	11	Leaves and stem	2	1.96	8
Bud and fruit	1	1.18	11	Bark	1	0.98	12
Bud and stem	1	1.18	11	Rhizome	1	0.98	12
Bulb	1	1.18	11	Bud and stem	1	0.98	12
Latex and bulb	1	1.18	11	Root bark	1	0.98	12
Latex and root	1	1.18	11	Bud	1	0.98	12
Leaves and root	1	1.18	11	Leaves, fruit and root	1	0.98	12
Rhizome	1	1.18	11	Leaves, barkand root	1	0.98	12
Root and fruit	1	1.18	11	Root and fruit	1	0.98	12
Root and seed	1	1.18	11	Leaves and latex	1	0.98	12
Seed	1	1.18	11	Leaves , stem and bulb	1	0.98	12
Leaves and seed	-	-	-	Leaves and seed	1	0.98	12
Leaves, seed, bud, fruit	-	-	-	Leaves, seed, bud, fruit	1	0.98	12
Root, root bark and branch,	-	-	-	Root, root bark and branch,	1	0.98	12
Root, root bark	-	-	-	Root, root bark	1	0.98	12
Total	85	100	-		102	100	
Number and percentage of plant parts used to treat human ailments							
Leaves	33	41.25	1	Leaves	29	29.59	1
Leaves and Root	8	10.00	2	Leaves and root	13	13.26	2
Latex	5	6.25	3	Seed and fruit	12	12.24	2
Seed	5	6.25	3	Latex	8	8.16	4
Fruit	4	5.00	5	Root	7	7.14	5
Leaves and stem	4	5.00	5	Leaves and branch	3	3.06	6
Root	4	5.00	5	Bulb	3	3.06	6
Leaves and branch	2	2.50	8	Leaves and fruit	2	2.04	8
Leaves and fruit	2	2.50	8	Leaves and stem	2	2.04	8
Root bark	2	2.50	8	Above ground	2	2.04	8
Above ground	1	1.25	11	Leaves and bud	2	2.04	8
Branch	1	1.25	11	Root and fruit	2	2.04	8
Bud and fruit	1	1.25	11	Leaves , stem and bulb	2	2.04	18
Bud and stem	1	1.25	11	Rhizome	1	1.02	14
Bulb	1	1.25	11	Root bark	1	1.02	14
Latex and bulb	1	1.25	11	Bud and stem	1	1.02	14
Latex and root	1	1.25	11	Bud	1	1.02	14

Plant part used	No.	%	R	Plant part used	No.	%	R
Leaves and root	1	1.25	11	Leaves, fruit and root	1	1.02	14
Rhizome	1	1.25	11	Bark	1	1.02	14
Root and fruit	1	1.25	11	Leaves, barkand root	1	1.02	14
Root and seed	1	1.25	11	Leaves and latex	1	1.02	14
Leaves and seed	-	-	-	Leaves and seed	1	1.02	14
Leaves, seed, bud, fruit	-	-	-	Leaves, seed, bud, fruit	1	1.02	14
Root, root bark	-	-	-	Root, root bark	1	1.02	14
Total	80	100		Total	96	100	
Parts of medicinal plants used to treat livestock ailments							
Leaves only	13	56.52	1	Leaves only	21	70.00	1
Leaves and root	2	8.70	2	Root	3	10.00	2
Latex	2	8.70	2	Leaves and root	2	6.67	3
Root	2	8.70	2	Latex	1	3.33	4
Bark	1	4.35	5	Leaf and branch	1	3.33	4
Leaf and branch	1	4.35	5	Root and latex	1	3.33	4
Root and latex	1	4.35	5	Seed	1	3.33	4
Seed	1	4.35	5	-	-	-	-
Total	23	100		Total	30	100	

Appendix 10 List of medicinal plant species reported as having side effects and antidotes in the study area

Erob District				
No	**Scientific name**	**Ailments**	**Side effects**	**Antidotes**
1	*Allium sativum*	Troma	Burning sensation	No antidotes
2	*Aloe elegans*	Malaria	Diahrrea	Milk
		Abdominal pain	Bitter taste	Coffee
		Infection of eye	Burning and itching sensation	Washing
3	*Aloe macrocarpa .*	Jaundice	Bitter, diahrrea	Milk, yogurt
4	*Capsicum annuum*	A. parasite	burning sensation	Yogurt
5	*Citrus aurantifolia*	Pimple	Burning sensation	No antidotes
6	*Cordia africana*	Tonsilities	Bitter tast	Coffee
7	*Cucurbita pepo*	Tape worm	Dropping through the anus	No antidotes
8	*Cynoglossum lanceolatum*	Feberile	Bitter taste	Coffee
9	*Datura stramonium*	Wound of head	Weakness	No but can harm if stay for long time (wash soon)
10	*Eucalyptus globulus*	Feberile	Sweating	Rest / sleep
11	*Euphorbia abyssinica*	Abdominal parasite	Harm (can kill)	Coffe, milk, yogurt
12	*Euphorbia polyacantha*	C/ leshimeniasis	Burnig sensation	Hair butter
13	*Ficus palmata*	Hemorrhoids	Burnig sensation	Hair butter after washing
14	*Hordeum vulgare*	Head ache	Sweating	No antidotes
15	*Indigofera amorphoide*s	Abdominal pain	Bitter taste	No antidotes
16	*Indigofera vicioides*	Abdominal pain	Bitter taste	No antidotes
17	*Leptadenia arborea*	C/leshimeniasis	Burning sensation	Hair butter
18	*Leucas martinicensis*	Febrile	Sweating	No antidotes
19	*Linum usitatissimum*	Constipation	Diarrhea	No antidotes
20	*Lycopersicon esculentum*	Wound/ fresh cut	Burning sensation	No antidotes
21	*Melia azedarach*	Abortion	diarrhea, vomiting	Local beer (*SEWA)*, milk, coffee, Yogurt
22	*Meriandra dianthera*	Tape worm	Biter taste	coffee
		Feeling to vomit	Bitter taste	No antidotes
23	*Nicotina tabacum*	Leech	Drooping with mucou through nostril (livestock)	No antidotes
24	*Ocimum lamiifolium*	Feberile	Bitter taste	Coffee (to minimize the bitter taste)
15	*Olea europaea*	Abdominal pain	Bitter taste	No antidotes
		Tooth pain	Bitter taste	No antidotes
26	*Rhamnus prinoides*	Tonsillitis	Bitter taste	Coffee, breast milk(to minimize the bitter taste)
27	*Schinus molle*	Abdominal pain	Bitter taste	Coffee, milk, yogurt, SEWA
28	*Solanum schimperianum*	Abdominal pain	Bitter taste	Coffee
		Gastric	Burning sensation, bitter taste	Milk

No	Scientific name	Ailments	Side effects	Antidotes
29	*Tarchonanthus camphoratus*	Leech	Droping with mucous through the nasal cavity (Livestock)	No antidotes
30	*Trigonella foenum-graecum*	Abdominal pain	Bitter taste	No antidotes
31	*Verbena officinalis*	Abdominal pain	Bitter taste	No antidotes
33	*Withania somnifera*	Febrile	Sweating	Rest / sleep
33	*Xanthium strumarium*	Tinia scaplis	Burning sensation	No antidotes
Gulomahda District				
1	*Acacia etbaica*	Leech	Dropping with mucous through the nasal cavity (Livestock)	no antidotes
		Wound (head)	Burning sensation	no antidotes
2	*Allium sativum*	Troma	Burning sensation	Head butter
		Malaria	Gastric	No antidotes
3	*Aloe elegans*	Abdominal pain	Bitter taste	Coffee
		Jaundice	Bitter, vomiting	Milk, coffee
4	*Aloe macrocarpa*	Jaundice	Bitter, vomiting	Milk, coffee
		Malaria	Bitter taste	Coffee
5	*Argemone mexicana*	Wound	Burning sensation	Head butter
6	*Brassica nigra*	Cancer	Burning sensation	No antidotes
		Amoeba	Abdominal burning sensation/gastric	Milk & milk product, *SEWA*, water
7	*Calotropis procera*	Malaria	Bitter taste	Yogurt
		Wound	Burning sensation	Washing, hair butter
8	*Chenopodium ambrosioides*	Abortion	Bitter, diahrea, vomiting	Milk, milk
9	*Commicarpus plumbagineus*	Snake venom	Bitter taste	No antidotes
10	*Cordia africana*	Abdominal pain	Bitter tast	Coffee, SEWA
11	*Coronopus didymus*	Wound	Burning sensation	Washing, h/butter
12	*Croton macrostachyus*	Abdominal parasite	Can harm if excess	Milk and milk products, powder of toasted *Linum usitatissimum* mixed with water
13	*Cucumis ficifolius*	Abdominal pain	Bitter taste	Coffee
14	*Cynoglossum lanceolatum*	Feberile	Bitter taste	Coffee
15	*Cyphostemma cyphopetalum*	Snake venom	Bitter taste	No antidotes
16	*Datura stramonium*	Wound/parasite of head	Burning sensation	No but can harm if let for long time
17	*Eucalyptus globulus*	Feberile	Sweating	Rest / sleep
18	*Euphorbia abyssinica*	Swelling (livestock)	Bursting	No antidotes
19	*Foeniculum vulgare*	Urine problem	Bitter taste	No antidotes
20	*Gomphocarpus fruticosus*	Swelling, C/ leshimeniasis	Burnig sensation	No antidotes

No	Scientific name	Ailments	Side effects	Antidotes
21	*Indigofera vicioides*	Abdominal pain	Bitter taste	No antidotes
22	*Justicia schimperiana*	Jaundice	Diahhrea/or vomiting	Yogurt, milk, powder of toasted *Linum usitatissimum* mixed with water
23	*Lycopersicn esculentum*	Wound/ fresh cut	Burning sensation	No antidotes
24	*Maytenus senegalensis*	Leech	Drooping with mucou through nostril (Livestock)	No antidotes
25	*Melia azedarach*	Abortion	Bitter, diarrhea, vomiting	Yogurt, powder of toasted *Linum usitatissimum* mixed with water
26	*Meriandra dianthera*	Ameboa	Biter taste	Coffee
		Tape worm	Weakness, vomiting diahhrea	Milk
		Feeling to vomit	Bitter taste	Coffee
27	*Nicotina tabacum*	Leech	Drooping with mucou through nostril	No antidotes
28	*Ocimum lamiifolium*	Feberile	Bitter taste	No antidotes
29	*Olea europaea*	Tooth pain	Bitter taste	No antidotes
20	*Pollichia campestris*	Tooth pain	Bitter taste	Coffee
31	*Rhamnus prinoides*	Tonsillitis	Bitter taste	Coffee, breast milk
32	Ru*mex nepalensis*	Tinia scaplis	Burning sensation	No antidotes
33	*Schinus molle*	Abdominal pain	Bitter taste	Coffee, milk, yogurt, *SEWA*
34	*Solanum incanum*	Abdominal pain	Bitter taste	No antidotes
35	*Tagetes minuta*	Tinia scaplis	Burning sensation	No antidotes
		Jaundice	Sweating	No antidotes
36	*Tarchonanthus camphoratus*	Leech	Droping through the nasal cavity (Livestock)	No antidotes
37	*Trigonella foenum-graecum*	Abdominal pain	Bitter taste	Coffee
38	*Verbena officinalis*	Abdominal pain	Bitter taste	No antidotes
39	*Vernonia amygdalina*	Wound	Burning sensation	Washing, w/butter
40	*Withania somnifera*	Febrile	Sweating	Rest / sleep
		Amoeba	Bitter, diahrea, vomitting	SEWA, coffee
		Abdominal pain	Bitter, diahrea, vomitting	Milk, yogurt
41	*Xanthium strumarium*	Tinia scaplis	Burning sensation	No antidotes
42	*Zehneria scabra*	Feberile	Sweating	No antidotes

