

ADDIS ABABA UNIVERSITY
COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES
ZOOLOGICAL SCIENCES DEPARTMENT GENERAL
BIOLOGY PROGRAM



**Use and Management of Traditional Medicinal Plants by
Communities Living in Tselemti Wereda, North-West Zone, Tigray
Regional State**



By: Yigizaw Getahun

Addis Ababa University, Department of Zoological Sciences

Addis Ababa, Ethiopia

September, 2019

ADDIS ABABA UNIVERSITY
COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES
ZOOLOGICAL SCIENCES DEPARTMENT GENERAL
BIOLOGY PROGRAM



**Use and Management of Traditional Medicinal Plants by
Communities Living in Tselemti Wereda, North-West Zone,
Tigray Regional State**

By: Yigizaw Getahun

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

Addis Ababa, Ethiopia

September, 2019

Addis Ababa University

Graduate Programmes

Declaration

This is to certify that the thesis prepared by Yigizaw Getahun, entitled: Use and management of traditional medicinal plants by communities living in Tselemti Wereda, North-West Zone, Tigray Regional State and submitted in fulfillment of the requirements for the degree of Master of Science in Biology complies with the regulations of the University and meets the accepted standards with respect to originality and quality

Names and Signatures of the Examining Board:

	Name	Signature	Date
1.	_____ (Examiner)	_____	_____
2.	_____ (Examiner)	_____	_____
3.	<u>Prof. Legesse Negash</u> (Advisor)	_____	_____
4.	_____ (Chairman)	_____	_____

Abstract

Traditional medicine refers to any ancient and culturally based health care practice differing from scientific medicine. In Ethiopia, communities' knowledge about traditional medicinal plants (TMPs) is transferred secretly. The present study was conducted in Tselemti Wereda, North-West Tigray Regional State. The major objective of the study was to document communities' knowledge on the use and management of TMPs for treating various human and livestock diseases. The field study was carried out from December 1, 2018 to February 30, 2019 in the four purposively selected *Kebeles* of Tselemti Wereda. A total of 64 informants were selected (of which 20 key informants and 44 general informants were selected by purposive and snowball sampling techniques, respectively). Relevant data were collected using semi-structured interviews, group discussions, as well as guided field observations. Statistical analyses included descriptive statistics, informant consensus, preference ranking and pair-wise comparison. A total of 53 TMPs belonging to 52 genera and 36 families were documented. The family containing the highest number of medicinal plant species was Solanaceae (9.43%). Of the total studied TMPs, 36 species (67.93%), 6 species (11.32%) and 11 species (20.75%) are used to treat human, livestock and both human and livestock ailments, respectively. Tree species constituted the dominant growth forms (39.62 %), followed by herbs (35.85%) and shrubs (18.87%) of the medicinal plants studied. The most frequently used plant parts for human and/or livestock health care included leaves (31.64%), followed by roots (27.85%), and other plant parts. Crushing (31.64%), boiling (11.40%), and tying (10.13%), were the dominant preparation techniques. Oral applications were the most common ways (41.77%), followed by dermal (37.98%), and nasal application (15.19%). Medicinal plants with highest preference ranking to treat anthrax was *Plumbago zeylanica* L.. Major threats to plants in general and medicinal plants in particular were agricultural expansion, urbanization, deforestation, fire wood, and climate change. We recommend that technical support for intensive management and conservation activities (including selection, domestication, propagation and cultivation) of traditional medicinal plants are urgently required for backstopping the healthcare system of the studied communities.

Key words/phrases: Ailments, Conservation, Propagation, Traditional healers, Traditional medicine, Traditional Treatment

Acknowledgements

First, I would like to express my deepest gratitude to my adviser Professor Legesse Negash for his consistent advice and critical comments from the beginning to the end of my work. Note only this but also I have got all the necessary materials support as well as the thesis guidelines for my study.

I also thank Department of Zoological Sciences, Addis Ababa University for their proper organizing and financial support to carry out my research work.

My appreciation goes to wereda Tselemti local authorities, elders, Wereda Finance and Planning Office and all informants participated in my study to their great contribution in sharing their valuable knowledge and hospitality.

Furthermore, I like to thanks the following individuals for their moral & multidimensional support, provision of material, and in supporting computer writing skills in my study; My wife T/r Embeba Kasahun, T/r Mulalem Shumet and T/r Atalay Tsegy, respectively.

Table of Contents

Abstract	iii
Key words/phrases:	iii
Acknowledgements	iv
List of Figures	viii
List of Tables	ix
List of Appendices	x
List of Acronyms	xi
1. Introduction	1
1.1 Background.....	1
1.2 Statement of the Problem	3
1.3 Research Questions.....	3
2. Objectives	4
2.1 General Objective	4
2.2 Specific Objectives	4
3. Literature Review	5
3.1. Traditional Medicinal Plants	5
3.1.1 Traditional Medicine.....	5
3.1.2 Indigenous Knowledge	6
3.1.3 Medicinal Plants Diversity and Distribution in Ethiopia	7
3.1.4 Medicinal Plants in Public Health Care System	8
3.1.5 Medicinal Plants in Ethno Veterinary Medicine.....	9
3.1.6 Sources of Supply of Medicinal Plants	9
3.2 Threats and Conservations of Medicinal Plants	10
3.2.1 Threats of Medicinal Plants	10
3.2.2 Conservations of Medicinal Plants	11

4. Materials and Methods	13
4.1 Descriptions of the Study Area.....	13
4.2 Selection of the Study Sites	15
4.3 Selection of Informants	15
4.4 Methods of Data Collection.....	15
4.4.1 Semi-Structured Interviews.....	16
4.4.2 Guided Field Observations.....	16
4.4.3 Group Discussions	16
4.5 Statistical Analysis.....	16
4.5.1 Descriptive Statistics.....	17
4.5.2 Informant Consensus.....	17
4.5.3 Preference Ranking	17
4.5.4 Pair-wise Comparison	17
5. Results.....	18
5.1 Medicinal Plant Species Used and Ailments Treated by Communities of Tselemti Wereda.....	18
5.2. Medicinal Plants Used to Treat Human, Livestock and both Human and Livestock Diseases.	21
5.3. Growth Forms of Medicinal Plants Used by Communities in the Study Area	22
5.4. Parts of Medicinal Plants Used by the Communities in the Study Area.....	23
5.5. Conditions of Preparations of Traditional Medicine	24
5.6. Methods of Traditional Medicines Preparation and Dosage	25
5.7. Route of Applications of Traditional Medicine	27
5.8. Informant Consensuses of Most Frequently Used Medicinal Plants in the Study Area	28
5.9. Preference Ranking of Medicinal Plants Used to Treat Anthrax	29
5.10. Pair-wise Comparison.....	30

5.11. Threats, Managements and Conservations of Medicinal Plants of the Study Area.....	31
5.11.1 Threats of Medicinal Plants	31
5.11.2 Management and Conservation of Medicinal Plants in the Study Area	31
5.12. Domestication, Propagation and Cultivation of Medicinal Plants in the Study Area	34
6. Discussion	35
6.1 Traditional Medicinal Plants Used and Diseases Treated by Communities in the Study Area	35
6.2 Habits, Plant Parts and Conditions of Preparations Used in the Study Area	35
6.3 Ways of Preparations, Dosages and Routes of Applications	36
6.4 Threats to Medicinal Plants	37
6.5 Domestication, Propagation and Cultivation of Medicinal Plants	38
7. Conclusions and Recommendations	39
7.1 Conclusions.....	39
7.2 Recommendations.....	40
8. References.....	41
9. Appendices	45

List of Figures

Figure 1. Map of the study area of Tselemti Woreda, Tigray Regional State.	14
Figure 2. Growth forms and the corresponding percentages of medicinal plants used for human and/or livestock diseases.	22
Figure 3. Plant parts and their corresponding percentages used to treat human and/or livestock diseases. (WP, Whole plants; R&B, Roots and Barks).	23
Figure 4. Conditions of medicinal plants used for the preparation of traditional medicine and the corresponding percentages.	24
Figure 5. Routes of applications and the corresponding percentages of TMPs used for human and/or livestock diseases	27
Figure 6. Some conservation area of the study	33

List of Tables

Table 1. Family names, genera, species and the corresponding percentage of medicinal plants species studied in Tselemti Wereda, Tigray Regional State.	19
Table 2. Ailments treated, plant species used and the corresponding percentage of medicinal plants species used to treat human, livestock and both human and livestock diseases.....	21
Table 3. Methods of preparation, number of preparation and the corresponding percentage of preparation of medicinal plants used to treat human and/or livestock diseases.....	25
Table 4. Scientific name of medicinal plants, number of informants and the corresponding percentage of informant consensuses of most frequently used medicinal plants in the study area.....	28
Table 5. Preference ranking of five selected medicinal plants based on the degree of effectiveness to treat anthrax as suggested by informants.	29
Table 6. Pair-wise comparison of six medicinal plants used to treat evil eye.....	30
Table 7. Informants' response in domestication, propagation and cultivation of medicinal plants	34

List of Appendices

Appendix 1. English name, and local name of human and livestock diseases which are treated in the study area.....	46
Appendix 2. Scientific name, family name, local name, habit, habitat, condition used, disease treated, part used, method of preparation and dosage, route of application of traditional medicinal plants used for human, livestock and both human and livestock diseases.	48
Appendix 3. English name and local name of diseases, number of plant species used and the corresponding percentage of plant species used to treat those diseases.....	57
Appendix 4. Livestock ailments, local name, plant species used and the corresponding percentages of medicinal plants used to treat those ailments.....	59
Appendix 5. List of informants participated and their sex, age, marital status, educational level, religion, Kebeles and occupation of the study area.	60
Appendix 6. List of semi-structured interview questions for collecting information on medicinal plants and the corresponding uses.	63
Appendix 7. Sample Photograph of respondents contacted in (A) interviews; (B) field observations and (C) Gourp discustions.	76
Appendix 8. Photograph of some common domesticated TMPs and their names at (A) <i>Ocimum lamiifolium</i> , (B) <i>Justicia schimperiana</i> and (C) <i>Plumbago zeylenica</i>	76

List of Acronyms

ARRA – Administration for Refuges and Returnee Affairs

IK - Indigenous Knowledge

MPs - Medicinal Plants

TM - Traditional Medicine

TMPs - Traditional Medicinal Plants

UNESCO - United Nations Educational, Scientific and Cultural Organization

WHO - World Health Organization

1. Introduction

1.1 Background

Medicinal plants include various types of plants used by communities for their alleged medicinal activities. Medicinal plants are the backbone of traditional medicine, which means that more than 3.3 billion people in the Less Developed Countries utilize medicinal plants on a regular basis (Singh, 2015).

Traditional medicine refers to any ancient and culturally based health care practice differing from scientific medicine and is largely transmitted orally by communities of different cultures. Traditional system of medicine is one of the centuries-old practice and long serving companion to humankind in the fight against diseases and in leading health life (Karunamoorthi *et al.*, 2012).