Appendix 11 Medicinal plants requiring longer time to collect

Scientific name	**Average time required to collect medicinal plant species**					
	Erob District			**Gulomahda District**		
	30’ – 45’	**46’– 60’**	**>1 hour**	**30’ – 45’**	**46’– 60’**	**>1 hour**
Aloe macrocarpa		√				√
Buddleja polystachya					√	
Calpurnia aurea	√			√		
Capparis micrantha			√			√
Commicarpus plumbagineus				√		
Crinum ornatum						√
Croton macrostachyus			√			√
Euphorbia tirucalli					√	
Ficus ingens					√	
Ficus palmata		√			√	
Justicia schimperiana	√					√
Lobelia giberroa			√			√
Myrica salicifolia		√				√
Rosa abyssinica	√				√	
Tarchonanthus camphoratus		√				√
Vernonia rueppellii			√			

Appendix 12 Back ground of informants participated in the study area

Informants			Study districts						Grand Total		
			Erob District			Gulomehaeda District					
			#	%	R	#	%	R	#	%	R
Sex		M	119	31.15	1	134	35.08	1	253	66.23	1
		F	64	16.75	2	65	17.02	2	129	33.77	2
		T	183	47.90	-	199	52.10	-	382	100.00	-
Marital status	Married	M	69	18.06	1	99	25.92	1	168	43.98	1
		F	42	11.00	2	39	10.21	2	81	21.20	2
		T	111	29.06	-	138	36.13	-	249	65.18	-
	Single	M	50	13.09	1	35	9.16	1	85	22.25	1
		F	22	5.76	2	26	6.81	2	48	12.57	2
		T	72	18.85	-	61	15.97	-	133	34.82	-
Age		18-20	20	10.93	4	24	12.06	2	44	11.52	3
		46-50	24	13.12	2	26	13.07	1	50	13.09	1
		41-45	25	13.66	1	23	11.56	3	48	12.57	2
		36-40	21	11.48	3	23	11.56	3	44	11.52	3
		26-30	18	9.84	6	14	7.04	8	32	8.38	5
		56-60	10	5.47	9	15	7.54	7	25	6.53	8
		31-35	15	8.75	7	16	8.05	6	32	8.36	5
		51-55	19	10.38	5	12	6.30	9	31	8.11	7
		21-25	14	7.65	8	6	3.02	12	20	5.24	10
		61-65	7	3.83	10	17	8.54	5	24	6.28	9
		66-70	5	2.73	11	12	6.03	9	17	4.45	11
		71-75	3	1.64	12	4	2.01	13	7	1.83	13
		76-80	2	1.09	13	7	3.52	11	9	2.36	12
		Total	183	100	-	199	100	-	382	100	-
Educational status		No modern education	59	32.24	1	74	37.19	1	133	34.82	1
		5-8	45	24.59	2	42	21.11	2	87	22.77	2
		9-12	44	24.04	3	23	11.56	4	67	17.54	3
		1-4	14	7.65	4	32	16.08	3	46	12.04	4
		R/W	12	6.56	5	12	6.03	5	24	6.28	5
		Deacon and priests	-	-	-	10	5.03	6	10	2.62	6
		Diploma	4	2.19	6	3	1.51	7	7	1.83	7
		12 + 4	4	2.19	6	1	0.50	9	5	1.31	8
		TTI/10+1	1	0.55	8	2	1.01	8	3	0.79	9
		Total	183	100	-	199	100	-	382	100	-
Language and religious		Saho and Catholic	104	56.83	1	-	-	-	104	27.23	1
		Tigrigna and Orthodox	10	5.47	4	199	100	1	238	62.30	2
		Saho and Orthodox	35	19.13	2	-	-	-	23	6.027	3
		Tigrigna and Catholic	34	18.58	3	-	-	-	17	4.45	4
		Total	183	100	-	199	199	-		100	-

Appendix 13 Symptoms of human ailments

(One can mentioned two and more than two human ailment symptoms)

Symptoms	**Erob District**			**Gulomahda District**		
	No.	**%**	**R**	**No.**	**%**	**R**
Weakness	83	14.34	1	62	10.30	4
Vomiting	69	11.92	2	46	7.64	5
Sentiment of queasiness	64	11.05	3	20	3.32	11
Fever	58	10.02	4	86	14.29	1
Poor appetite	57	9.85	5	45	7.48	7
Sweating	53	9.15	6	72	11.96	2
Shivering	47	8.12	7	46	7.64	5
Diarrhea	39	6.74	8	21	3.49	10
Discomfort	27	4.66	9	-	-	-
Itchy	25	4.32	10	41	6.81	9
Coughing	20	3.45	11	44	7.31	8
Frequent sleeping	15	2.59	12	63	10.47	3
Behavioral change such as frequent crying	11	1.90	13	-	-	-
Frequent landing of fly on the body	4	0.69	14	7	1.16	14
Nasal fluid	3	0.52	15	7	1.16	14
Constipation	2	0.35	16	4	0.67	17
Head ache (Pain specially half face)	2	0.35	16	14	2.33	13
Inflammation of eye	-	-	-	16	2.66	12
Stomach pain	-	-	-	2	0.33	18
Skin scratch	-	-	-	6	1.00	16
Total	579	100	-	602	100	-

Appendix 14 Medicinal plants found in some protected sites

Erob District					**Gulomahda District**			
Arer	**Asabol**	**As-aleta**	**Giniato**	**Sibida**	**Aba-libanos**	***Alakima***	**Sebeya**	**Sihurto**
Acacia etbaica *Opuntia ficus-indicus* *Psiadia punctulata* *Nicotiana glauca* *Euphorbia abyssinica* *Aloe elegans* *Olea europaea* *Euphorbia polyacantha* *Leucas abyssinica*	*Rhamnus prinoides* *Psidium guajava* *Carica papaya* *Lagenaria siceraria* *Schinus molle* *Allium sativum* *Argemone mexicana* *Calotropis procera* *Carica papaya* *Cucurbita pepo*	*Acacia etbaica* *Euphorbia abyssinica* *Argemone mexicana* *Nicotiana glauca* *Solanum adoense* *Solanum incanum* *Rumex nervosus* *Schinus molle*	*Dodonaea angustifolia* *Olea europaea* *Euphorbia abyssinica* *Solanum schimperianum* *Acacia origena* *Laggera tomentosa* *Tarchonanthus camphoratus* *Juniperus procera* *Rumex nervosus* *Meriandra dianthera*	*Juniperus procera* *Becium grandiflorum* *Acacia origena* *Rumex nervosus* *Dodonaea angustifolia* *Aloe elegans* *Cordia africana* *Clutia abyssinica* *Euphorbia abyssinica* *Maytenus arbutifolia* *Calpurnia aurea* *Kalanchoe marmorata* *Kalanchoe laciniata* *Tarchonanthus camphoratus* *Olea europaea* *Nicotiana glauca* *Psiadia punctulata*	*Acacia origena* *Aloe elegans.* *Clutia abyssinica* *Ficus ingens* *Hypoestes forskaolii* *Juniperus procera* *Olea europaea* *Psiadia punctulata* *Solanum schimperianum*	*Meriandra dianthera* *Becium grandiflorum* *Nicotiana glauca* *Leucas abyssinica* *Laggera tomentosa,* *Hypoestes forskaolii* *Calotropis procera* *Aloe elegans*	*Acacia etbaica* *Acacia origena* *Dodonaea angustifolia* *Calpurnia aurea* *Schinus molle* *Vernonia rueppellii* *Solanum adoense* *Otostegia integrifolia* *Calpurnia aurea*	*Myrica salicifolia* *Vernonia rueppellii* *Croton macrostachyus* *Lobelia giberroa* *Phytolacca' dodecandra* *Calpurnia aurea* *Dodonaea angustifolia* *Olea europaea*

Appendix 15 Informant consensus of livestock ailments

(One informant may cited more than one ailment)

Livestock ailments	Local name	Number of citation in Erob (24 ailments)			Number of citation in Gulomahda (18ailments)		
		No.	**%**	**Rank**	**No.**	**%**	**Rank**
1. Anthrax	Mendef	1	0.36	11	6	2.00	8
2. Bleeding	Mifsas dem	1	0.36	11	-	-	-
3. Blotting	E'Fel	1	0.36	11	1	0.37	16
4. Broken bones	Sibar Atsmi	1	0.36	11	-	-	-
5. Cough	Si-Al	2	0.72	8	16	5.84	5
6. Diarrhea	Tsi-htsah	2	0.72	8	7	2.56	7
7. Exto-parasite including lice	Kumal	50	17.92	2	41	14.96	2
8. Eye infection	Himam a'yni	1	0.36	11	2	0.73	14
9. Flea	Kunicha	1	0.36	11	-	-	-
10. Fracture	Gimay	3	1.08	7	2	0.73	14
11. Frothy blottis	Minfah	29	10.39	5	26	9.49	4
12. Itchy	Hafew	91	32.62	1	101	36.86	1
13. Leech	Aleiti	50	17.92	2	42	15.33	2
14. Liver disease	Himam Kebdi (Gubet)	1	0.36	11	-	-	-
15. Liver fluke	Zigag	2	0.72	8	-	-	-
16. Placenta- retention	Muindgay meskeb	1	0.36	11	1	0.37	16
17. Prevent abortion	Miklihal michngaf	1	0.36	11	-	-	-
18. Rabies	Himam Ewud kelbi	1	0.36	11	-	-	-
19. Swelling in the neck region	Hibtet Kisad	31	11.11	4	10	3.65	6
20. Swelling of hooves	Hibet shohena	1	0.36	11	4	1.46	10
21. Tick	Kurdid	1	0.36	11	-	-	-
22. Urination problem	Tsegem shinti	1	0.36	11	3	1.10	12
23. Worms	Hasahut	1	0.36	11	-	-	-
24. Wound	Kusli	5	1.79	6	4	1.46	10
25. Black leg	Halafyo	-	-	-	3	1.10	12
26. Nose cancer	Nekersa	-	-	-	5	1.83	9
27. Stomach parasite	Hasahut chegora	-	-	-	1	0.37	16
	Total	279	100	-	274	100	-

Appendix 16 Informant consensus of human ailments

(One informant cited more than one ailment)

No.	Human ailment	Local name	Erob District			Gulomahda District		
			No	%	R	No	%	R
1	Abdominal pain	Kurtset	97	9.60	4	127	10.06	3
2	Abdominal parasite	Hasahut chedora	7	0.69	22	2	0.16	51
3	Abortion	Michingaf	4	0.4	31	11	0.87	23
4	Abortion avoidance	Michingaf miklihal	-	-	-	3	0.24	47
5	Acne	Shifta	-	-	-	2	0.16	51
6	Allergic dermitis	Mikutae Korbet	1	0.1	48	1	0.08	56
7	Amoeba	Amoeba	10	0.99	31	7	0.55	30
8	Anemia	Dem wahidi	-	-	-	1	0.08	56
9	Arthritis	Kurtmat	15	1.48	15	23	1.82	13
10	Asthma	Azma	-	-	-	1	0.08	56
11	Bad mouth odor	Chena Af.	-	-	-	5	0.40	38
12	Belching	Migusae'	2	0.1	38	-	-	-
13	Bleeding during delivery	Dem-hirsi	2	0.1	38	1	0.08	56
14	Blotting	Minfah	1	0.1	48	1	0.1	48
15	Cancer	Ahlae	-	-	-	9	0.71	27
16	Common cold	Wugat	4	0.4	31	6	0.48	34
17	Constipation	Dirket	18	1.79	14	37	2.93	9
18	Cough/ Catarrh	Si-Al	75	7.41	5	93	7.36	5
19	Cutaneous leshimeniasis	Gizwa	12	1.19	16	4	0.32	43
20	Dandruff	Forefor	39	3.85	8	51	4.04	6
21	Delay of infant to upright and stiff	Hitsan dewuta Tidingui	-	-	-	3	0.24	47
22	Delivery	M-wulad	-	-	-	5	0.40	38
23	Diahrrea	Wutsi-A't	2	0.2	38	1	0.08	56
24	Ear infection/Otits	Himam Ezni	-	-	-	6	0.48	34
25	Evil eye	Ede Seb	4	0.4	31	13	1.03	20
26	Eye infection	Himam Ayni	2	0.2	38	6	0.48	34
27	Febrile	Michi	144	14.23	1	173	13.70	1
28	Fever	Tikusat	1	0.1	48	1	0.08	56
29	Fire burn	Hawi Zitkatsele	8	0.79	20	10	0.79	26
30	Fleas	Kunicha	25	2.47	11	14	1.11	18
31	Fracture	Gimay	-	-	-	12	0.95	21
32	Ganen	Seitan	-	-	-	8	0.63	28
32	General health problem	Midham/ Teklala Himam	2	0.2	38	-	-	-
34	Gonorrhea	Fentata	1	0.1	48	1	0.08	56
35	Gum bleeding	Midmay Didi	1	0.1	48	-	-	-
36	Hang nil	Tsifre Metmt	3	0.03	35	7	0.55	30
37	Head ache	Merzen	41	4.05	7	40	3.17	8
38	Heart disease	Diham libi	2	0.2	38	-	-	-
39	Hemorrhoids	Kintarot	5	0.49	26	2	0.16	51
40	Herpes zoster	Almaz balechira	-	-	-	3	0.24	47
41	House fly on the wound	Hamema	6	0.59	23	11	0.87	23
42	Hypertension	Dem bezhi	-	-	-	6	0.48	34

No.	Human ailment	Local name	No	%	R	No	%	R
43	Itchy	Hafow	9	0.89	18	12	0.95	21
44	Jaundice	Ef-Shiwa	8	0.79	20	23	1.82	14
45	Louse	Kumal	9	0.89	18	18	1.43	15
46	Low appetite	Migbi Mikinas	1	0.1	48	5	0.40	38
47	Malaria	Aso	5	0.50	26	4	0.32	43
48	Nephritis	Himam Hulit	1	0.1	48	1	0.1	48
49	Paralyze	Gusay	5	0.50	26	1	0.08	56
50	Pimple	Fetsega	3	0.3	35	4	0.32	43
51	Polio	Lemsi	2	0.2	38	7	0.55	30
52	Rabies	Himam ewud Kelbi	2	0.2	38	2	0.2	38
53	Rat killer	Enchiwa Mekteli	19	1.88	13	18	1.43	15
54	Ring worm	Tefsas	46	4.55	6	42	3.33	7
55	Scar	Milkt kusli	2	0.2	38	2	0.16	51
56	Scorpion poisons	Merzi Tinkrbiet	1	0.1	48	3	0.24	47
57	Snake prevention	Mekelakeli teben	-	-	-	5	0.40	38
58	Snake venom	Merzi Teben	4	0.4	31	23	1.82	12
59	Spine /thorn	Eshoh	31	3.06	10	18	1.43	15
60	Stress	Chinket	5	0.49	26	-	-	-
61	Swelling	Hibtet	2	0.2	38	4	0.32	43
62	Tape worm	Habi /Koso	20	1.98	12	16	1.27	17
63	Tendency of vomiting	Ewulwul	6	0.59	23	-	-	-
64	Termites	Filho	-	-	-	1	0.08	56
75	Tinia scaplis	Qukusha	5	0.50	26	27	2.14	11
66	Tonsillitis	Hanat	107	10.57	3	109	8.63	4
67	Tooth infection/pain	HimamiKurmti	38	3.76	9	34	2.69	10
68	Troma	Finkat	6	0.59	23	14	1.11	18
69	Ulcer (Gastric)	Chegora	2	0.2	38	8	0.63	28
70	Urine retention	Tsegem shinti may	-	-	-	11	0.87	23
71	Vitiligo	Lemsti	-	-	-	7	0.55	30
72	Vomiting	Tif-At	1	0.1	48	1	0.08	56
73	Wart	Tub Adgi	1	0.1	48	1	0.08	56
74	Womb infection	Himam mahtsen	1	0.1	48	-	-	-
75	Wound	Kusli	134	13.24	2	153	11.93	2
			1010			**1282**		

Appendix 17 Informant consensus of medicinal plants treating livestock ailments

(One informant mentioned more than two medicinal plants)

Scientific name	Erob District			Gulomahda District		
	No. of informants	**%**	**Rank**	**No. of informants**	**%**	Rank
Acacia etbaica	12	4.90	3	13	3.23	7
Acacia origena	1	0.41	17	2	0.50	24
Achyranthes aspera	3	1.22	9	3	0.75	21
Aloe elegans	5	2.04	8	3	0.75	21
Aloe macrocarpa	1	0.41	17	1	0.25	27
Asparagus africanus	1	0.41	17	-	-	-
Calpurnia aurea	1	0.41	17	17	4.22	5
Carissa spinarum	3	1.22	9	4	0.99	18
Croton macrostachyus	1	0.41	17	-	-	-
Datura stramonium	7	2.86	5	-	-	-
Euphorbia abyssinica	3	1.22	9	-	-	-
Foeniculum vulgare	-	-	-	11	2.72	10
Hordeum vulgare	2	0.82	14	-	-	-
Hypoestes forskaolii	3	1.22	9	-	-	-
Justicia schimperiana	1	0.41	17	4	0.99	18
Kalanchoe marmorata	3	1.22	9	-	-	-
Kalanchoe laciniata	-	-	-	1	0.25	27
Laggera tomentosa	1	0.41	17	12	2.98	8
Leucas abyssinica	-	-	-	24	5.96	4
Linum usitatissimum	-	-	-	5	1.24	15
Lobelia giberroa	-	-	-	2	0.50	24
Lycopersicon esculentum	-	-	-	11	2.72	10
Maytenus senegalensis	-	-	-	12	2.98	8
Meriandra dianthera	6	2.45	6	14	3.47	6
Myrica salicifolia	-	-	-	10	2.48	13
Nicotiana glauca	82	33.47	2	93	23.08	1
Nicotiana tabacum	91	37.14	1	93	23.08	1
Otostegia integrifolia	-	-	-	29	7.16	3
Otostegia minucii	2	0.82	14	-	-	-
Pollichia campestris	-	-	-	1	0.25	27
Ru*mex nepalensis*	-	-	-	11	2.72	10
Rumex nervosus	6	2.45	6	5	1.24	15
Sideroxylon oxyacanthum	-	-	-	4	0.99	18
Solanum adoense	2	0.82	14	-	-	-
Solanum incanum	-	-	-	3	0.75	21
Tarchonanthus camphoratus	8	3.27	4	5	1.24	15
Vernonia rueppellii	-	-	-	8	1.99	14
Withania somnifera	-	-	-	2	0.50	24
Total	**245**	**100**		**403**	**100**	**-**

Appendix 18 Informant consensus of all medicinal plants

(One informant mentioned more than two medicinal plants)

Scientific name	Erob District			Gulomahda District		
	No. of informants	%	Rank	No. of informants	%	Rank
Acacia etbaica	50	2.29	10	46	2.51	9
Acacia origena	1	0.07	72	7	0.38	57
Achyranthes aspera	91	5.98	2	79	4.31	5
Allium sativum	28	1.84	20	39	2.13	14
Aloe elegans	29	1.91	19	13	0.71	42
Aloe macrocarpa	3	0.20	55	8	0.44	55
Argemone mexicana	104	6.83	1	110	6.00	1
Artemisia absinthium	-	-	-	2	0.11	82
Asparagus africanus	1	0.07	72	-	-	-
Becium grandiflorum	7	4.60	40	11	0.60	48
Beta vulgaris	-	-	-	1	0.06	91
Brassica nigra	-	-	-	5	0.27	67
Buddleja polystachya	-	-	-	22	1.20	24
Calotropis procera	4	0.26	47	5	0.27	67
Calpurnia aurea	1	0.07	72	18	0.98	29
Capparis micrantha	12	0.79	31	-	-	-
Capsicum annum	1	0.07	72	-	-	-
Capsicum frutescens	1	0.07	72	-	-	-
Carica papaya	9	0.59	33	9	0.49	53
Carissa spinarum	26	1.71	21	21	1.15	25
Chenopodium ambrosioides	2	0.13	62	1	0.06	91
Citrus aurantifolia	4	0.26	47	4	0.22	75
Clutia abyssinica	4	0.26	47	12	0.66	45
Coffea arabica	9	0.59	33	26	1.42	19
Commicarpus plumbagineus	-	-	-	10	0.55	50
Cordia africana	35	2.30	16	32	1.75	17
Coronopus didymus	1	0.07	72	-	-	-
Crinum ornatum	-	-	-	2	0.11	82
Croton macrostachyus	1	0.07	72	13	0.71	42
Cucumis ficifolius	-	-	-	2	0.11	82
Cucurbita pepo	17	1.12	27	1	0.06	91
Cynoglossum lanceolatum	87	5.72	4	106	5.78	2
Cyphostemma cyphopetalum	2	0.13	62	6	0.33	63
Datura stramonium	16	1.05	28	20	1.09	26
Dodonaea angustifolia	14	0.92	29	14	0.76	40
Dovyalis abyssinica	2	0.13	62	-	-	-
Echinops pappii Chiov.	1	0.07	72	-	-	-
Emex spinosa	-	-	-	1	0.06	91
Eragrostis tef	-	-	-	1	0.06	91
Eucalyptus camaldulensis	-	-	-	1	0.06	91
Eucalyptus globulus	26	1.71	21	25	1.36	22
Euclea racemosa	-	-	-	11	0.60	48
Euphorbia abyssinica	36	2.37	15	17	0.93	31
Euphorbia polyacantha	33	2.17	17	12	0.66	45
Euphorbia tirucalli	-	-	-	2	0.16	82