Traditional medicine is used throughout the world as it is dependent on locally available plants, which are easily accessible and capitalizes on traditional wisdom-repository of knowledge, which again is simple to use and affordable.

Ethiopia is endowed with a considerable potential of medicinal plants which provides a wide range of treatment to human and livestock ailments (Mulugeta Kebebew and Erchafo Mohamed, 2017). Around 80% of Ethiopia's population (particularly the rural community) still relies on traditional medicinal plants to fight a number of diseases. This is attributed to high costs of modern drugs, paucity and inaccessibility of modern health care services, and acceptability of traditional medicines. Communities inhabiting different localities in the country have developed their own medicinal plant arsenals and knowledge on their utilization, management and conservation (Alebie Getachew *et al.*, 2017).

In most situations, knowledge on Ethiopia's traditional medicine is passed verbally from generation to generation and valuable information can be lost whenever a traditional medical practitioner passes away without conveying his/her traditional medicinal plant knowledge to others. In addition, the loss of valuable medicinal plants due to population pressure, agricultural expansion, deforestation is happening at an unprecedented rate (Abebe Demissie, 2001; Legesse

Negash, 2010), the need to document the medicinal plants and the associated indigenous knowledge must be an urgent task (Gidey Yirga, 2010).

Similar to elsewhere, traditional medication is important health care system in Tigray Region, especially in Tselemti Wereda mainly in the use of local available medicinal plants. However, the knowledge, potential, and traditional skill are not documented. Due to this, the present work aimed to study and to document the use and management of traditional medicinal plants by communities living in Wereda Tselemti, North-West Zone, Tigray Regional State.

1.2 Statement of the Problem

In Ethiopia, communities' knowledge about traditional medicinal plants (TMPs) is transferred secretly. There is a gap in knowledge between the documented and undocumented medicinal plants in the country. In addition, the communities' knowledge on the identification and use of traditional medicinal plants as remedies are getting lost due to secrecy that should medicinal plants, traditional healers' migration from rural to urban areas, industrialization, as well as expansion of modern education. In most parts of the country, the wild plants are decreased by human induced factors such as population growth, agricultural expansion, and deforestation and these results in loss of biodiversity (Eskedar Abebe, 2011). As part of Ethiopia, the above problem is common in Tigray Regional State in general (Gidey Yirga, 2010). Therefore, the above problem is common in Tselemti Wereda. Even if common in the study area, any TMPs research was not conducted. The study area is now in danger of loss of plants species and loss of communities' knowledge on the use of traditional medicinal plants. Therefore, the study concerned on the use and management of traditional medicinal plants by communities living in Tselemti Wereda. The findings of the present work will help community of the study area to be aware of problems related with medicinal plants and give attention for the threatened medicinal plants. The documentation of communities' knowledge of medicinal plants can serve as source of information for other people who wants to conduct research in further study on traditional medicinal plants.

1.3 Research Questions

- What kind of traditional medicinal plants are used by the communities in the study area to treat diseases and ailments?
- Which parts of the plants are used for traditional medicinal values?
- How do communities use/apply medicinal plants traditionally?
- Do the communities in the study area conserve and develop medicinal plants? If so, how?
- What is the level of knowledge about propagating medicinal plants?

2. Objectives

2.1 General Objective

The general objective of the present study was to investigate the use and management practices of traditional medicinal plants by communities living in Tselemti Wereda, North-West Zone, Tigray Regional State.

2.2 Specific Objectives

- To identify traditional medicinal plants used for treatment of human and/or livestock health problem in the study area;
- To document communities' knowledge on the use of traditional medicinal plants in the study area;
- To assess current status of traditional medicinal plants and communities knowledge in the study area;
- To study factors that threaten sustainability of medicinal plants; and,
- To find out if the communities in the study area undertakes active propagation and domestication of medicinal plants.

3. Literature Review

3.1. Traditional Medicinal Plants

3.1.1 Traditional Medicine

Traditional medicine (indigenous or folk medicine) describes medicinal aspects of traditional knowledge that developed over generations within various societies before the era of modern medicine (Mersha Ashagre, 2011). According to the World Health Organization (WHO), as quoted by Fassil Kibebew (2001), traditional medicine is defined as the sum total of all the knowledge and practices, whether explicable or not, used in diagnosis, prevention and elimination of physical, mental, or social imbalance and relying exclusively on practical experience and observation handed down from generation to generation, whether verbally or in writing. On the other hand, traditional medicine is the oldest form of health care in the world and is used in the prevention, and treatment of physical and mental illness. Different societies historically developed various useful healing methods to combat a variety of health and life-threatening diseases (WHO, 2000).

Traditional medicine has been utilized by the majority of the world population for thousands of years. Until the beginning of the 19th century, all medicines were traditional. Yet, in many developing countries, it is true that for the majority of rural population, traditional medicine is the only primary or any other kind of health care available (Eyasu Chama, 2017). In addition to this, TM is widely used and of rapidly growing health system and economic importance. In Africa up to 80% of the population uses TM to help meet their health care needs. In Asia and Latin America, populations continue to use TM as a result of historical circumstances and cultural beliefs. In China, TM accounts for around 40% of all health care delivered (WHO, 2002).

Ethiopia has a long history of traditional medicine and has developed ways to combat disease through it. The ways are also as diverse as the different cultures. Healing in Ethiopia is not only concerned with curing of diseases but also with the protection and promotion of human physical, spiritual, social, and mental wellbeing (Kebede Deribe *et al.*, 2014).

Ethiopia is one of the six a center of diversity for a number flora and fauna in the world. The country is endowed with rich flora, having more than 6,500 species of vascular plants out of which an estimated 12% are endemic and about 887 species are used as medicinal plants. The majority (80%) of Ethiopian people depends on traditional medicine for their health care, and a home for many languages, cultures and beliefs that have in turn contributed to the high diversity of traditional knowledge and practice of the people, which, among others include the use of medicinal plants (Ashenif Tadele, 2017).

Dawit Abebe (1986) indicated that more than 95% of traditional medical preparations are plant origin.

3.1.2 Indigenous Knowledge

Indigenous knowledge defined as the accumulation of knowledge, rules, standards, skills, and mental sets, which are transmitted by local people in a particular area (Quanash, 1998). According to UNESCO (2018), indigenous and local knowledge refers to the understandings, skills and philosophies developed by societies with long histories of interaction with their natural surroundings. For rural and indigenous peoples, local knowledge informs decision-making about fundamental aspects of day to day life. It is the results of many generations, carefull observations and trial and error experiments (Martin, 1995). The direct and close dependency of local people on natural resources resulted in the accumulation of indigenous knowledge that helped people to adapt and survive in their environments in which they live. It is a local knowledge that is unique to a given culture or societies and the base for agricultural, health care, environmental conservation and a host of other activities (Thomas, 1995).

Indigenous knowledge is the basis for local-level decision making in agriculture, health care, food preparation, education, natural resource management, and a host of other activities in rural communities (Mersha Ashagre, 2011). Woyek and Gorjestani (1998) also define IK as the knowledge that is locally situated and related to a more or less of common values, beliefs, and experiences, held by a particular tribal group, kinship or indigenous community. It includes practices and technologies, such as seed treatment and storage methods and tools used for planting and harvesting. Traditional knowledge also encompasses belief systems that play a fundamental role in people's livelihood, maintaining their health, and protecting and replenishing the environment (Stphen and Justin, 2003).

Indigenous knowledge is extremely important for development projects, allows better innovation and adaptation of technologies, adds to scientific knowledge, increases understanding between researchers and local people, increases the local capacity to experiment and empowers local people. And also relevance to conservation and sustainable development because of locally appropriate, diversified production systems, respect for nature, flexible and social responsibility (Eskedar Abebe, 2011).

One of the widely used indigenous knowledge system in many countries is the knowledge and application of traditional medicine. Such knowledge is known as ethno medicinal knowledge that includes traditional diagnosis, collection of raw materials, preparation of remedies and its prescription to the patients. Indigenous knowledge on remedies in many countries including Ethiopia, pass from generation to generation orally with great secrecy. Such secrete and crude transfer makes IK or ethno medicinal knowledge vulnerable to distortion in most cases, some of the lore is lost at each point of transfer (Endalew Amenu, 2007). Therefore, people want to document such useful knowledge through research.

3.1.3 Medicinal Plants Diversity and Distribution in Ethiopia

Different vegetation types are found in the various agro ecological zones of Ethiopia accommodate various types of medicinal plants (Edwards, 2001). Ethiopia is a country with great range of ecological diversity and climate (Dawit Abebe, 2001). The number of plants in each corner of the country and the vegetation type is also varied ranging from arid lowland to the Afro alpine vegetation (Abebe Demissie, 2001). As it was reported by Edwards (2001), the wood lands, mountain vegetation including grass lands, forests, and the evergreen shrubs and rocky areas contain more medicinal plants which indicated that traditional medicinal plant species are not equally distributed throughout the country similar to the distribution of the total plant species. According to this report the vegetation types found in the wood lands contain more medicinal plants species while the Afro alpine vegetation consists of the least medicinal plants of all the vegetation types (Endashaw Bekele, 2007). The number of different languages spoken in Ethiopia approaches 90 (Maffi, 1999) and each corresponds to its unique socio cultural population thus amounting to the high human cultural diversity. Each of these cultural domains has its own set of written and/or oral pharmacopoeias with the medicinal use of some species

being restricted to that given culture. Jansen (1981) reported that Ethiopia has rich medicinal plant lore and points out that almost all plants of the Ethiopian flora are used somewhere somehow medicinally. Similarly, according to Asmamaw Demeke and Achamyeleh Haimanot (2018), Ethiopia is the origin and center of diversity for many plant species. There are about 6500 species of plants in Ethiopia that make the country one of the most diverse floristic regions in the world. The country has diverse climatic and demographic potential several of such indigenous and exotic species and essential oil bearing plants could grow in Ethiopia and provide remarkable benefits to the national economy. About 1000 identified medicinal plant species are reported in the flora; however, many others are not yet identified. About 300 of these species are frequently mentioned in many sources.

3.1.4 Medicinal Plants in Public Health Care System

The use of medicinal plants species as a medicine is as old as man and this makes traditional medicine an integral part of the different cultures of Ethiopia who are especially vulnerable to underserved health facilities (Yeneayehu Fenetahun and Girma Eshetu, 2017). The use of plants in religious ceremonies as well as for magic and medicinal purpose is very common and widely distributed in Ethiopia (Amare Getahun, 1976).

Plant diversity remains crucial for human well-being and still provides a significant number of remedies required in health care (Yeneayehu Fenetahun and Girma Eshetu, 2017). Medicinal plants play typical role in the lives of many people in terms of health support, financial income and lively hood security (Abduhamid Bedri *et al.*, 2004; Hamilton, 2004). Plants have been indispensable and the most important sources of both preventive and curative traditional preparation for human beings and live stocks since the time immemorial. By their capacity of photosynthesis, plants form the basis of the biological food web and producing oxygen which is the key for our lives and they are balancing the gases of our environment. Plants are also recycling essential nutrients, establishing soils and soil fertility, protecting areas of water catchments. They keep ecological and climatic balances and helping to control rain fall through the process of transpiration. All these benefits of plants are directly or indirectly linked with health care (Hamilton, 2004).