Scientific name	No. of informants	%	Rank	No. of informants	%	Rank
Ficus ingens	-	-	-	3	0.16	80
Ficus palmata	4	0.26	47	2	0.11	82
Foeniculum vulgare	-	-	-	13	0.71	42
Gomphocarpus fruticosus	-	-	-	5	0.27	67
Gossypium hirsutum	-	-	-	6	0.33	63
Heliotropium cinerascens	2	0.13	62	-	-	-
Hordeum vulgare	43	2.83	14	34	1.87	16
Hypoestes forskaolii	6	0.39	42	17	0.93	31
Indigofera amorphoide	1	0.07	72	-	-	-
Indigofera vicioides	8	0.53	37	19	1.04	29
Juniperus procera	6	0.39	42	4	0.22	75
Justicia schimperiana	4	0.26	47	17	0.93	31
Kalanchoe marmorata	7	0.46	40	-	-	-
Kalanchoe laciniata	-	-	-	2	0.11	82
Lactuca sativa	-	-	-	1	0.06	91
Lagenaria siceraria	-	-	-	2	0.11	82
Laggera tomentosa	3	0.20	55	15	0.82	37
Lepidium sativum	-	-	-	16	0.87	35
Leptadenia arborea	1	0.07	72	-	-	-
Leucas abyssinica	-	-	-	24	1.31	23
Leucas martinicensis	9	0.59	33	1	0.06	91
Linum usitatissimum	21	1.38	24	40	2.18	12
Lobelia giberroa	-	-	-	2	0.11	82
Lycopersicon esculentum	45	2.96	12	26	1.42	21
Malva parviflora	2	0.13	62	-	-	-
Maytenus arbutifolia	2	0.13	62	18	0.96	29
Maytenus senegalensis	1	0.07	72	16	0.87	35
Melia azedarach	6	0.39	42	10	0.55	50
Mentha longifolia	1	0.07	72	-	-	-
Mentha spicata	5	0.33	46	-	-	-
Meriandra dianthera	12	0.79	31	26	1.42	21
Myrica salicifolia	-	-	-	10	0.55	50
Nicotiana glauca	82	5.39	5	93	5.07	3
Nicotiana tabacum	91	5.98	2	93	5.07	3
Ocimum basilicum	8	0.53	37	-	-	-
Ocimum lamiifolium	20	0.13	26	20	1.09	26
Olea europaea subsp. *Cuspidata*	53	3.48	9	42	2.29	11
Opuntias ficus-indica	2	1.13	62	-	-	-
Otostegia integrifolia	24	1.58	23	29	1.58	18
Otostegia minucii	2	0.13	62	-	-	-
Plectranthus ornatus	-	-	-	1	0.06	91
Phytolacca dodecandra	-	-	-	1	0.06	91
Pollichia campestris	2	0.13	62	3	0.16	80
Prunus persica	21	1.38	24	14	0.76	40
Psiadia punctulata	2	0.13	62	7	0.38	57
Psidium guajava	-	-	-	3	0.16	80
Rhamnus prinoides	64	4.21	6	40	2.18	13
Ricinus communis	-	-	-	7	0.38	57
Rosa abyssinica	3	0.20	55	5	0.82	67

Scientific name	No. of informants	%	Rank	No. of informants	%	Rank
Rumex abyssinicus	-	-	-	5	0.82	67
R*umex nepalensis*	1	0.07	72	15	0.82	37
Rumex nervosus	9	0.59	33	15	0.82	37
Ruta chalepensis	62	4.08	7	69	3.76	7
Schinus molle	44	2.89	13	75	4.09	6
Sida schimperiana	-	-	-	12	0.66	45
Sideroxylon oxyacanthum	-	-	-	4	0.22	75
Solanum adoense	3	0.20	55	5	0.28	67
Solanum incanum	-	-	-	6	0.33	63
Solanum schimperianum	14	0.92	29	17	0.93	31
Solanum villosum	4	0.26	47	-	-	-
Tagetes minuta	2	0.13	62	7	0.38	57
Taraxacum sp. agg.	3	0.20	55	-	-	-
Tarchonanthus camphoratus	8	0.53	37	5	0.28	67
Trigonella foenum-graecum	4	0.26	47	7	0.38	57
Triticum aestivum	-	-	-	1	0.06	91
Urtica simensis	-	-	-	1	0.06	91
Verbena officinalis	56	3.68	8	45	2.46	10
Vernonia amygdalina.	-	-	-	4	0.22	75
Vernonia rueppellii	-	-	-	9	0.49	55
Vicia faba	-	-	-	5	0.28	67
Vitis vinifera	3	0.20	55	4	0.22	75
Withania somnifera	47	3.09	11	64	3.49	8
Xanthium strumarium	1	0.07	72	5	0.28	67
Zehneria scabra	4	0.26	47	7	0.38	57
Zingiber officinale	6	0.39	42	8	0.44	55
Ziziphus mauritiana	30	1.97	18	35	1.91	15
Total	1522	100	-	1833	100	-

Appendix 19 Fidelity level of each medicinal plant for being used against a given ailment

(Ailment treated by the plant species was selected based on high citation by the informants)

Scientific name	Example of ailment	Erob District					Gulomahda District				
		I_p	I_u	FL	%	R	I_p	I_u	FL	%	R
Acacia etbaica	Ring worm	44	50	0.74	74	66	41	46	0.89	89	59
Acacia origena	Itchy	1	1	1.00	100	1	4	7	0.57	57	56
Achyranthes aspera	Tonsillitis	91	91	1.00	100	1	73	79	0.92	92	58
Allium sativum	Troma	16	28	0.57	57	76	20	39	0.51	51	88
Aloe elegans	House flies feeding on wound	12	29	0.41	41	80	11	13	0.85	85	60
Aloe macrocarpa	Jaundice	2	3	0.67	67	67	5	8	0.63	63	79
Argemone mexicana	Wound	104	104	1.00	100	1	110	110	1.00	100	1
Artemisia absinthium	Tooth infection	-	-	-	-	-	2	2	1.00	100	1
Asparagus africanus	Urine retention	1	1	1/00	100	1	-	-	-	-	-
Becium grandiflorum	Fire burn	7	7	1.00	100	1	11	11	1.00	100	1
Beta vulgaris	Anemia	-	-	-	-	-	1	1	1.00	100	1
Brassica nigra	Cancer	-	-	-	-	-	3	5	0.60	60	81
Buddleja polystachya	Leech	-	-	-	-	-	13	22	0.59	59	85
Calotropis procera	Wound	4	4	1.00	100	1	4	5	0.80	80	65
Calpurnia aurea	Ext. parasite	1	1	0.33	33	81	13	18	0.72	72	77
Capparis micrantha	Tooth infection	8	12	0.67	67	67	-	-	-	-	-
Capsicum annum	Gut parasite	1	1	1.00	100	1	-	-	-	-	-
Capsicum frutescens	Abdominal pain	1	1	1.00	100	1	-	-	-	-	-
Carica papaya	Gut parasite	9	9	1.00	100	1	9	9	1.00	100	1
Carissa spinarum	Thorn	22	26	0/85	85	61	16	21	0.76	76	74
Chenopodium ambrosioides	Wound	2	2	1.00	100	1	1	1	1.00	100	1
Citrus aurantifolia	Pimple	4	4	1.00	100	1	4	4	1.00	100	1
Clutia abyssinica	Tinia scaplis	3	4	0.75	75	65	5	12	0.42	42	74
Coffea arabica	Wound	8	9	0.89	89	59	22	26	0.85	85	60
Commicarpus plumbagineus	Snack venom	-	-	-	-	-	10	10	1.00	100	1
Cordia africana	Febrile (Michi)	35	35	1.00	100	1	32	32	1.00	100	1
Coronopus didymus	Wound	1	1	1.00	100	1	-	-	-	-	-
Crinum ornatum	Tinia scaplis	-	-	-	-	-	2	2	1.00	100	1
Croton macrostachyus	Jaundice	1	1	1.00	100	1	9	13	0.69	69	78
Cucumis ficifolius	Abdominal pain	-	-	-	-	-	2	2	1.00	100	1
Cucurbita pepo	Tapeworm	17	17	1.00	100	1	1	1	1.00	100	1
Cynoglossum lanceolatum	Febrile (Michi)	85	87	0.98	98	52	105	106	0.99	99	49
Cyphostemma cyphopetalum	Snack venom	2	2	1.00	100	1	6	6	1.00	100	1
Datura stramonium	Wound	15	16	0.94	94	58	17	20	0.85	85	60
Dodonaea angustifolia	Arthritis	9	14	0.64	64	73	11	14	0.79	79	71
Dovyalis abyssinica	Evil eye	2	2	1.00	100	1	-	-	-	-	-
Echinops pappii Chiov.	Tinia scaplis	1	1	1.00	100	1	-	-	-	-	-
Emex spinosa	Snake Venom	-	-	-	-	-	1	2	0.50	50	89
Eragrostis tef	Cough	-	-	-	-	-	1	1	1.00	100	1
Eucalyptus camaldulensis	Febrile (Michi)	-	-	-	-	-	1	1	1.00	100	1
Eucalyptus globulus	Febrile (Michi)	26	26	1.00	100	1	25	25	1.00	100	1
Euclea racemosa	Snack venom	-	-	-	-	-	5	11	0.46	46	94
Euphorbia abyssinica	Swelling	32	36	0.89	89	59	16	17	0.94	94	54