3.1.5 Medicinal Plants in Ethno Veterinary Medicine

Livestock production plays an important role in the livelihood and economy of Ethiopia, as in other developing countries, through provision of food and income for the majority of its population. Crop production is almost entirely dependent on traction power provided by animals. In addition, livestock serve as a means of employment, saving and investment. They offer the only way of survival in many harsh environments. Moreover, livestock constitute a driving force for food security and sustainable development in developing countries like Ethiopia (Tafesse Mesfine and Mekonnen Lemma, 2001). However, in Ethiopia as well as in most developing countries, disease remains one of the principal causes of poor livestock performance leading to an ever increasing gap between supply and demand for livestock and products. The ever-declining provision of animal health services has resulted in the reappearance of a number of epizootic diseases reducing the economic efficiency of livestock production in Africa (Endalew Amenu, 2007).

Ethno veterinary medicine and related study is one of the most important means of controlling livestock diseases. Ethno veterinary medicine which refers to traditional animal health care knowledge and practices comprising of traditional surgical and manipulative techniques, traditional immunization, magic-religious practices and beliefs, management practices and the use of herbal remedies to prevent and treat a range of disease problems encountered by livestock holder (Eskedar Abebe, 2011). Similarly, as reported by Yeneayehu Fenetahun and Girma Eshetu (2017), Ethno veterinary medicine involves the use of medicinal plants, surgical techniques and livestock management practices to prevent a range of animal diseases.

3.1.6 Sources of Supply of Medicinal Plants

In Ethiopia, most of medicinal plants used by the herbalists are collected from the natural vegetation. Home based medicinal plants rely on plants of the home garden crops, weeds and that grow wild around human habitation. The cultivated medicinal plants are mostly produced in home gardens either for medicinal or rather primary purposes. Medicinal plants of home garden are known to the public as the knowledge on them is open or public (Zemedede Asfaw, 1999, 2001). Medicinal plants obtained from wild habitats are found in different natural ecosystems of the forests, grasslands, woodlands, wetlands, in field margins and garden fences, as weeds and in

many other microhabitats from where they are harvested when the need arises. These are free access resources to all with appropriate knowledge and who want to use them for the family for practicing traditional medicine or for sales. Many medicinal plants are also harvested for non-medicinal values such as for timber implements, fuel wood and other purposes and hence they are subjected to multiple pressures like *Hagenia abyssinica* and *Prunus africana* are facing at present. Conservation measures should target habitats of such vulnerable species. Most traders purchase medicinal plants from collectors. Consumers get their supply from different sources including from own garden, purchasing from traders and healers. Medicinal plants are also imported informally from e.g. Sudan through border towns like Assosa, Dire Dawa etc. The domestic supply sources are closely associated with the biodiversity and concentration of forest areas e.g. Jimma, Bale. Traders from Dire Dawa for example travel to Bale, Jimma, Gonder, Menz etc.

In Ethiopia, except in a few cases where a few food crops with medicinal value are cultivated, there is no organized cultivation of plant species for medicinal purposes. The reason for this is that the quantities of medicinal plants traded are very small, and there is no organized large scale value addition and processing. However, there is a potential in the future for increased demand for some of the species and, therefore, it is important to identify them and start the necessary research on the propagation and cultivation techniques. Such program will also provide basis for small enterprises to improve the income generating capacity of the local people (Endeshaw Bekele, 2007).

3.2 Threats and Conservations of Medicinal Plants

3.2.1 Threats of Medicinal Plants

Ethiopia's traditional medicine, as elsewhere in Africa, is faced with problems of continuity and sustainability (Ensermu Kelbessa *et al.*, 1992). The first causes of this problem are loss of species of medicinal plants, loss of habitats of medicinal plants and loss of indigenous knowledge. As some studies have shown that, most of the medicinal plants used by Ethiopian people are harvested from wild habitats (Mirutse Gidey, 1999; Tesfaye Awas and Zemedu Asfaw, 1999). This increases the rate of loss taxa with related indigenous knowledge and loss of widely occurring medicinal plant species. In addition to this Edwards (2001) stated that the threat

to medicinal plants can be made from the types of the plant and the part used. Harvesting the roots of a tree possess more of a threat than collecting the fruits and seeds, and this can be more threatening than using the leaves.

On the other hand, as medicinal plants are part of the total plant of the different ecosystems of the earth, they are affected by anthropogenic and natural forces. Majority of medicinal plants utilized in Ethiopia are part of forest and range-land. Therefore, most of the threats to the forests and range-land plants are also threats to medicinal plants. Now days, herbal practitioners have to walk greater distance for collection of herbal medicine that once grew in the vicinity of their homes. This is because of availability of plants in general and medicinal plants in particular have been affected by a dramatic decrease in areas of native vegetation (Yeneayehu Fenetahun and Girma Eshetu, 2017).

According to Zemedu Asfaw (2001), people use many wild species of plants for food, clothing, shelter, fuel, fiber, income generation and fulfilling of cultural and spiritual needs throughout the world in addition to medicinal value. Moreover as Endalew Amenu (2007) in his study stated that, there are two sources of threats to medicinal plants, i.e. manmade and natural causes. Rapid increase in population, the need for fuel, urbanization, timber production, over harvesting, destructive harvesting, invasive species, commercialization, honey cut, degradation, agricultural expansion and habitat destruction are human caused threats to medicinal plants. Similarly, natural causes include recurrent drought, bush fire, diseases and pest outbreaks.

3.2.2 Conservations of Medicinal Plants

Conservation is defined as the sustainable use of natural resources. The concept of sustainability is now seen as the guiding principle for economic and social development, particularly with reference to biological resources (Endalew Amenu, 2007). According to Zemedu Asfaw (2001), medicinal plants are considered to be at conservation risk due to over use and destructive harvesting (roots and barks collection). Similarly, Dawit Abebe and Ahadu Ayehu (1993) found that many medicinal preparations use roots, stem and bark by effectively killing the plant in harvest. Plant parts used to prepare remedies are different; however, root is

the most widely used part. Such wide utilization of root part for human and live-stock ailments with no replacement has severe effect on the future availability of the plant.

On the point of view Ensermu Kelbessa *et al.*(1992) and Edwards (2001) stated that habitat and species are being lost rapidly as a result of the combined effects of environmental degradation, agricultural expansion, deforestation and over harvesting of species and this is further enhanced by human and livestock population increase thus hastening the overall rural livelihood impoverishment and loss of the biological diversity and indigenous knowledge which is also of global concern since some of these are endemic to Ethiopia.

However, according to Abebe Demissie (2001), conservation should be aimed at conserving maximum diversity within each species to ensure that its genetic potential will be available in the future.

Sustainable management of traditional medicinal plant resources is important not only because of their value as potential sources of new drugs but also due to reliance on traditional medicine for health (Cunningham, 1993).

Generally, there are two conservation methods; these are in-situ conservation and ex-situ conservation that have been under taken around the world aimed at protecting threatened medicinal plant species from further destruction (Cunningham, 1993). This includes in-situ conservation, the conservation of species in their natural habitats (e.g. home garden), is considered the most appropriate way of conserving biodiversity in particular medicinal plants and ex-situ conservation is the preservation of components of biological diversity outside their natural habitats (e.g. Field gene bank, seed bank, botanical garden). In order to conserve useful plants (including medicinal plants) which are threatened due to natural or manmade factors in Ethiopia, in-situ and ex-situ conservation should be complimentarily implemented (Abebe Demissie, 2001).

4. Materials and Methods

4.1 Descriptions of the Study Area

The present study was conducted in Tselemti Wereda, North-West Zone, Tigray Regional State. The study site is located 1,112 km, 400 km and 90 km away from Addis Ababa (capital city of Ethiopia), Mekele city and Shire Enda-Silassie town, respectively. Tselemti Wereda is bounded by five neighboring Weredas, (namely Naedier-Adiet, Kola-Temben and Tanqua-Abrgele in the East, Walkait in the West, Asgede-Tsimbla in the North) as well as Amhara Regional State in the South. The altitudinal range of Tselemti Wereda falls between 850 and 1,300 m a.s.l. The range of temperature varies between 21 and 27° C and the average rainfall of the Wereda ranges from 650 to 800 mm. According to the Tselemti Wereda Planning and Finance Office, the total population of the Wereda is 176,063 (89,557 males and 86,506 females). The Wereda has two urban centers, namely Maitsebri (Which is the Wereda center) and Dimma. Maitsebri is found along the highway that leads from Mekelle to Gonder, whereas Dimma is off the main highway. Communities of the Wereda earn their livelihoods by farming crops and rearing livestock.

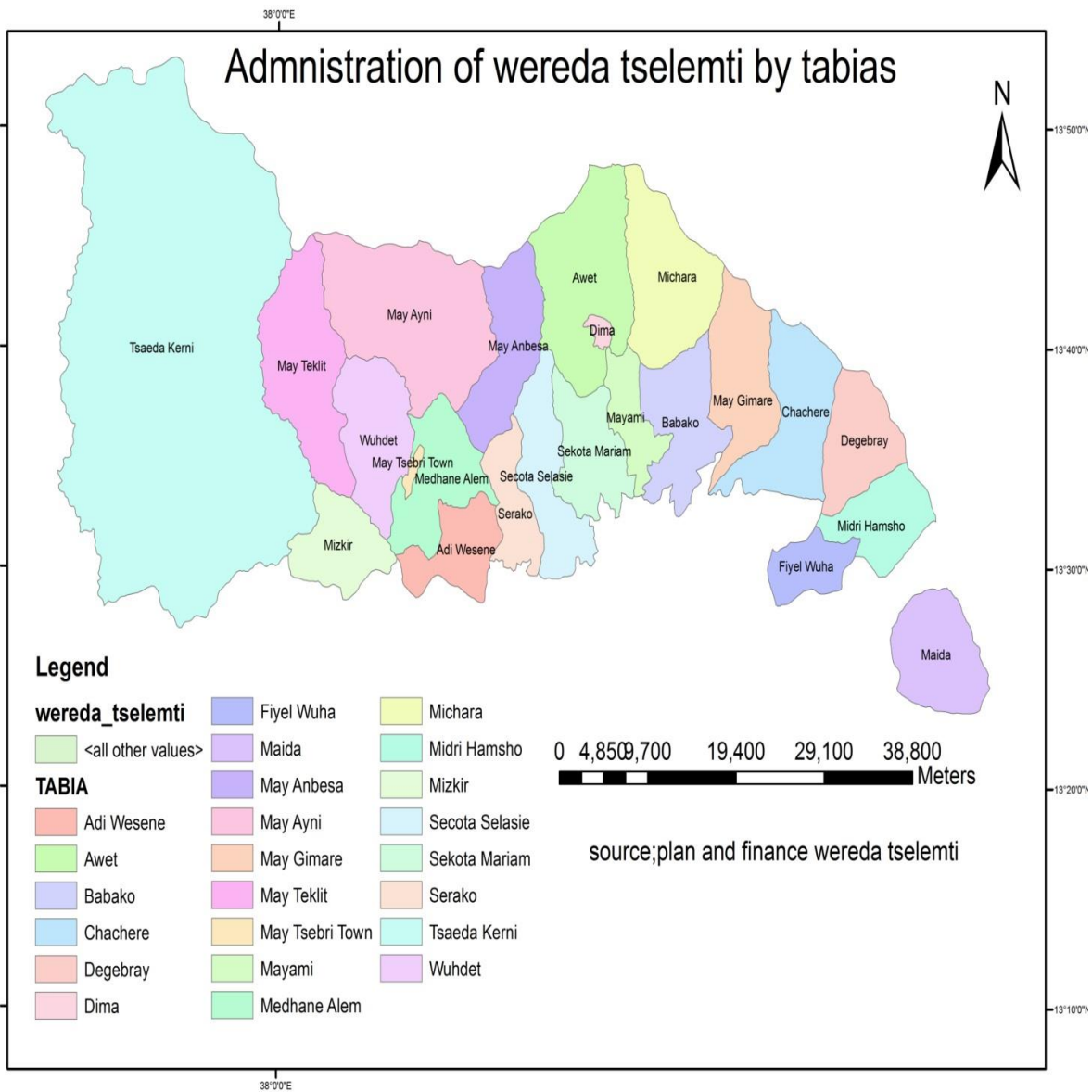


Figure 1. Map of the study area of Tselemti Woreda, Tigray Regional State

4.2 Selection of the Study Sites

Tselemti Wereda consists of 25 *kebeles*. Among these, the study was conducted in four *kebeles*, namely Tsaidakerni, Adiwesene, Mebrahtom Shila, and Hayelom. The study *kebeles* were selected based on the availability of traditional healers, access to the proposed study of medicinal plants, and altitudinal differences. The information sources to the selected four *kebeles* were chosen from amongst the elderly, as well as from the local authorities of the Wereda.

4.3 Selection of Informants

A total of 64 informants (52 males and 12 females), 16 individuals from each of the study *kebeles* from age of above 18 years were selected from the local communities. From these, 20 key informants (knowledgeable informants) and the rest 44 general informants were selected by purposive and snowball sampling techniques, respectively. The sample size was determined by using the formula Yemane (1967) cited in (Asmamaw Demeke and Achamyeleh Haimanot, 2018).

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

Where,

N= population size

n= sample size

e= acceptable level of error (0.05), Therefore, the sample size was determined by this equation.

4.4 Methods of Data Collection

The methods used in TMPs data collection were accomplished from December 1, 2018 to February 30, 2019 in the selected *kebeles* in strongly contact with the communities in the study sites. The methods of data collection were semi-structured interviews, guided field activities /direct observations and group discussions.

4.4.1 Semi-Structured Interviews

Interviews were carried out based on the prepared semi-structured checklists that consisting 20 main questions prepared first in Tigrigna and then translated to English.

The main focus of the interview was: I) Personal information of the respondents that included date of interview, *kebele*, name, age, gender, religion, education level, marital status and occupation. II) Information on the medicinal plants and their corresponding uses, which included common diseases of human and livestock, local name of the plants, parts of the plant used, condition of preparations, methods of preparations, dosages, mode of administrations, side effects and solutions, habits, habitats, threats of the medicinal plants, conservation methods, knowledge of propagation, domestication and cultivation of medicinal plants (Appendix 6).

4.4.2 Guided Field Observations

The researcher conducted repeated field observations with informants in order to obtain sufficient data to the study. Since, observation or field work is the process of gathering reliable information practically. Therefore, field work data were collected on the actual medicinal plants name, the parts used, condition of preparations, preparation methods, dosages, habits and habitats, ways of conservation of medicinal plants in the study sites with guided interviewee.

4.4.3 Group Discussions

Group discussions were made at each *kebeles* between 5 to 6 informants about the use and management of traditional medicinal plants such as medicinal plants used to treat different human and/or livestock diseases, local names, parts of the plant used, methods of preparations, dosages, side effects and solutions were discussed and recorded.

4.5 Statistical Analysis

Data collected from informants were entered in to Excel spreadsheet and summarized. In addition to this, descriptive statistics, informant consensus, preference ranking and pair-wise comparison were used for comparing the results.

4.5.1 Descriptive Statistics

Descriptive statistical methods such as percentages and frequencies were used to analyze and summarize the collected data about the use and management of traditional medicinal plants. Information gathered on medicinal plants such as medicinal plants used to treat human, livestock, and both human and livestock diseases, parts of the plants used, conditions of preparations, method of preparations, mode of administrations, habits, and habitats were analyzed by means of descriptive statistics.

4.5.2 Informant Consensus

Informant consensus was used to determine the reliability of medicinal plants information recorded during the interviews. The informants were contacted for at least two times for the same idea and the validity of the information was proved and recorded. At that time, if the idea of the informant different from the original information, it was rejected since it was considered irrelevant information. Therefore, only the relevant information was taken and statistically analyzed (Table 4). This method was taken from Alexiades (1996) cited in Mersha Ashagre (2011).

4.5.3 Preference Ranking

Preference ranking methods were also used in data analysis following Martin (1995) by selecting the five most effective plants based on their use value as suggested by most informants to treat specific disease called anthrax (Table 5). Eleven informants were selected to identify the most preferred medicinal plant species for treatment of anthrax. Each informant was considered the highest value (5) for plant species most preferred, about this illness and the lowest value (1) for the least preferred plant in their orders. At the end, each of the plant species values were summed and ranked.

4.5.4 Pair-wise Comparison

Pair-wise comparison can be used for evaluating the levels of importance of certain selected plants following the method of Martin (1995). Based on this, six medicinal plants were selected to treat evil eye by eight randomly selected informants to indicate the efficacies of these six medicinal plant species used to treat evil eye summed and ranked based on the report of the informants (Table 6).

5. Results

5.1 Medicinal Plant Species Used and Ailments Treated by Communities of Tselemti Wereda

The study area was concerned with diverse and rich source of medicinal plants. These serve to the local communities as source of medicines, financial incomes and other values. A total of 53 medicinal plants specie belonging to 52 genera 36 families were identified and documented from the study area.

In terms of number of species, Solanaceae with 5 species has the highest species. The second highest family in terms of species number was Lamiaceae with 3 species, the third highest families in terms of species number were Alliaceae, Apocynaceae, Asteraceae, Capparaceae, Cobretaceae, Cucurbitaceae, Fabaceae, Asteraceae, Phytolacaceae, polygonanceae, Rhamnaceae, and Rutaceae with 2 species each. The remaining families were represented by 1 species each (Table 1).

Table 1. Family names, genera, species and the corresponding percentage of medicinal plants species studied in Tselemti Wereda, Tigray Regional State

Serial No	Family name	Number of genera	Number of plant species	Percentage of plant species
1	Acanthaceae	1	1	1.89
2	Alliaceae	1	2	3.77
3	Amaranthaceae	1	1	1.89
4	Apocynaceae	2	2	3.77
5	Asteraceae	2	2	3.77
6	Bigniniaceae	1	1	1.89
7	Boraginaceae	1	1	1.89
8	Capparaceae	2	2	3.77
9	Caricaceae	1	1	1.89
10	Celastraceae	1	1	1.89
11	Cobretaceae	2	2	3.77
12	Cucurbitaceae	2	2	3.77
13	Ebenaceae	1	1	1.89
14	Eupherbiaceae	1	1	1.89
15	Fabaceae	2	2	3.77
16	Lamiaceae	3	3	5.66
17	Linaceae	1	1	1.89

18	Lobeliaceae	1	1	1.89
19	Malvaceae	1	1	1.89
20	Meliaceae	1	1	1.89
21	Moraceae	1	1	1.89
22	Moringanaceae	1	1	1.89
23	Phytolacaceae	1	2	3.77
24	Plumbaginaceae	1	1	1.89
25	Polygalaceae	2	2	3.77
26	Polygonaceae	1	1	1.89
27	Ranunculaceae	1	1	1.89
28	Rhamnaceae	2	2	3.77
29	Rosaceae	1	1	1.89
30	Rubiaceae	1	1	1.89
31	Ruttaceae	2	2	3.77
32	Sapinadaceae	1	1	1.89
33	Scrophulariaceae	1	1	1.89
34	Solanaceae	5	5	9.43
35	Vitaceae	1	1	1.89
36	Zingiberacea	1	1	1.89
Total		52	53	100

5.2. Medicinal Plants Used to Treat Human, Livestock and both Human and Livestock Diseases.

From the total medicinal plants reported by the respondents in the study area, 36 plant species (67.93%), 6 species (11.32%) and 11 species (20.75%) are used to treat human, livestock and both human and livestock ailments, respectively (Table 2).

Table 2. Ailments treated, plant species used and the corresponding percentage of medicinal plant species used to treat human, livestock and both human and livestock diseases

Types of ailment treated	Number of Plant Species used	Percentage of plant species
Human	36	67.93
Livestock	6	11.32
Both human and livestock	11	20.75
Total	53	100

5.3. Growth Forms of Medicinal Plants Used by Communities in the Study Area

The present study indicated that trees were the dominant growth forms with 21 species (39.62%), followed by herbs 19 species (35.85%), and the remaining others (Figure 2).