Scientific name	Example of ailment	I_p	I_u	FL	%	R	I_p	I_u	FL	%	R
Euphorbia polyacantha	Rat killer	19	33	0.58	58	75	10	12	0.83	83	64
Euphorbia tirucalli	Hemorrhoids	-	-	-	-	-	2	2	1.00	100	1
Ficus ingens	Delay of upright	-	-	-	-	-	3	3	1.00	100	1
Ficus palmata	Hemorrhoids	4	4	1.00	100	1	-	-	-	-	-
Foeniculum vulgare	Urine retention	-	-	-	-	-	8	13	0.62	62	80
Gomphocarpus fruticosus	Swelling	-	-	-	-	-	4	5	0.80	80	65
Gossypium hirsutum	Snake venom	-	-	-	-	-	6	6	1.00	100	1
Heliotropium cinerascens	Wound	2	2	1.00	100	1	-	-	-	-	-
Hordeum vulgare	Head ache/Fever	42	43	0.98	98	52	32	34	0.94	94	54
Hypoestes forskaolii	Evil eye	4	6	0.67	67	67	7	17	0.41	41	97
Indigofera amorphoides	Abdominal pain	1	1	1.00	100	1	-	-	-	-	-
Indigofera vicioides	Abdominal pain	8	8	1.00	100	1	19	19	1.00	100	1
Juniperus procera	Dandruff	5	6	0.83	83	63	3	4	0.75	75	75
Justicia schimperiana	Jaundice	1	4	0.25	25	84	16	17	0.94	94	54
Kalanchoe marmorata	General health problem	2	7	0.29	29	83		-	-	-	-
Kalanchoe laciniata	Allergic dermites	-	-	-	-	-	1	2	0,50	50	89
Lactuca sativa	Anemia	-	-	-	-	-	1	1	1.00	100	1
Lagenaria siceraria	Wound	-	-	-	-	-	2	2	1.00	100	1
Laggera tomentosa	Fibrile (Michi)	2	3	0.67	67	67	12	15	0.80	80	65
Lepidium sativum	Tonsillitis	-	-	-	-		5	16	0.31	31	99
Leptadenia arborea	Cutaneous leshimeniasis	1	1	1.00	100	1	-	-	-	-	-
Leucas abyssinica	Cough (Live stock)	-	-	-	-	-	19	24	0.79	79	71
Leucas martinicensis	Febrile	9	9	1.00	100	1	1	1	1.00	100	1
Linum usitatissimum	Constipation	20	21	0.95	95	56	37	40	0.93	93	57
Lobelia giberroa	Swelling	-	-	-	-	-	2	2	1.00	100	1
Lycopersicon esculentum	Cut	37	45	0.82	82	64	26	26	1.00	100	1
Malva parviflora	Hang nil	2	2	1.00	100	1	-	-	-	-	-
Maytenus arbutifolia	Arthritis	2	2	1.00	100	1	18	18	1.00	100	1
Maytenus senegalensis	Diarrhea	1	1	1.00	100	1	7	16	0.44	44	95
Melia azedarach	Abortion	4	6	0.67	67	67	8	10	0.80	80	65
Mentha longifolia	Tooth infection	1	1	1.00	100	1	-	-	-	-	-
Mentha spicata	Stress	5	5	1.00	100	1	-	-	-	-	-
Meriandra dianthera	Tendency of vomiting	6	12	0.50	50	78	8	26	0.31	31	99
Myrica salicifolia	Nose cancer	-	-	-	-	-	10	10	1.00	100	1
Nicotiana glauca	Itchy	49	82	0.60	60	74	27	93	0.29	29	101
Nicotiana tabacum	Leech	91	91	1.00	100	1	93	93	1.00	100	1
Ocimum basilicum	Wound	8	8	1.00	100	1	-	-	-	-	-
Ocimum lamiifolium	Febrile (Michi)	20	20	1.00	100	1	20	20	1.00	100	1
Olea europaea	Tooth infection	26	53	0.49	49	79	25	42	0.60	60	81
Opuntia ficus-indica	Snack venom	2	2	1/00	100	1	-	-	-	-	-
Otostegia integrifolia	Flees	24	24	1.00	100	1	28	29	0.97	97	51
Otostegia minucii	Louse	2	2	1.00	100	1	-	-	-	-	-
Phytolacca dodecandra	Abortion	-	-	-	-	-	1	1	1.00	100	1
Plectranthus ornatus	Evil eye	-	-	-	-	-	1	1	1.00	100	1

Scientific name	Example of ailment	I_p	I_u	FL	%	R	I_p	I_u	FL	%	R
Pollichia campestris	Tooth infection	2	2	1.00	100	1	3	3	1.00	100	1
Prunus persica	Tonsillitis	20	21	0.95	95	56	14	14	1.00	100	1
Psiadia punctulata	Damaged joint	2	2	1.00	100	1	7	7	1.00	100	1
Psidium guajava	Ulcer	-	-	-	-	-	3	3	1.00	100	1
Rhamnus prinoides	Tonsillitis	64	64	1.00	100	1	40	40	1/00	100	1
Ricinus communis	Wound	-	-	-	-	-	7	7	1.00	100	1
Rosa abyssinica	Vitiligo	3	3	1.00	100	1	5	5	1.00	100	1
Rumex abyssinicus	Eye disease	-	-	-	-	-	5	5	1.00	100	1
Ru*mex nepalensis*	Tinia scaplis	1	1	1.00	100	1	12	15	0.80	80	65
Rumex nervosus	Dandruff	2	9	0.22	22	85	12	15	0.80	80	65
Ruta chalepensis	Cough	61	62	0.98	98	52	68	69	0.99	99	49
Schinus molle	Abdominal pain	37	44	0.84	84	62	72	75	0/96	96	52
Sida schimperiana	Fracture	-	-	-	-	-	6	12	0.50	50	89
Sideroxylon oxyacanthum	Leech	-	-	-	-	-	1	4	0.25	25	102
Solanum adoense	Rabies	2	3	0.67	67	67	3	5	0.60	60	81
Solanum incanum	Tooth infection	-	-	-	-	-	3	6	0.50	50	89
Solanum schimperianum	Abdominal pain	6	14	0.57	57	76	6	17	0.35	35	97
Solanum villosum	Wound	4	4	1.00	100	1	-	-	-	-	-
Tagetes minuta	Tinia scaplis	2	2	1.00	100	1	7	7	1.00	100	1
Taraxacum sp. agg.	Tooth infection	1	3	0.33	33	81	-	-	-	-	-
Tarchonanthus camphoratus	Cough	8	8	1.00	100	1	5	5	1.00	100	1
Trigonella foenum-graecum	Abdominal pain	4	4	1.00	100	1	7	7	1,00	100	1
Triticum aestivum	Cough	-	-	-	-	-	1	1	1,00	100	1
Urtica simensis	Scorpion bit	-	-	-	-	-	1	1	1,00	100	1
Verbena officinalis	Abdominal pain	56	56	1.00	100	1	38	45	0.84	84	63
Vernonia amygdalina.	Abdominal pain	-	-	-	-	-	3	4	0.75	75	75
Vernonia rueppellii	Neck swelling	-	-	-	-	-	7	9	0.70	78	73
Vicia faba	Cancer	-	-	-	-	-	3	5	0.60	60	81
Vitis vinifera	Hangnail	3	3	1.00	100	1	4	4	1.00	100	1
Withania somnifera	Febrile (Michi)	45	47	0.96	96	55	61	64	0.95	95	53
Xanthium strumarium	Tinia scaplis	1	1	1.00	100	1	5	5	1.00	100	1
Zehneria scabra	Febrile	4	4	1.00	100	1	4	7	0.57	57	86
Zingiber officinale	Tooth infection	6	6	1.00	100	1	8	8	1.00	100	1
Ziziphus mauritiana.	Dandruff	30	30	1.00	100	1	35	35	1.00	100	1

Appendix 20 UV of medicinal plants in Erob and Gulomahda districts

Scientific name	Erob District				Gulomahda District			
	ΣUi	n	UV	R	ΣUi	n	UV	R
Acacia etbaica	184	50	3.68	7	171	46	3.72	7
Acacia origena	3	1	3.00	12	22	7	3.14	12
Achyranthes aspera	94	91	1.03	58	92	79	1.17	11
Allium sativum	72	28	2.57	15	89	39	2.28	32
Aloe elegans	36	29	1.24	52	23	13	1.77	53
Aloe macrocarpa	3	3	1.00	59	8	8	1.00	81
Argemone mexicana	135	104	1.30	50	143	110	1.30	67
Artemisia absinthium	-	-	-	-	2	2	1.00	81
Asparagus africanus	1	1	1.00	59	-	-	-	-
Becium grandiflorum	18	7	2.57	15	32	11	2.91	18
Beta vulgaris	-	-	-	-	2	1	2.00	39
Brassica nigra	-	-	-	-	9	5	1.80	51
Buddleja polystachya	-	-	-	-	29	22	1.32	64
Calotropis procera	7	4	1.75	43	11	5	2.20	33
Calpurnia aurea	2	1	2.00	31	46	18	2.56	26
Capparis micrantha	13	12	1.08	55	-	-	-	-
Capsicum annum	2	1	2.00	31	-	-	-	-
Capsicum frutescens	1	1	1.00	59	-	-	-	-
Carica papaya	17	9	1.89	41	18	9	2.00	39
Carissa spinarum	102	26	3.92	4	79	21	3.76	3
Chenopodium ambrosioides	2	2	1.00	59	1	1	1.00	81
Citrus aurantifolia	7	4	1.75	43	8	4	2.00	39
Clutia abyssinica	6	4	1.50	46	13	12	1.08	73
Coffea arabica	20	9	2.22	25	60	26	2.31	30
Commicarpus plumbagineus	-	-	-	-	10	10	1.00	81
Cordia africana	163	35	4.66	1	130	32	4.06	2
Coronopus didymus	1	1	1.00	59	-	-	-	-
Crinum ornatum	-	-	-	-	2	2	1.00	81
Croton macrostachyus	2	1	2.00	31	2a9	13	2.30	31
Cucumis ficifolius	-	-	-	-	3	2	1.50	60
Cucurbita pepo	33	17	1.94	39	2	1	2.00	39
Cynoglossum lanceolatum	87	87	1.00	59	113	106	1.07	77
Cyphostemma cyphopetalum	2	2	1.00	59	6	6	1.00	81
Datura stramonium	24	16	1.50	46	20	20	1.00	81
Dodonaea angustifolia	44	14	3.14	11	37	14	2.64	25
Dovyalis abyssinica	2	2	1.00	59	-	-	-	-
Echinops pappii	1	1	1.00	59	-	-	-	
Emex spinosa	-	-	-	-	1	1	1.00	81
Eragrostis tef	-	-	-	-	1	1	1.00	81
Eucalyptus camaldulensis	-	-	-	-	3	1	3.00	13
Eucalyptus globulus	89	26	3.42	8	91	25	3.64	7
Euclea racemosa	-	-	-	-	26	11	2.36	29
Euphorbia abyssinica	82	36	2.28	34	64	17	3.76	3
Euphorbia polyacantha	40	33	1.21	53	16	12	1.33	63
Euphorbia tirucalli	-	-	-	-	6	2	3.00	13
Ficus ingens	-	-	-	-	10	3	3.33	9

Scientific name	ΣUi	n	UV	R	ΣUi	n	UV	R
Ficus palmata	8	4	2.00	31	6	2	3.00	13
Foeniculum vulgare	-	-	-	-	15	13	1.15	70
Gomphocarpus fruticosus	-	-	-	-	5	5	1.00	81
Gossypium hirsutum	-	-	-	-	10	6	1.67	57
Heliotropium cinerascens	2	2	1.00	59	-	-	-	-
Hordeum vulgare	159	43	3.70	6	94	34	2.77	21
Hypoestes forskaolii	13	6	2.17	28	18	17	1.06	78
Indigofera amorphoide	1	1	1.00	59	-	-	-	-
Indigofera vicioides	8	8	1.00	59	25	19	1.32	64
Juniperus procera	19	6	3.19	9	15	4	3.75	5
Justicia schimperiana	8	4	2.00	31	32	17	1.88	50
Kalanchoe marmorata	7	7	1.00	59	-	-	-	-
Kalanchoe laciniata	-	-	-	-	2	2	1.00	81
Lactuca sativa	-	-	-	-	2	1	2.00	39
Lagenaria siceraria	-	-	-	-	4	2	2.00	39
Laggera tomentosa	3	3	1.00	59	15	15	1.00	81
Lepidium sativum	-	-	-	-	21	16	1.31	66
Leptadenia arborea	1	1	1.00	59	-	-	-	
Leucas abyssinica	-	-	-	-	26	24	1.08	73
Leucas martinicensis	9	9	1.00	59	1	1	1.00	81
Linum usitatissimum	58	21	2.76	14	83	40	2.08	37
Lobelia giberroa	-	-	-	-	3	2	1.50	60
Lycopersicon esculentum	103	45	2.29	33	56	26	2.15	34
Malva parviflora	2	2	1.00	59	-	-	-	
Maytenus arbutifolia	8	2	4.00	3	57	18	3.17	11
Maytenus senegalensis	5	2	2.50	17	43	15	2.87	20
Melia azedarach	19	6	3.17	10	29	10	2.90	19
Mentha longifolia	2	1	2.00	31	-	-	-	-
Mentha spicata	9	5	1.80	42	-	-	-	-
Meriandra dianthera	21	12	1.75	43	28	26	1.08	73
Myrica salicifolia	-	-	-	-	20	10	2.00	39
Nicotiana glauca	93	82	1.13	54	103	93	1.11	72
Nicotina tabacum	95	91	1.04	57	96	93	1.03	79
Ocimum basilicum	16	8	2.00	31	-	-	-	-
Ocimum lamiifolium	20	20	1.00	59	20	20	1.00	81
Olea europaea	232	53	4.38	2	171	42	4.07	1
Opuntia ficus-indica	6	2	3.00	12	-	-	-	-
Otostegia integrifolia	58	24	2.42	19	73	29	2.52	27
Otostegia minucii	3	2	1.50	46	-	-	-	-
Plectranthus ornatus	-	-	-	-	1	1	1.00	81
Phytolacca dodecandra	-	-	-	-	2	1	2.00	39
Pollichia campestris	2	2	1.00	59	3	3	1.00	81
Prunus persica	44	21	2.10	30	27	14	1.93	49
Psiadia punctulata	2	2	1.00	59	7	7	1.00	81
Psidium guajava	-	-	-	-	5	3	1.67	57
Rhamnus prinoides	158	64	2.47	18	109	40	2.73	23
Ricinus communis	-	-	-	-	14	7	2.00	39
Rosa abyssinica	7	3	2.33	20	16	5	3.20	10
Rumex abyssinicus	-	-	-	-	7	5	1.40	62