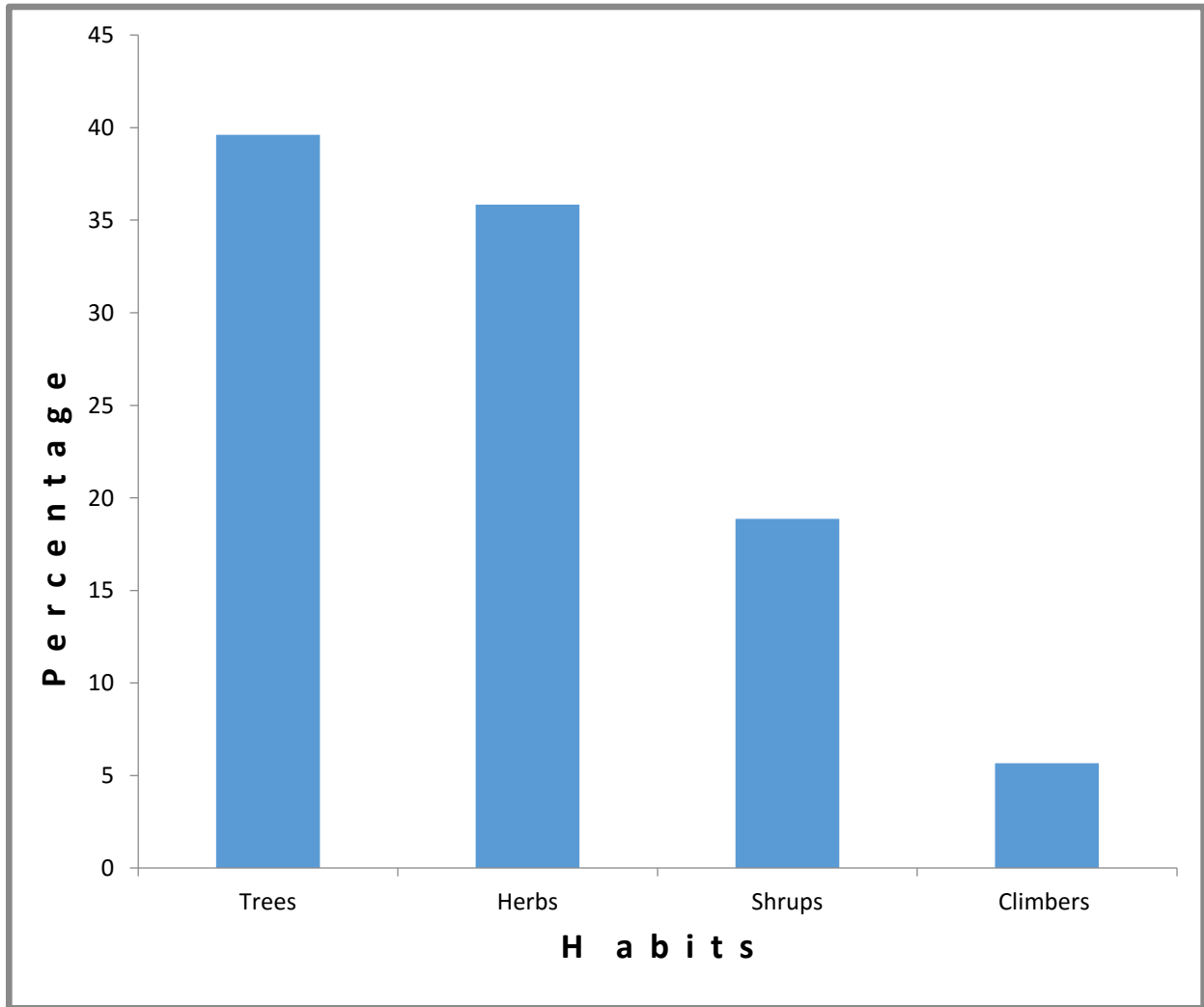


Figure 2. Growth forms and the corresponding percentages of medicinal plants used for human and/or livestock diseases

5.4. Parts of Medicinal Plants Used by the Communities in the Study Area

Communities in the study area used different medicinal plant parts to treat various types of human and/or livestock diseases. These included leaves, roots, seeds, barks, fruits, stems, whole plants, Mistletoe, bulbs, latex, and rhizomes (Figure 3). The most widely used medicinal plant parts for traditional remedy were leaves 25 species (31.64%), followed by roots 22 species (27.85%), seeds 8 species (10.13%), barks 5 species (6.33%) and others (Figure 3).

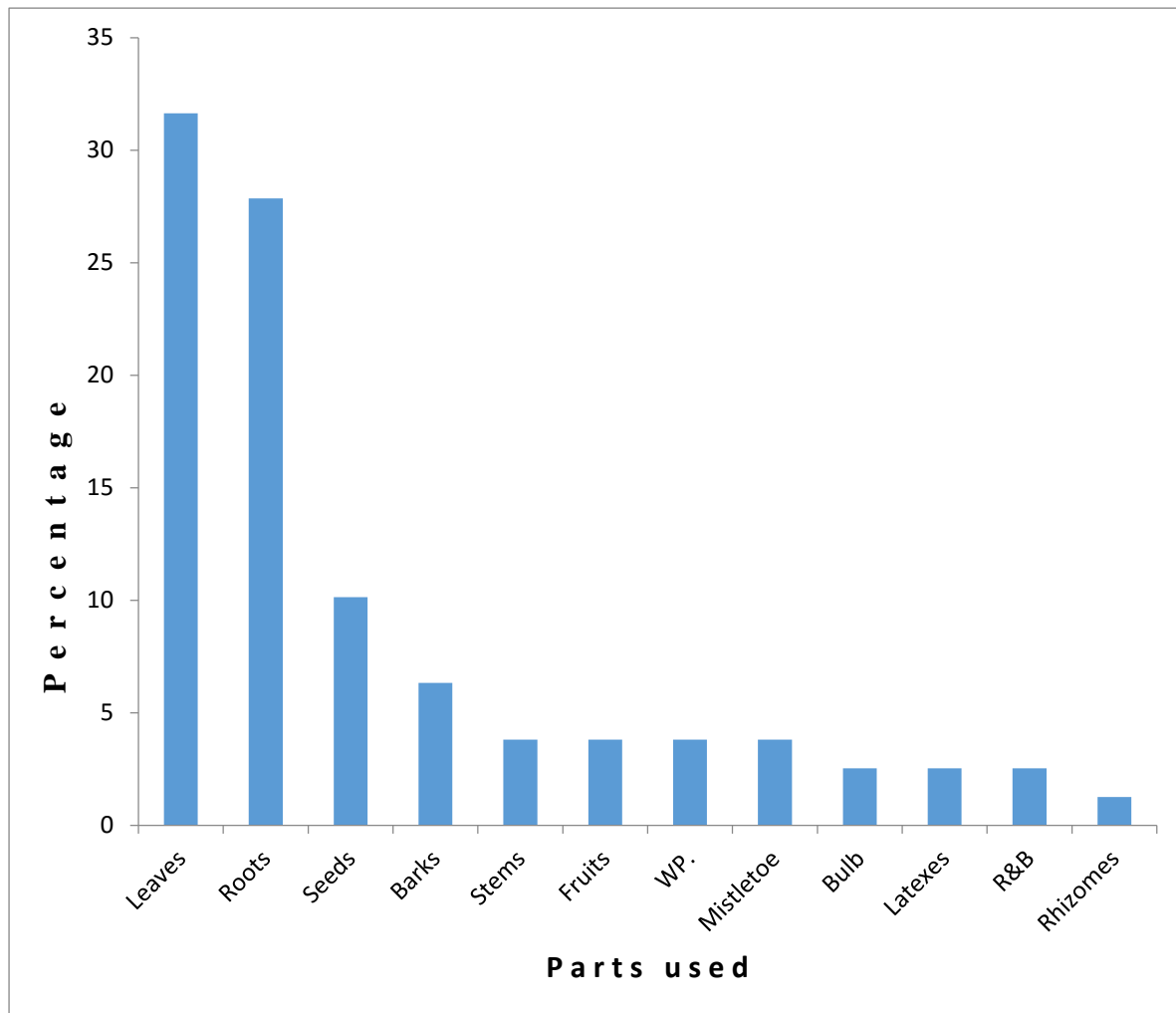


Figure 3. Plant parts and their corresponding percentages used to treat human and/or livestock diseases (WP, Whole plants; R&B, Roots and Barks; Mistletoe, a parasitic green plant usually grow on trees and locally is called “Teketia”)

5.5. Conditions of Preparations of Traditional Medicine

The present study showed that medicinal plant remedies are prepared from fresh plant parts 40 (50.63%), dried plant parts 9 (11.39%) and 30 plant parts (37.98%) are prepared from either fresh or dried (Figure 4).

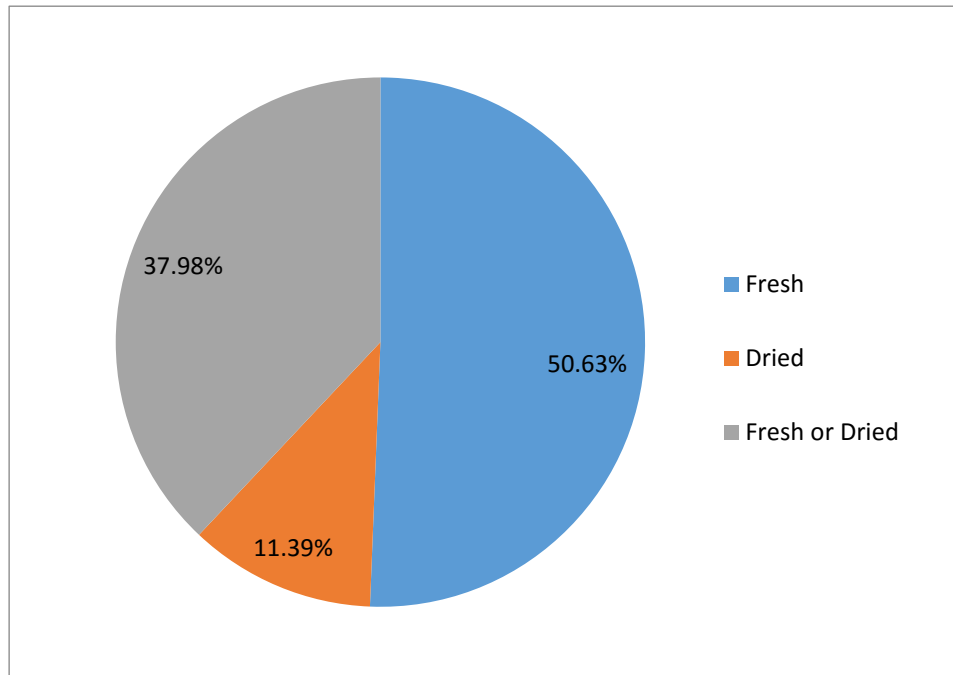


Figure 4. Conditions of medicinal plants used for the preparation of traditional medicine and the corresponding percentages

5.6. Methods of Traditional Medicines Preparation and Dosage

The communities in the study area used different forms of remedy preparations to treat human and/or livestock diseases. But, the most common methods of preparations were crashing 25 (31.64%), boiling 9 (11.40%), tying 8 (10.13%), crushing and mixing & crushing and squeezing 6 (7.60%) each, eating and fumigating 4 (5.06%) each and others (Table 3).

Table 3. Methods of preparation, number of preparation and the corresponding percentage of preparation of medicinal plants used to treat human and/or livestock diseases

Methods of preparation	Number of preparation	Percentage
Crashing	25	31.64
Boiling	9	11.40
Tying	8	10.13
Crushing and squeezing	6	7.60
Crushing and mixing	6	7.60
Eating	4	5.06
Fumigating	4	5.06
Roasting and crashing	3	3.80
Chewing	3	3.80
Squeezing	3	3.80
Grind and swallow	2	2.53
Heating and touching	2	2.53
Others	4	5.06
Total	79	100

In terms of dosage, the traditional healers as well as the whole informants or respondents in the study area reported that different measurements such coffee cup, litter, number, finger 'Kubaya', tea spoon and bottle cup were used for dosage prescription. Accordingly, dosage prescription to patients was different based on the different age levels. Generally, the dosage prescription for the children was lower than for adults. But, in most of the preparations, dosage prescription was unknown. The treatment duration was common for 1 up to 7 days according to the types of ailments.

5.7. Route of Applications of Traditional Medicine

The routes of applications of traditional remedies in the study area were oral, dermal, nasal and optical. From these routes of applications oral was to be the highest 33 (41.77%), followed by dermal 30 (37.98%), nasal 12 (15.19%) and optical 4 (5.06%)(Figure 4).

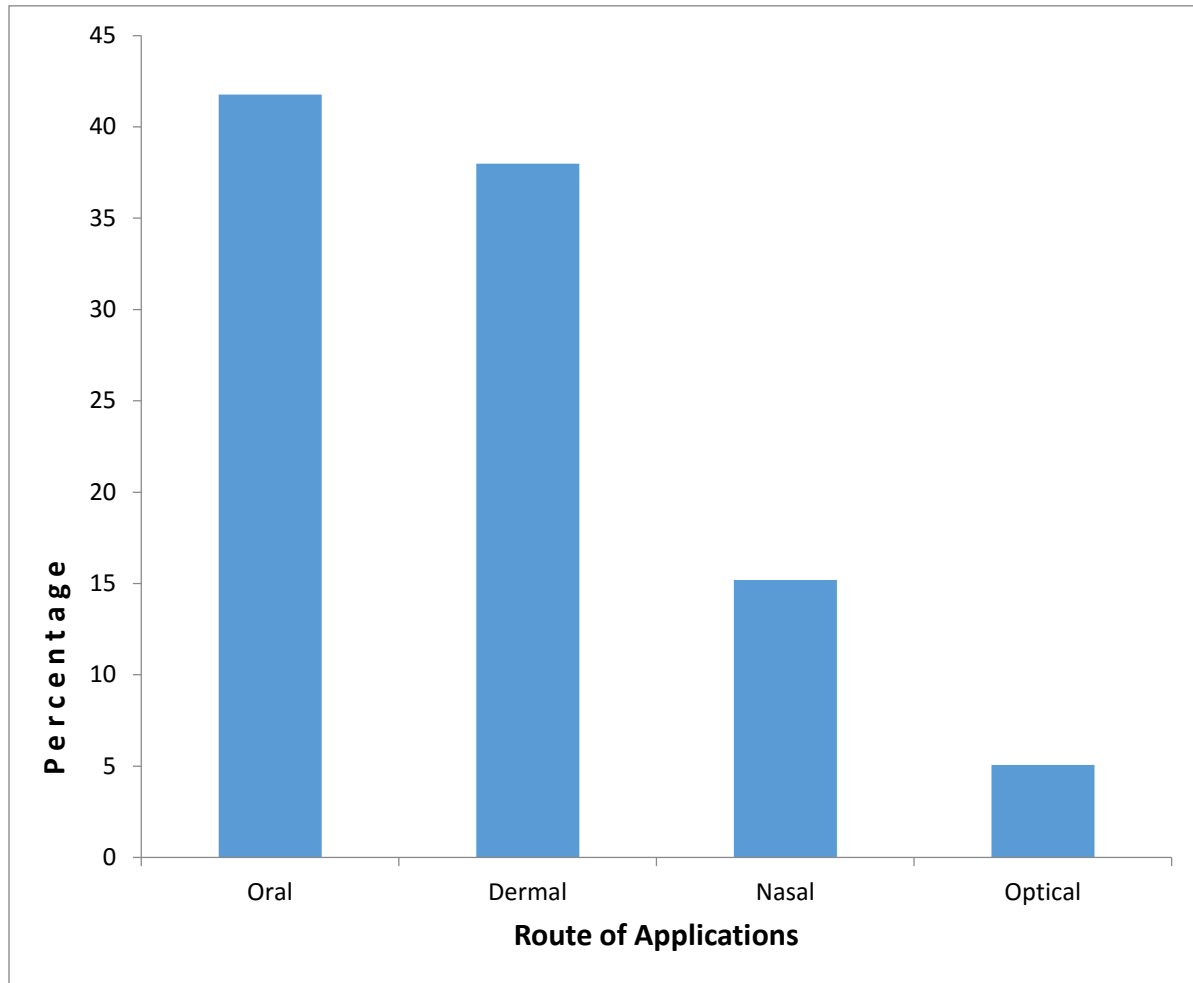


Figure 5. Routes of applications and the corresponding percentages of TMPs used for human and/or livestock diseases

5.8. Informant Consensuses of Most Frequently Used Medicinal Plants in the Study Area

The present study showed that some medicinal plants are well known than others in the study area. As a result, selected informants cited these medicinal plants repeatedly for remedies of various human and/or livestock diseases. For example, *Plumbago zeylanica* L. was cited by fifty six (87.50%) of informants as remedy for anthrax, *Withania somnifera* (L.) Dunal cited by fifty two (81.25%) of informants to treat eye disease; *Ocimum lamiifolium* (Hochst. Ex Nees) by forty eight (75%) informants to treat fibril illness; *Verbascum sinaiticum* (Benth.) by forty four (68.75%) informants to treat fibril illness and evil eye; *Cucumis dipsaceus* (Ehrenb) was cited by forty two (65.62%) of informants to treat anthrax and mouth closed diseases; *Justicia schimperiana* (L.) by thirty nine (60.94%) of informants to treat malaria and jaundice; *Lobelia rhynchopetalum* (Hemsl.) and *Moringa oleifera* (Lam.) by thirty five (54.69%) informants to treat evil eye and gastritis and hypertension, respectively (Table 4).

Table 4. Scientific name of medicinal plants, number of informants and the corresponding percentage of informant consensuses of most frequently used medicinal plants in the study area

Scientific name of medicinal plants	Number of informants	Percentage of the total informants (= 64)
<i>Plumbagozeylanica</i>	56	87.5
<i>Withania somnifera</i>	52	81.25
<i>Ocimum lamiifolium</i>	48	75
<i>Vervascumsinaiticum</i>	44	68.75
<i>Cucumisdipsaceus</i>	42	65.62
<i>Justicia schimperiana</i>	39	60.94
<i>Lobelia rhynchopetalum</i>	35	54.69
<i>Moringa oleifera</i>	35	54.69

5.9. Preference Ranking of Medicinal Plants Used to Treat Anthrax

At the time of different plant species used for the same health problem, people used preference of one over the other. Therefore, preference ranking was used for five medicinal plants that treat anthrax disease by randomly selected eleven key informants suggested that *Plumbago zeylanica* L. ranked first and hence it was the most effective medicinal plant to treat anthrax. *Cucumis dipsaceus* (Ehrenb), *Sida ovate* (Forssk), *Clerodendrum myricoides* (Hochst.) and *Solanum incanum* L. were ranked 2nd, 3rd, 4th and 5th, respectively (Table 5).

Table 5. Preference ranking of five selected medicinal plants based on the degree of effectiveness to treat anthrax as suggested by informants

Medicinal plant species	Respondents (R ₁ -R ₁₁)											Total	Rank
	R ₁	R ₂	R ₃	R ₄	R ₅	R ₆	R ₇	R ₈	R ₉	R ₁₀	R ₁₁		
<i>Clerodendrum myricoides</i> (Hochst.) Vitke.	2	4	1	3	2	3	1	2	1	2	1	22	4 th
<i>Cucumis dipsaceus</i> Ehrenb	4	3	4	5	3	5	3	4	5	4	2	42	2 nd
<i>Plumbago zeylanica</i> L.	4	5	5	4	5	4	5	5	4	4	5	50	1 st
<i>Sida ovata</i> Forssk	3	4	2	1	2	3	4	3	5	3	2	32	3 rd
<i>Solanum incanum</i> L.	1	2	1	1	3	1	2	4	2	2	1	20	5 th

5.10. Pair-wise Comparison

In the present study, eight informants were selected randomly by tossing coin to evaluate the efficacy of the species used to treat evil eye with pair comparison of six medicinal plants (Table 6). *L. rhynchopetalum* (Hemsl.), *Securidaca longepedunculata* (Fresen.), *Carissa spinarum* (L.), and *Capparis tomentosa* (Lam.) were ranked 1st, 2nd, 3rd and 4th respectively. *Artemisia abyssinica* and *V. sinaiticum* (Benth.) were less efficacious compared to the other four species.

Table 6. Pair-wise comparison of six medicinal plants used to treat evil eye

Medicinal plants	Respondents (R ₁ -R ₈)								Total	Rank
	R ₁	R ₂	R ₃	R ₄	R ₅	R ₆	R ₇	R ₈		
<i>Artemisia abyssinica</i>	4	1	2	2	1	3	1	1	15	5 th
<i>Capparis tomentosa</i>	3	2	1	1	0	4	3	2	16	4 th
<i>Carissa spinarum</i>	1	3	2	2	4	3	5	2	22	3 rd
<i>Lobelia rhynchopetalum</i>	4	2	5	3	5	5	4	4	32	1 st
<i>Securidaca longepedunculata</i>	2	4	3	5	4	3	5	4	30	2 nd
<i>Verbascum sinaiticum</i>	1	3	2	0	4	1	1	2	14	6 th

5.11. Threats, Managements and Conservations of Medicinal Plants of the Study Area

5.11.1 Threats to Medicinal Plants

Results of the interview and group discussion in the study area indicated that the major threats to plants in general and medicinal plants in particular were human induced factors such as deforestation, agricultural expansion, urbanization, charcoal, construction and natural factors included drought and climate change. In addition to this, the other threatening factors of plants in the study area were cutting plants for household activities and animal food, overgrazing, burning and harvesting roots for medicinal purposes.

5.11.2 Management and Conservation of Medicinal Plants in the Study Area

The local communities in the study area used various management and conservation strategies of plants in general and medicinal plants in particular. For example, many plants including medicinal plants were widely grown in farmlands, around homes as shade, in side of road and governmental and non-governmental protected areas. These included, conserved areas in the Administration for Refugees and Returnee Affairs (ARRA), plants found in the Orthodox Tewahdo Church forests, governmental plant nursery in Maitsebri Town. This grows and distributes seedling plants for the communities planting (afforestation) activities. The other conservation measure taken is Maidasat conserved area. The conserved areas are protected by the community, government and non-government organization of the study area. Even if the above management and conservation strategies were applied, Traditional medicinal plants in the study area are highly affected by different factors mentioned in the above. Communities in the study area have used most of the medicinal plants from wild. The diversity of plants in general and medicinal plants in particular from time to time is decreasing. According to the informants, the conservation areas are conserved due to other purposes rather than for medicinal plants. Most of the people (with exception of some healers) in the study area were with lack of awareness to conserve medicinal plants.