Scientific name	ΣUi	n	UV	R	ΣUi	n	UV	R
Ru*mex nepalensis*	1	1	1.00	59	15	15	1.00	81
Rumex nervosus	19	9	2.11	29	44	15	2.93	17
Ruta chalepensis	120	62	1.94	39	143	69	2.07	38
Schinus molle	102	44	2.32	22	181	75	2.41	28
Sida schimperiana	-	-	-	-	32	12	2.67	24
Sideroxylon oxyacanthum	-	-	-	-	7	4	1.75	54
Solanum adoense	3	3	1.00	59	6	5	1.20	68
Solanum incanum	-	-	-	-	6	6	1.00	81
Solanum schimperianum	31	14	2.21	27	26	17	1.53	59
Solanum villosum	6	4	1.50	46	-	-	-	
Tagetes minuta	2	2	1.00	59	7	7	1.00	81
Taraxacum sp. agg.	3	3	1.00	59	-	-	-	-
Tarchonanthus camphoratus	16	8	2.00	31	10	5	2.00	39
Trigonella foenum-graecum	5	4	1.25	51	12	7	1.71	56
Triticum aestivum	-	-	-	-	3	1	3.00	13
Urtica simensis	-	-	-	-	1	1	1.00	81
Verbena officinalis	56	56	1.00	59	46	45	1.02	80
Vernonia amygdalina.	-	-	-	-	7	4	1.75	54
Vernonia rueppellii	-	-	-	-	19	9	2.11	36
Vicia faba	-	-	-	-	9	5	1.80	51
Vitis vinifera	7	3	2.33	20	11	4	2.75	22
Withania somnifera	50	47	1.06	56	69	64	1.08	76
Xanthium strumarium	1	1	1.00	59	5	5	1.00	81
Zehneria scabra	4	4	1.00	59	8	7	1.14	71
Zingiber officinale	12	6	2.22	25	17	8	2.13	35
Ziziphus mauritiana	113	30	3.77	5	122	35	3.49	8

Appendix 21 Ranking of individual medicinal plant species using relative importance in Erob District

(M = Medicine, F =Fuel, C= Construction, Fd =Food, Br = Broom and tooth brush, O = Ornament, E= Equipment, Fum = Fumigation, Or = Others such as shade, food making, cloth, NUCS = Number of use-categories of a given species, NUCVS = Total number of use-categories of the most versatile species, NUC= Number of use-categories, NTS = Number of types of uses attributed to a given species, NTMIT = Total number of types of uses attributed to the most important taxon, NT = Number of types of uses, RI = Relative Importance, R = Rank)

Plant species	**Use categories and number of use types of each spp.**									**NUCS**	**NUC VS**	**NUC**	**NTS**	**NTM IT**	**NT**	**RI**	**R**
	M	**F**	**C**	**Fd**	**Br**	**O**	**E**	**Fum**	**Or**								
Acacia etbaica	2	2	2	1	-	-	2	-	1	6	8	0.75	10	14	0.71	1.46	3
Acacia origena	2	1	1	1	-	-	-	-	-	4	8	0.50	5	14	0.36	0.86	16
Achyranthes aspera	3	-	-	-	1	-	-	-	-	2	8	0.25	4	14	0.29	0.54	41
Allium sativum	3	-	-	2	-	-	-	-	-	2	8	0.25	5	14	0.36	0.61	33
Aloe elegans	7	1	-	2	-	-	-	-	-	3	8	0.38	10	14	0.71	1.09	5
Aloe macrocarpa	2	1	-	-	-	-	-	-	-	2	8	0.25	3	14	0.21	0.46	45
Argemone mexicana	2	-	-	-	-	-	-	-	1	2	8	0.25	3	14	0.21	0.46	45
Asparagus africanus	1	-	-	-	-	-	-	-	-	1	8	0.13	1	14	0.07	0.20	74
Becium grandiflorum	1	1	-	1	-	-	-	-	-	3	8	0.38	3	14	0.21	0.59	38
Calotropis procera	3	1	-	-	-	-	-	-	-	2	8	0.25	6	14	0.43	0.60	37
Calpurnia aurea	3	1	1	-	-	-	2	-	-	4	8	0.50	8	14	0.57	0.97	9
Capparis micrantha	1	1	-	-	-	-	-	-	-	2	8	0.25	3	14	0.21	0.46	45
Capsicum annum	1	-	-	1	-	-	-	-	-	2	8	0.25	2	14	0.15	0.40	55
Capsicum frutescens	1	-	-	1	-	-	-	-	-	2	8	0.25	2	14	0.15	0.40	55
Carica papaya	1	-	-	1	-	-	-	-	-	2	8	0.25	2	14	0.15	0.49	43
Carissa spinarum	2	1	1	2	-	-	-	-	-	4	8	0.50	7	14	0.50	1.00	8
Chenopodium ambrosioides	1	-	-	-	-	-	-	-	-	1	8	0.13	2	14	0.15	0.28	66
Citrus aurantifolia	1	-	1	1	-	-	-	-	-	3	8	0.38	5	14	0.36	0.74	23
Clutia abyssinica	2	1	-	-	-	-	-	-	-	2	8	0.25	3	14	0.21	0.46	45
Coffea arabica	1	1	-	1	-	-	-	-	-	3	8	0.38	4	14	0.29	0.67	27
Cordia africana	3	1	1	3	-	-	1	-	2	6	8	0.75	12	14	0.86	1.61	2
Coronopus didymus	2	-	-	-	-	-	-	-	-	1	8	0.13	3	14	0.21	0.34	62
Croton macrostachyus	2	1	1	-	-	-	-	-	1	4	8	0.50	4	14	0.29	0.79	21
Cucurbita pepo	1	-	1	-	-	-	-	-	-	2	8	0.25	2	14	0.15	0.40	55
Cynoglossum lanceolatum	3	-	-	-	-	-	-	-	-	1	8	0.13	4	14	0.29	0.42	53
Cyphostemma cyphopetalum	2	-	-	-	-	-	-	-	-	1	8	0.13	2	14	0.15	0.28	66
Datura stramonium	2	-	-	-	-	-	-	-	-	1	8	0.13	6	14	0.43	0.56	40
Dodonaea angustifolia	4	1	1		1	-	-	1	-	5	8	0.63	9	14	0.71	1.34	4

Plant species	Use categories and number of use types of each spp.									NUCS	NUC VS	NUC	NTS	NTM IT	NT	RI	R
	M	F	C	Fd	Br	O	E	Fum	Or								
Dovyalis abyssinica	1	-	-	-	-	-	-	-	-	1	8	0.13	1	14	0.07	0.20	74
Echinops pappii	1	-	-	-	-	-	-	-	-	1	8	0.13	1	14	0.07	0.20	74
Eucalyptus globulus	3	1	1	-	-	-	-	-	1	4	8	0.50	6	14	0.43	0.93	12
Euphorbia abyssinica	2	1	1	-	-	-	-	1	-	4	8	0.50	5	14	0.36	0.86	16
Euphorbia polyacantha	3	-	-	-	-	-	-	-	-	1	8	0.13	3	14	0.21	0.34	62
Ficus palmata	3	1	-	1	-	-	-	-	-	3	8	0.38	7	14	0.50	0.88	14
Heliotropium cinerascens	1	-	-	-	-	-	-	-	-	1	8	0.13	1	14	0.07	0.20	74
Hordeum vulgare	4	-	-	5	-	-	-	-	-	2	8	0.25	9	14	0.71	0.96	10
Hypoestes forskaolii	3	-	-	1	-	-	-	-	-	2	8	0.25	5	14	0.36	0.61	31
Indigofera amorphoide	1	-	-	-	-	-	-	-	-	1	8	0.13	1	14	0.07	0.20	74
Indigofera vicioides	2	1	1	-	-	-	-	-	-	3	8	0.38	4	14	0.29	0.67	27
Juniperus procera	2	2	1	-	-	-	-	-	1	4	8	0.50	6	14	0.43	0.93	12
Justicia schimperiana	2	1	-	-	-	-	-	-	-	2	8	0.25	4	14	0.29	0.54	41
Kalanchoe marmorata	2	-	-	-	-	-	-	-	-	1	8	0.13	2	14	0.15	0.28	66
Laggera tomentosa	2	-	-	-	-	-	-	-	-	1	8	0.13	2	14	0.15	0.28	66
Leptadenia arborea	1	-	-	-	-	-	-	-	-	1	8	0.13	1	14	0.07	0.20	74
Leucas martinicensis	1	-	-	-	-	-	-	-	-	1	8	0.13	1	14	0.07	0.20	74
Linum usitatissimum	2	-	-	1	-	-	1	-	1	4	8	0.50	5	14	0.36	0.86	16
Lycopersicon esculentum	2	-	-	4	-	-	-	-	-	2	8	0.25	6	14	0.43	0.68	26
Malva parviflora	1	-	-	-	-	-	-	-	-	1	8	0.13	1	14	0.07	0.20	74
Maytenus arbutifolia	1	1	1	1	-	-	-	-	-	4	8	0.50	4	14	0.29	0.79	21
Maytenus senegalensis	2	1	1	1	-	-	-	-	1	5	8	0.63	6	14	0.43	1.06	7
Melia azedarach	3	1	-	-	-	-	-	-	3	3	8	0.38	7	14	0.50	0.88	14
Mentha longifolia	1	-	-	-	-	1	-	-	-	2	8	0.25	2	14	0.15	0.40	55
Mentha spicata	1	-	-	1	-	-	-	-	-	2	8	0.25	2	14	0.15	0.40	55
Meriandra dianthera	5	-	-	1	-	-	-	-	-	2	8	0.25	8	14	0.57	0.82	20
Nicotiana glauca	4	1	-	-	-	-	-	-	-	2	8	0.25	5	14	0.36	0.61	33
Nicotina tabacum	1	-	-	-	-	-	-	-	-	1	8	0.13	1	14	0.07	0.20	74
Ocimum basilicum	1	-	-	1	-	-	-	-	-	2	8	0.25	2	14	0.15	0.40	55
Ocimum lamiifolium	1	-	-	-	-	-	-	-	-	1	8	0.13	1	14	0.07	0.20	74
Olea europaea	4	2	2	1	1	-	2	1	1	8	8	1.00	14	14	1.00	2.00	1
Opunia ficus-indica	1	-	2	2	-	-	-	-	-	3	8	0.38	5	14	0.36	0.67	27
Otostegia integrifolia	3	1	1	-	-	-	-	-	-	3	8	0.38	5	14	0.36	0.74	23
Otostegia minucii	1	-	-	-	-	-	-	-	-	1	8	0.13	1	14	0.07	0.20	74
Pollichia campestris	3	-	-	-	-	-	-	-	-	1	8	0.13	4	14	0.29	0.42	53
Prunus persica	1	1	-	1	-	-	-	-	-	3	8	0.38	3	14	0.21	0.59	38