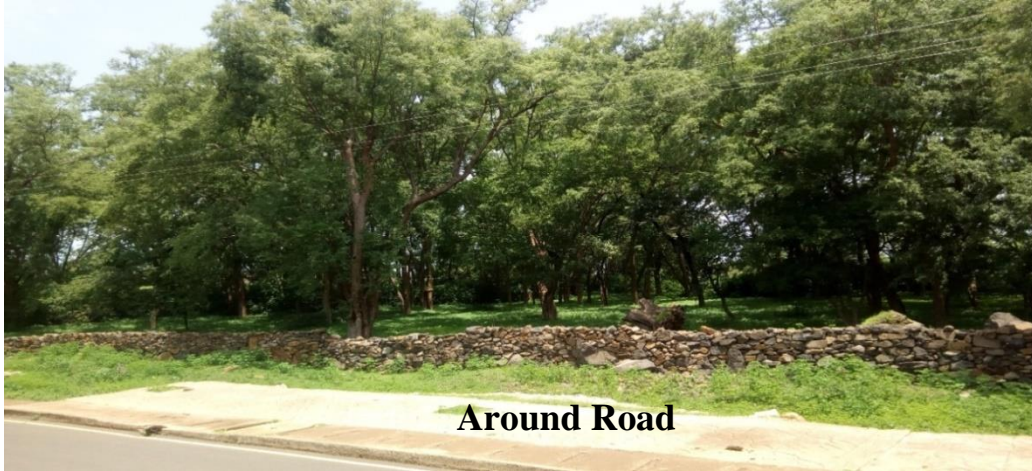




Figure 6. Some conservation area of the study

5.12. Domestication, Propagation and Cultivation of Medicinal Plants in the Study Area

The informants' response about domestication, propagation and cultivation of TMPs in the study area were very rare. Accordingly, 14 informants (21.88%), 8 informants (12.50%) and 21 informants (32.81%) responded that as participated in domestication, propagation and cultivation, respectively (Table 7).

Table 7. Informants' response in domestication, propagation and cultivation of medicinal plants

Activities	Informants Responses			
	Participated	Percent of the total informants (=64)	Non-participated	Percent of the total informants (=64)
Domestication	14	21.88	50	78.12
Propagation	8	12.50	56	87.50
Cultivation	21	32.81	43	67.19

As participated informants responded that, medicinal plants are domesticated, propagated and cultivated around their homes and farms in order to get easily access of traditional medicinal plants by taking seedling, through seeds and stem cuttings from wild and governmental nursery.

On the other hand, non-participated informants said that, they have never involved in domestication, propagation and cultivation because of lack of awareness, lack of knowledge how to domesticate and propagate medicinal plants, since mostly TMPs are limited to the individual healers to keep secret their medicinal values, due to lack of motivation and training by governmental experts. As a result, income is low. So, healers are careless.

6. Discussion

6.1 Traditional Medicinal Plants Used and Diseases Treated by Communities in the Study Area

In the present study, a total 53 medicinal plant species were found to treat different human and/or livestock diseases. The majority of these medicinal plant species used were reported as wild (66.04%). Similar studies reported that, large numbers of medicinal plants were collected from wild (Fitsumbrhan Tewelde *et al.*, 2017). In addition to this, some studies have shown that most of the medicinal plants used by Ethiopian people are harvested from wild habitats (Mirutse Gidey, 1999; Tesfay Awas and Zemedede Asfaw, 1999) This practice of harvesting medicinal plants from the wild indicates that medicinal plants cultivation, propagation and domestication are seriously limited.

Interestingly, among the total species studied, 36 species (67.93%), 6 species (11.32%) and 11 species (20.75%) are noted to treat various human, livestock and both human and livestock diseases, respectively. The finding showed that use of traditional medicine in human was higher than in livestock could be due to humans faced to different diseases and peoples of the study area were aware to human rather than livestock.

Medicinal plants in family distribution noted first, solanaceae with 5 species (9.43%), followed by Lamiaceae 3 species (5.66%), and others (Table 1). This idea is different with Eyasu Chama (2017) and Getnet Chokole (2011) ideas, in which their findings showed that the Asteraceae and followed by Fabaceae have contributed the highest medicinal plants species in Limbo Kemkem Wereda, South Gonder Zone and in Dmot-Gale District, Wolaita Zone, South Ethiopia, respectively.

6.2 Habits, Plant Parts and Conditions of Preparations Used in the Study Area

The growth forms of medicinal plant species used in the study area, trees were the dominant growth forms with 21 species (39.62%), followed by herbs 16 species (35.85%), and others (Figure 2). This finding showed that the most dominant life forms of medicinal plants in the study area were trees followed by herbs. This could be due to better availability of trees in the study areas. Similar results were reported by Gidey Yirga *et al.* (2015) trees 41.74% were the

most frequently used, followed by herbs 38.26% and shrub 17.39% from Kunama ethnic group in Northern Ethiopia. Similar findings were also reported in Ethiopia, for instance, Endalew Amenu (2007) identified 37% trees and 29.6% herbs from Ejaji area in West Shoa for the treatment of livestock ailments.

In terms of remedy preparation in the study area, communities used different plant parts for traditional medicinal purposes. But, the most commonly used plant parts were leaves 25 (31.64%), followed by roots 22 (27.85%), and others (Figure 3). This idea agreed with other studies (Endalew Amenu, 2007; Eskedar Abebe, 2011; Haile Yineger and Delenasaw Yewhalaw, 2007; Fitsumbirhan Tewelde *et al.*, 2017; Miruts Gidey and Gobena Ameni, 2003 and Mersha Ashagre, 2011) who reported that leaves followed by roots were the most dominant plant parts used in remedy preparations. The most frequent use of leaves by the communities of the study area in the preparation of their remedies could partially be related to the availability of this plant part throughout the year, as leaves were usually harvested from perennial trees and shrubs. As compared to other plant parts, such as stem, bark, bulb and whole plant, harvesting leaves possess relatively less danger to the existence of a plant. Therefore, use of leaves for traditional medicine mean use of the plants in sustainable manner.

In the study area remedies are mostly prepared from fresh plant parts. In line with this, other studies conducted in different parts of Ethiopia (Mirutse Gidey and Gobena Ameni, 2003) in Southern Ethiopia; (Mersha Ashagre, 2011) in Bule Hora District of Borana Zone, Oromia Region; (Tlahun Tolossa, 2018) in Berbera District, Bale Zone Oromia) reported that the majority of remedies prepared from fresh plants material. This indicated that using fresh plant materials are the most advisable for traditional medicines.

6.3 Ways of Preparations, Dosages and Routes of Applications

There were various methods of traditional medicinal plant preparations in the study area. The most dominant mode of preparation was in the form of crushed which contains (31.64%), followed by boiling (11.40%) and tying (10.13%) (Figure 3). This finding agrees with the results of other ethno medicinal studies carried out by Atinafu Kebede *et al.* (2017) they found that the main ways of preparation was crushing. During preparation some substances like water, honey,

sugar, butter, milk, and/or oil were added with the plant part to some of the remedies. According to the informants stated that, even if different measurements like coffee cup, tea spoon, bottle cup, Litre, finger were used for dosage prescription, but there was lack of agreement among the informants on the dosage of certain remedies prescribed in the study area. This indicates lack of precision and standardization as one of the drawbacks for the recognition of traditional health care system.

The most frequently used route of traditional medicinal applications in the study area were oral (41.77%) followed by dermal (37.98%). This finding indicates that there is high prevalence of internal parasites and skin related diseases in the study area. The result is similar with other studies conducted elsewhere in Ethiopia Asmamaw Demeke and Achamyelch Haimanot (2018) in Gozamen Wereda, East Gojjam Zone; Asfaw Tora and Tarekegn Heliso (2017) in Wolaita Zone, Southern Ethiopia reported that oral, followed by dermal were the dominant applications of traditional medicine.

6.4 Threats to Medicinal Plants

The informants in the study area stated that before 20 years ago, the study area was covered with plenty of diversity of plants in general and medicinal plants in particular. Because of that, most of medicinal plants were easily accessible everywhere and every season in the study area. But, today, this situation is changed. Medicinal plants are at increasing risk from destruction of their habitats due to human induced factors such as deforestation, agricultural expansion, urbanization, construction, charcoal, overgrazing and natural factors included climate change and drought were the major threats in the study area. As a result, many plants are disappeared. In addition to this, communities or traditional healers are forced to travel a long distance to get some of the medicinal plants. For example, *Artemisia abyssinica* (Sch.) Bip., *Clerodendrum myricoides* (Hochst.) Vatke., *Hagenia abyssinica* (Bruce) J.F. Gmel., *Lobelia rhynchopetalum* (Hemsl.), *Phytolacca dodecandra* (L'Herit), *Securdaca longepedunculata* (Fresen.), *Thymus schimperi* (Ronniger) and *Zehneria scabra* (Linn.F.) medicinal plants are not easily accessible in the study area. Similarly, Ensermu Kelbessa *et al.* (1992) and Edwards (2001), stated that habitat and species are being lost rapidly as a result of the combined effects of environmental degradation, agricultural expansion, deforestation and over harvesting of species.

Moreover, Endalew Amenu (2007) in his study stated that, there are two sources of threats to medicinal plants, i.e. manmade and natural causes.

6.5 Domestication, Propagation and Cultivation of Medicinal Plants

The activities of domestication, propagation and cultivation were highly minimal. In the study area, the communities domesticated a very few in number and common medicinal plants in their home gardens and farmlands for the purpose of medicine such as *W. somnifera* (L.) Dunal, *J. schimperiana* (Hochst. Ex Nees), *P. zeylanica* L., *O. lamiifolium* (Hochst. ex Benth.), and *M. oleifera* (Lam.). On the other hand, some other traditional healers in the study area do not have interest to grow plant species that are used to treat specific ailments in their home gardens in order to keep secret their medicinal knowledge. That means, most of the medicinal plants found in the home gardens were these also known to have other ornamental uses as shelter, fence and/or use as foods. Except in a few cases in which a few food crops, plants as a shelter to control temperature and soon. There is no organized domestication, propagation and cultivation of plants species for medicinal purposes. Similarly, Fitsum Tewelde *et al.* (2017) stated that, local people cultivate some popular medicinal plants in their home gardens and farmlands for the purpose of medicine.

7. Conclusions and Recommendations

7.1 Conclusions

- The present study revealed that several plant species were used as traditional medicine in the study area. A total of 53 traditional medicinal plants (TMPs) were collected and recorded from 4 *Kebeles* of the study area. Which of 36 plant species (67.93%), 6 species (11.32%) and 11 species (20.75%) were used to treat various human, livestock and both human and livestock diseases, respectively. This showed that traditional medicine, which involves the use of medicinal plants, is supporting Wereda Tselemti community in addressing the requirements of primary health care system.
- From the result, most of the TMPs utilized by the communities of the study area were collected from wild (66.04%) whereas only few numbers of medicinal plants were documented from crop fields (13.21%) and home gardens (20.75%). That means, the wild areas were the most sources of the TMPs. This shows that, there is lack of conserving medicinal plants in the study area.
- In the study area, trees were highly used (39.62%) for medicinal purposes than herbs and shrubs (35.85% & 18.87%), respectively. Leaves (31.64%) were used for medicinal values more than other plant parts for the preparations of human and/or livestock remedies. But, TMPs used to treat livestock were very rare when compared to human.
- In the preparations of traditional medicinal plants, crushing (31.64%), followed by boiling (11.40%) and tying (10.13%) were dominant in the treatment of human and/or livestock diseases.
- Remedies were administered mostly through oral (41.77%) followed by dermal (37.98%) applications based on the types of diseases. But, in most cases, dosage prescription was unknown. Therefore, lack of precision and standardization was one of the drawbacks for the recognition of traditional health care system.
- As suggested by the informants, human induced factors such as agricultural expansion, deforestation, urban expansions, fire wood, charcoal and natural factors included drought and climate change were the major threats to plant species in general and to medicinal plants in particular in the study area.