Plant species	Use categories and number of use types of each spp.									NUCS	NUC VS	NUC	NTS	NTM IT	NT	RI	R
	M	F	C	Fd	Br	O	E	Fum	Or								
Psiadia punctulata	2	-	-	-	-	-	-	-	-	1	8	0.13	2	14	0.15	0.28	66
Rhamnus prinoides	1	-	-	2	1	-	-	-	-	3	8	0.38	4	14	0.29	0.67	27
Rosa abyssinica	2	-	1	1	-	-	-	-	-	3	8	0.38	4	14	0.29	0.67	27
Ru*mex nepalensis*	2	-	-	-	-	-	-	-	-	1	8	0.13	2	14	0.15	0.28	66
Rumex nervosus	3	1	-	1	-	-	-	-	-	3	8	0.38	5	14	0.36	0.74	23
Ruta chalepensis	2	-	-	3	-	-	-	-	-	2	8	0.25	5	14	0.36	0.61	33
Schinus molle	4	1	-	-	-	-	-	-	1	3	8	0.38	8	14	0.57	0.95	11
Solanum adoense	5	-	-	-	-	-	-	-	-	1	8	0.13	5	14	0.36	0.49	43
Solanum schimperianum	7	1	-	-	-	-	-	1	-	3	8	0.38	9	14	0.71	1.09	5
Solanum villosum	2	-	-	1	-	-	-	-	-	2	8	0.25	3	14	0.21	0.46	45
Tagetes minuta	2	-	-	-	-	-	-	-	-	1	8	0.13	2	14	0.15	0.28	66
Taraxacum sp. agg.	3	-	-	-	-	-	-	-	-	1	8	0.13	3	14	0.21	0.34	62
Tarchonanthus camphoratus	2	1	-	-	-	-	-	-	-	2	8	0.25	3	14	0.21	0.46	45
Trigonella foenum-graecum	1	-	-	1	-	-	-	-	-	2	8	0.25	2	14	0.15	0.40	55
Verbena officinalis	3	-	-	-	-	-	-	-	-	1	8	0.13	3	14	0.21	0.34	62
Vitis vinifera	1	-	-	2	-	-	-	-	1	3	8	0.38	4	14	0.29	0.67	27
Withania somnifera	2	1	-	-	-	-	-	-	-	2	8	0.25	3	14	0.21	0.46	45
Xanthium strumarium	1	-	-	-	-	-	-	-	-	1	8	0.13	1	14	0.07	0.20	74
Zehneria scabra	2	-	-	-	-	-	-	-	-	1	8	0.13	2	14	0.15	0.28	66
Zingiber officinale	1	-	-	2	-	-	-	-	-	2	8	0.25	3	14	0.21	0.46	45
Ziziphus mauritiana	1	1	1	2	-	-	-	-	-	4	8	0.50	5	14	0.36	0.86	16

Appendix 22 Ranking of individual medicinal plant species using relative importance in Gulomahda District

Plant species	**Use categories and number of use types of each species**									**NUCS**	**NUC VS**	**NUC**	**NTS**	**NTM IT**	**NT**	**RI**	**R**
	M	**F**	**C**	**Fd**	**Br**	**O**	**E**	**Fum**	**Ors**								
Acacia etbaica	1	2	2	-	-	-	1	1	1	5	8	0.63	8	16	0.50	1.13	3
Acacia origena	3	1	1	1	-	-	-	-	-	4	8	0.50	6	16	0.38	0.88	10
Achyranthes aspera	4	-	-	-	1	-	-	-	-	2	8	0.25	5	16	0.31	0.56	43
Allium sativum	5	-	-	2	-	-	-	-	-	2	8	0.25	7	16	0.44	0.69	29
Aloe elegans	8	1	-	2	-	-	-	-	-	3	8	0.38	11	16	0.69	1.07	5
Aloe macrocarpa	4	1	-	1	-	-	-	-	-	3	8	0.38	6	16	0.38	0.76	25
Argemone mexicana	1	-	-	-	-	-	-	-	1	2	8	0.25	2	16	0.13	0.38	65
Artemisia absinthium	1	-	-	-	-	1	-	-	-	2	8	0.25	2	16	0.13	0.38	65
Becium grandiflorum	2	1	-	1	-	-	-	-	-	3	8	0.38	4	16	0.25	0.63	31
Beta vulgaris	1	-	-	2	-	-	-	-	-	2	8	0.25	3	16	0.19	0.44	55
Brassica nigra	3	-	-	1	-	-	-	-	-	2	8	0.25	4	16	0.25	0.50	51
Buddleja polystachya	4	1	-	-	-	-	-	-	-	2	8	0.25	5	16	0.31	0.56	43
Calotropis procera	4	1	-	-	-	-	-	-	-	2	8	0.25	5	16	0.31	0.56	43
Calpurnia aurea	3	1	1	-	-	-	2	-	-	4	8	0.50	7	16	0.44	0.94	7
Carica papaya	1	-	-	1	-	-	-	-	-	2	8	0.25	2	16	0.13	0.38	65
Carissa spinarum	3	1	1	2	-	-	-	-	-	4	8	0.50	7	16	0.44	0.94	7
Chenopodium ambrosioides	2	-	-	-	-	-	-	-	-	1	8	0.13	2	16	0.13	0.26	84
Citrus aurantifolia	2	1	1	1	-	-	-	-	-	4	8	0.50	5	16	0.31	0.81	18
Clutia abyssinica	2	1	-	-	-	-	-	-	-	2	8	0.25	3	16	0.19	0.44	55
Coffea arabica	2	1	-	1	-	-	-	-	-	3	8	0.38	4	16	0.25	0.63	31
Commicarpus plumbagineus	1	-	-	-	-	-	-	-	-	1	8	0.13	1	16	0.06	0.19	96
Cordia africana	4	1	1	3	-	-	1	-	2	6	8	0.75	12	16	0.75	1.50	2
Crinum ornatum	1	-	-	-	-	-	-	-	-	1	8	0.13	1	16	0.06	0.19	96
Croton macrostachyus	3	1	1	-	-	-	-	-	1	4	8	0.50	6	16	0.38	0.88	10
Cucumis ficifolius	1	-	1	-	-	-	-	-	-	2	8	0.25	2	16	0.13	0.38	65
Cucurbita pepo	1	-	1	-	-	-	-	-	-	2	8	0.25	2	16	0.13	0.38	65
Cynoglossum lanceolatum	4	-	-	-	-	-	-	-	-	1	8	0.13	4	16	0.25	0.38	65
Cyphostemma cyphopetalum	2	-	-	-	-	-	-	-	-	1	8	0.13	2	16	0.13	0.26	84
Datura stramonium	6	-	-	-	-	-	-	-	-	1	8	0.13	6	16	0.38	0.51	50
Dodonaea angustifolia	4	1	1		1	-	-	1	-	5	8	0.63	8	16	0.50	1.13	3
Emex spinosa	1	-	-	-	-	-	-	-	-	1	8	0.13	1	16	0.06	0.19	96

Plant species	Use categories and number of use types of each species									NUCS	NUC VS	NUC	NTS	NTM IT	NT	RI	R
	M	F	C	Fd	Br	O	E	Fum	Ors								
Eragrostis tef	1	-	2	-	-	-	-	-	-	2	8	0.25	3	16	0.19	0.44	55
Eucalyptus camaldulensis	1	1	1	-	-	-	-	-	1	3	8	0.38	4	16	0.25	0.63	31
Eucalyptus globulus	3	1	1	-	-	-	-	-	1	4	8	0.50	6	16	0.38	0.88	10
Euclea racemosa	2	1	1	1	-	-	-	-	-	4	8	0.50	5	16	0.31	0.81	18
Euphorbia abyssinica	2	1	1	-	-	-	-	1	-	4	8	0.50	5	16	0.31	0.81	18
Euphorbia polyacantha	3	-	-	-	-	-	-	-	-	1	8	0.13	3	16	0.19	0.32	80
Euphorbia tirucalli	1	1	1	-	-	-	-	1	-	4	8	0.50	4	16	0.25	0.75	26
Ficus ingens	1	1	-	2	-	-	-	-	-	3	8	0.38	4	16	0.25	0.63	31
Ficus palmata	5	1	-	1	-	-	-	-	-	3	8	0.38	7	16	0.44	0.82	15
Foeniculum vulgare	4	-	-	-	-	-	-	-	-	1	8	0.13	4	16	0.25	0.38	65
Gomphocarpus fruticosus	2	-	-	-	-	-	-	-	-	1	8	0.13	2	16	0.13	0.26	84
Gossypium hirsutum	1	-	-	-	-	-	-	-	1	2	8	0.25	2	16	0.13	0.38	65
Hordeum vulgare	4	-	-	5	-	-	-	-	-	2	8	0.25	9	16	0.56	0.81	18
Hypoestes forskaolii	4	-	-	1	-	-	-	-	-	2	8	0.25	5	16	0.31	0.56	43
Indigofera vicioides	2	1	1	-	-	-	-	-	-	3	8	0.38	4	16	0.25	0.63	31
Juniperus procera	2	2	1	-	-	-	-	-	1	4	8	0.50	6	16	0.38	0.88	10
Justicia schimperiana	3	1	-	-	-	-	-	-	-	2	8	0.25	4	16	0.25	0.55	49
Kalanchoe laciniata	2	-	-	-	-	-	-	-	-	1	8	0.13	2	16	0.13	0.26	84
Lactuca sativa	1	-	-	1	-	-	-	-	-	2	8	0.25	2	16	0.13	0.38	65
Lagenaria siceraria	2	-	-	-	-	-	1	-	-	2	8	0.25	3	16	0.19	0.44	55
Laggera tomentosa	2	-	-	-	-	-	-	-	-	1	8	0.13	2	16	0.13	0.26	84
Lepidium sativum	3	-	-	-	-	-	-	-	1	2	8	0.25	4	16	0.25	0.50	51
Leucas abyssinica	1	-	-	-	-	-	-	-	-	1	8	0.13	1	16	0.06	0.19	96
Leucas martinicensis	1	-	-	-	-	-	-	-	-	1	8	0.13	1	16	0.06	0.19	96
Linum usitatissimum	2	-	-	1	-	-	1	-	1	4	8	0.50	5	16	0.31	0.81	18
Lobelia giberroa	1	1	-	-	-	-	-	-	-	2	8	0.25	2	16	0.13	0.38	65
Lycopersicon esculentum	2	-	-	4	-	-	-	-	-	2	8	0.25	6	16	0.38	0.63	31
Maytenus arbutifolia	1	1	1	1	-	-	-	-	-	4	8	0.50	4	16	0.25	0.75	26
Maytenus senegalensis	2	1	1	1	-	-	-	-	1	5	8	0.63	6	16	0.38	1.01	6
Melia azedarach	3	1	-	-	-	-	-	-	3	3	8	0.38	7	16	0.44	0.82	15
Meriandra dianthera	7	-	-	1	-	-	-	-	-	2	8	0.25	8	16	0.50	0.75	26
Myrica salicifolia	1	1	-	-	-	-	-	-	-	2	8	0.25	2	16	0.13	0.38	65
Nicotiana glauca	4	1	-	-	-	-	-	-	-	2	8	0.25	5	16	0.31	0.56	43
Nicotina tabacum	1	-	-	-	-	-	-	-	-	1	8	0.13	1	16	0.06	0.19	96
Ocimum basilicum	1	-	-	1	-	-	-	-	-	2	8	0.25	2	16	0.13	0.38	65
Olea europaea	5	2	2	1	1	-	3	1	1	8	8	1.00	16	16	1.00	2.00	1

Plant species	Use categories and number of use types of each species									NUCS	NUC VS	NUC	NTS	NTM IT	NT	RI	R
	M	F	C	Fd	Br	O	E	Fum	Ors								
Otostegia integrifolia	3	1	1	-	-	-	-	-	-	3	8	0.38	5	16	0.31	0.69	29
Plectranthus ornatus	2	-	-	-	-	-	-	-	-	1	8	0.13	2	16	0.13	0.26	84
Phytolacca dodecandra	2	-	-	-	1	-	-	-	-	2	8	0.25	3	16	0.19	0.44	55
Pollichia campestris	4	-	-	-	-	-	-	-	-	1	8	0.13	4	16	0.25	0.38	65
Prunus persica	1	1	-	1	-	-	-	-	-	3	8	0.38	3	16	0.19	0.57	42
Psiadia punctulata	2	-	-	-	-	-	-	-	-	1	8	0.13	2	16	0.13	0.26	84
Psidium guajava	1	1	-	2	-	-	-	-	-	3	8	0.38	4	16	0.25	0.63	31
Rhamnus prinoides	1	-	-	2	1	-	-	-	-	3	8	0.38	4	16	0.25	0.63	31
Ricinus communis	1	-	-	-	-	-	-	-	1	1	8	0.13	2	16	0.13	0.26	84
Rosa abyssinica	2	-	1	1	-	-	-	-	-	3	8	0.38	4	16	0.25	0.63	31
Rumex abyssinicus	1	-	-	3	-	-	-	-	-	2	8	0.25	4	16	0.25	0.50	51
R*umex nepalensis*	2	-	-	-	-	-	-	-	-	1	8	0.13	2	16	0.13	0.26	84
Rumex nervosus	3	1	-	1	-	-	-	-	-	3	8	0.38	5	16	0.31	0.79	24
Ruta chalepensis	2	-	-	3	-	-	-	-	-	2	8	0.25	5	16	0.31	0.56	43
Schinus molle	6	1	-	-	-	-	-	-	1	3	8	0.38	8	16	0.50	0.88	10
Sida schimperiana	3	-	-	1	3	-	-	-	-	3	8	0.38	7	16	0.44	0.82	15
Sideroxylon oxyacanthum	3	-	-	-	-	-	-	-	-	1	8	0.13	3	16	0.19	0.32	80
Solanum adoense	5	-	-	-	-	-	-	-	-	1	8	0.13	5	16	0.31	0.44	55
Solanum incanum	3	-	-	-	-	-	-	-	-	1	8	0.13	3	16	0.19	0.32	80
Solanum schimperianum	7	1	-	-	-	-	-	1	-	3	8	0.38	9	16	0,56	0.94	7
Tagetes minuta	2	-	-	-	-	-	-	-	-	1	8	0.13	2	16	0.13	0.26	84
Tarchonanthus camphoratus	2	1	-	-	-	-	-	-	-	2	8	0.25	3	16	0.19	0.44	55
Trigonella foenum-graecum	1	-	-	1	-	-	-	-	-	2	8	0.25	2	16	0.13	0.38	65
Triticum aestivum	1	-	-	2	-	-	-	-	-	2	8	0.25	3	16	0.19	0.44	55
Urtica simensis	1	-	-	-	-	-	-	-	-	1	8	0.13	1	16	0.06	0.19	96
Verbena officinalis	3	-	-	-	-	-	-	-	-	1	8	0.13	3	16	0.19	0.32	80
Vernonia amygdalina.	2	1	-	-	1	-	-	-	-	3	8	0.38	4	16	0.25	0.63	31
Vernonia rueppellii	3	1	-	-	-	-	-	-	-	2	8	0.25	4	16	0.25	0.50	51
Vicia faba	1	1	-	-	-	-	-	-	-	2	8	0.25	2	16	0.13	0.38	65
Vitis vinifera	1	-	-	2	-	-	-	-	1	3	8	0.38	4	16	0.25	0.63	31
Withania somnifera	2	1	-	-	-	-	-	-	-	2	8	0.25	3	16	0.19	0.44	55
Xanthium strumarium	1	-	-	-	-	-	-	-	-	1	8	0.13	1	16	0.06	0.19	96
Zehneria scabra	2	-	-	-	-	-	-	-	-	1	8	0.13	2	16	0.13	0.26	84
Zingiber officinale	1	-	-	2	-	-	-	-	-	2	8	0.25	3	16	0.19	0.44	55
Ziziphus mauritiana	1	1	1	2	-	-	-	-	-	4	8	0.50	5	16	0.31	0.81	18

Appendix 23 Distribution of medicinal plants in the two districts

MPs found in both districts		**MPs found only in the Erob District**	**MPs found only in the Gulomahda District**
Acacia etbaica	*Leucas martinicensis*	*Asparagus africanus*	*Artemisia absinthium*
Acacia origena	*Linum usitatissimum*	*Capparis micrantha*	*Beta vulgaris*
Achyranthes aspera	*Lycopersicon esculentum*	*Capsicum annum*	*Brassica nigra*
Allium sativum	*Maytenus arbutifolia*	*Capsicum frutescens*	*Buddleja polystachya*
Aloe elegans	*Maytenus senegalensis*	*Coronopus didymus*	*Commicarpus plumbagineus*
Aloe macrocarpa	*Melia azedarach*	*Dovyalis abyssinica*	*Crinum ornatum*
Argemone mexicana	*Meriandra dianthera*	*Echinops pappii* Chiov.	*Cucumis ficifolius*
Becium grandiflorum	*Nicotiana glauca*	*Heliotropium cinerascens*	*Emex spinosa*
Calotropis procera	*Nicotiana tabacum*	*Indigofera amorphoide*	*Eragrostis tef*
Calpurnia aurea	*Ocimum lamiifolium*	*Kalanchoe marmorata*	*Eucalyptus camaldulensis*
Carica papaya	*Olea europaea*	*Leptadenia arborea*	*Euclea racemosa*
Carissa spinarum	*Otostegia integrifolia*	*Malva parviflora*	*Euphorbia tirucalli*
Chenopodium ambrosioides	*Pollichia campestris*	*Mentha longifolia*	*Ficus ingens*
Citrus aurantifolia	*Prunus persica*	*Mentha spicata*	*Foeniculum vulgare*
Clutia abyssinica	*Psiadia punctulata*	*Ocimum basilicum*	*Gomphocarpus fruticosus*
Coffea arabica	*Rhamnus prinoides*	*Opuntias ficus-indica*	*Gossypium hirsutum*
Cordia africana	*Rosa abyssinica*	*Otostegia minucii*	*Kalanchoe laciniata*
Croton macrostachyus	Rumex *nepalensis*	*Solanum villosum*	*Lactuca sativa*
Cucurbita pepo	*Rumex nervosus*	*Taraxacum* sp. agg.	*Lagenaria siceraria*
Cynoglossum lanceolatum	*Ruta chalepensis*	Total=19	*Lepidium sativum*
Cyphostemma cyphopetalum	*Schinus molle*		*Leucas abyssinica*
Datura stramonium	*Solanum adoense*		*Lobelia giberroa*
Dodonaea angustifolia	*Solanum schimperianum*		*Myrica salicifolia*
Eucalyptus globulus	*Tagetes minuta*		*Plectranthus ornatus*
Euphorbia abyssinica	*Tarchonanthus camphoratus*		*Phytolacca dodecandra*
Euphorbia polyacantha	*Trigonella foenum-graecum*		*Psidium guajava*
Ficus palmata	*Verbena officinalis*		*Ricinus communis*
Hordeum vulgare	*Vitis vinifera*		*Rumex abyssinicus*
Hypoestes forskaolii	*Withania somnifera*		*Sida schimperiana*
Indigofera vicioides	*Xanthium strumarium*		*Sideroxylon oxyacanthum*
Juniperus procera	*Zehneria scabra*		*Solanum incanum*
Justicia schimperiana	*Zingiber officinale*		*Triticum aestivum*
Laggera tomentosa	*Ziziphus mauritiana*		*Urtica simensis*
Total	66		*Vernonia amygdalina.*
			Vernonia rueppellii
			Vicia faba
			Total = 36

Appendix 24 Comparing the mean knowledge of the study kebeles

	N	Mean	SD	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Hagre-lekuma	39	8.8462	3.91716	.62725	7.5764	10.1159	4.00	18.00
Alitenia	75	8.9467	3.64985	.42145	8.1069	9.7864	3.00	17.00
Harezea-sebehata	25	7.6000	3.21455	.64291	6.2731	8.9269	4.00	16.00
Weratele	44	7.1591	3.39592	.51195	6.1266	8.1915	3.00	16.00
Anbeste-fikada	38	7.6842	3.58756	.58198	6.5050	8.8634	3.00	20.00
May-tseada	35	9.4000	4.27854	.72320	7.9303	10.8697	4.00	20.00
Regibay-medabay	49	7.7755	3.22920	.46131	6.8480	8.7030	3.00	16.00
Sebya	77	10.4026	4.14303	.47214	9.4622	11.3430	3.00	22.00
Total	382	8.7016	3.86042	.19752	8.3132	9.0899	3.00	22.00

Summarized ANOVA for eight kebeles

ANOVA

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	461.568	7	65.938	4.728	.000
Within Groups	5216.411	374	13.948		
Total	5677.979	381			

Declaration

I, the undersigned declare that this Dissertation is my original work and it has not been presented in other universities, colleges or institutes for a degree or other purpose. All sources of the materials used have been duly acknowledged.

Name: Tadesse Beyene Wereta Signature: _______________ Date: _____________

This work has been done under my supervision.

Name: Prof. Zemede Asfaw Signature: _________________ Date: ___________

Prof. Ensermu Kelbessa Signature: ________________ Date: ___________

Prepared (Based on AAU's "Thesis Writing, Examination and Grading Guidelines", Printed in April 2012) (Dr. Tamrat Bekele, Chairman, Department of Plant Biology and Biodiversity Management)