7.2 Recommendations

Based on the results of the present study, the following recommendations are suggested:

- ✓ The local communities in Wereda Tselemti should be involved in conservation and management of plants in general and medicinal plants in particular.
- ✓ Attention should be given to the medicinal plants that were reported as not easily accessible in the study areas.
- ✓ Traditional healers should discuss with each other to moderate dosage precision and standardization of the traditional health care system.
- ✓ The government should give attention to the proper management and conservation activities of traditional medicinal plants of the study area by establishing Traditional Healers Associations; supplying medicinal plants in the form of seedling and forest expansion.
- ✓ Technical support for intensive management and conservation activities (including selection, domestication, propagation and cultivation) of traditional medicinal plants are urgently required for backstopping the healthcare system of the studied communities.

8. References

- Abebe Dedissie (2001). Biodiversity conservation of medicinal plants: conservation and sustainable use of medicinal plants in Ethiopia: problems and prospects. **In:** (Medhin Zewdu and Abebe Demissie, ed.). *Conservation and Sustainable Use of Medicinal plants in Ethiopia*. IBCR, Addis Ababa. Pp. 137.
- Abdulhamid Bedri, Sebsib Belay, Werkinah Nigatu and Addisu Asmare (2004). Survey Results: Socio economic study of medicinal plants. Addis Ababa University, Addis Ababa.
- Alebie Getachew, Befikadu Urga and Amha Worku (2017). Systematic review on traditional medicinal plants used for the treatment of Malaria in Ethiopia. *Malaria Journal*. pp. 2-3.
- Ashenif Tadele (2017). *Ethiopian Herbal Medicine Research Article Profile Part I*, Traditional and Modern Medicine Research Directorate, Addis Ababa, Ethiopia.
- Asmamaw Demeke and Achamayeleh Haimanot (2018). Assessment of medicinal plants and their conservation status in case of Daligaw Kebela, Gozamen Wereda, East Gojam Zone. *Journal of Biodiversity, Bio prospecting and Development* **5**: 170. DOI: 10.4172/2376-0214.1000170
- Amare Getahun (1976). *Some common medicinal and poisonous plants used in Ethiopian folk medicine*. Pp. 63. Addis Ababa University, Ethiopia.
- Atinafu Kebede, Shimels Ayalew, Akalu Mesfin, and Getachew Mulalem (2017). Assessment on the use, knowledge and conservation of Medicinal plants in selected Kebeles of Dire Dawa Administration, Eastern Ethiopia. *Journal of plant sciences*.**5** (2): Pp. 5960.
- Cunningham, A. B. (1993). *Africa medicinal plants: Setting properties at the interface between conservation and primary health care*. People and plants working, Paris. UNESCO. Pp. 1-7750.
- Dawit Abebe (1986). Traditional medicine in Ethiopia: The Attempts being made to promote it for effective and better Utilization. *SINET: Ethiopian Journal of Science (Supp.)*: pp. 62-69.
- Dawit Abebe (2001). The role of medicinal plants in Health care Coverage of Ethiopia, the possible benefits of integration. **In:** (Medhin Zewdu and Abebe Demissie (ed.)). *Conservation and Sustainable Use of Medicinal plants in Ethiopia*. Proceeding of the

- National workshop on Biodiversity Conservation and Sustainable use of medicinal plants in Ethiopia, 28 April- 01 May 1998, pp.107-118. IBCR, Addis Ababa.
- Dawit Abebe and Ahadu Ayehu (1993). Medicinal plants and Enigmatic Health practices of Northern Ethiopia. B.S.P.E. Addis.
- Edwards S. (2001). The ecology and conservation status of medicinal plants in Ethiopia. What do we know? **In:** (Medhin Zewdu and Abebe Demissie (eds). *Conservation and Sustainable Use of Medicinal plants in Ethiopia*. Proceeding of Natural Workshop on Biodiversity Conservation and Sustainable use of medicinal plants in Ethiopia, Institute of Biodiversity Conservation and Research, Addis Ababa Ethiopia. pp. 46-55.
- Endalew Amenu (2007). Use and management of medicinal plants by indigenous people of Ejaji area (Chelya Woreda) West Shoa, Ethiopia. pp. 7-10. M.Sc. Thesis Addis Ababa.
- Endashaw Bekele (2007). Study on Actual Situation of Medicinal Plants in Ethiopia. Page address: <http://www.endashaw.com>.assessed on oct.10, 2010.
- Ensermu Kelbessa, Sebsebe Demissew, Zerihun Weldu, and Edwards, S. (1992). Some of threatened endemic plants of Ethiopia. In: (Edwards, S. and Zemedu Asfaw eds.). The status of some plants in parts of tropical Africa. Pp.35-55.NAPRECA. No 2. Botany 2000: East and Central Africa.
- Eskedar Abebe (2011). Ethno botanical study on medicinal plants used by local communities in Debark Woreda, North Gonder Zone, Amhara Regional State, Ethiopia. M.Sc. Thesis, Addis Ababa University. PP. 7-22.
- Eyasu Chama (2017). The study on Medicinal Plants and Their Uses to Treat Human Ailments in Damot-Gale District, Wolaita Zone, South Ethiopia. *International Journal of Africa and Asia Studies*, **30**:.PP. 88-93.
- Fassil Kibebew (2001). The status and availability of oral and written knowledge on traditional health care in Ethiopia. **In:** (Medhin Zewdu and Abebe Demissie (eds). *Conservation and Sustainable Use of Medicinal plants in Ethiopia*. Proceeding of the National workshop on Biodiversity Conservation and Sustainable use of medicinal plants in Ethiopia, 28 April- 01 May 1998, pp. 107-119. IBCR, Addis Ababa.

- Fitsumbrirhan Tewelde, Mebrahtom Mesfin, and Semere Tsewene (2017). Ethno botanical Survey of Traditional Medicinal Practices in Laelay Adi-yabo District, Northern Ethiopia. *International Journal of Ophthalmology and visual Science*. **2** (4): pp. 80-87. DOI: 10.11646/j.ijovs.20170204.11.
- Getnete Chekole (2011). An Ethno botanical Study of Plants used in Traditional Medicine and as wild foods in and around Tara Gedam and Amba Remnant Forests in Limbo Kemkem Woreda, South Gondar Zone, Amhara Region, Ethiopia. pp. 11-56. M.Sc. Thesis, Addis Ababa University.
- Gidey Yirga (2010). Use of Traditional Medicinal plants by indigenous people in Mekele Town, capital city of Tigray Regional State of Ethiopia. *Journal of Medicinal plant Research* **4** (17): pp.1799.
- Gidey Yirga, Meaza Gidey, Tadese Beyene, Signorini, A. M. and Bruschi, P. (2015). Traditional medicinal plants used by Kunama ethnic group in Northern Ethiopia. *Journal of Medicinal Plants Research* **9** (15): pp. 494-508. DOI: 10.5897/JMPR 2014.5681
- Haile Yineger and Delenasaw Yewhalaw (2007). Traditional Medicinal plant knowledge and use by local healers in Sekoru Woreda, Jimma Zone, Southern Western Ethiopia. *Journal of Ethno botanical and Ethno Med.* **3**: Pp. 24.
- Hamilton, A. C. (2004). Medicinal Plants and Conservation Unit, WWF-UK, Panda House, Catteshall Lane, Godalming. Pp. 35.
- Jansen, P.C.M. (1981). *Species condiments and medicinal plants in Ethiopia, their Taxonomy and agricultural Significance*. Center for Agricultural Publishing and Documentation, Wageningen, Netherlands. Pp. 325.
- Karunamoorthi, K., Jegajeevanran, K., Vijayalakshmi, J., and Mengistie, E. (2012). Traditional Medicinal Plants: A Sources of Phytotherapeutic Modality in Resource-Constrained Health care settings. *Journal of Evidence-Based Complementary and Alternative medicine* **18**(1): pp. 67-69.

- Kebede Deribe, Alemayehu Amberbir, Binyam Getachew, and Yunis Musema (2014). A historical overview of traditional medicine practices and policy in Ethiopia. *In Ethiopian Journal of Health Development*. Dol:10.4314/ejhd.v20i2.10023
- Legesse Negash (2010). A selection of Ethiopia's Indigenous Trees: Biology, Uses and Propagation Techniques. Addis Ababa University Press, Addis Ababa.
- Maffi, L. (1999). Linguistic Diversity. Pp.19, In: Cultural and Spiritual Values of Biodiversity.
- Martin, G. J. (1995). Ethno botanical: A method manual. Chapman and Hall, London. pp. 265-270.
- Mersha Ashagre (2011). Ethno botanical Study of Medicinal plants in Guji Agro-Pastorilists, Blue Hora District of Borana Zone, Oromia Region, Ethiopia. M.Sc. Thesis ,Addis Ababa University.
- Mirutse Gidey (1999). An Ethno botanical Study of Medicinal plants used by the Zay people in Ethiopia. M.Sc. Thesis Uppsala, Sweden.
- Mirutse Gidey and Gobena Ameni (2003). An Ethno botanical Survey on plants of Veterinary importance in two Woredas of Southern Tigray, Northern Ethiopia. *SINET: Ethiopian Journal of Science* **26**(2): pp. 126-130.
- Mulugeta Kebebew and Erchafo Mohamed (2017). Indigenous knowledge on use of medicinal plants by indigenous people of Lemo District, Hadiya Zone, Southern Ethiopia. *International Journal of Herbal Medicine*, **5**(4): Pp. 124.
- Quanash, N. (1998). *Bicultural diversity and integrated health care in Madagascar. Nature and Resource*. **30**: pp. 18-22.
- Singh R. Medicinal plants: A Review. *Journal of plant sciences*. Special Issues: Medicinal plants. **3**(1-1) 2015, PP. 51-52. Doi:10.11648/j.jps.s20150301001.18.
- Stephen, A. H. and Justin, W.V. (2003). *Traditional Knowledge and Intellectual Property: A Handbook on Issues and Options or Traditional Knowledge Holders in Protecting their Intellectual Property and Maintaining Biological Diversity*. American Association for the Advancement of Science (AAAS) and Human Rights Program. Washington, DC.

- Tafesse Mesfin and Mekonen Lemma (2001). The role of traditional veterinary herbal medicine and its constraints in animal health care system in Ethiopia. **In:** (Medhin Zewdu and Abebe Demissie eds.). *Conservation and Sustainable Use of Medicinal plants in Ethiopia*. Proceeding of the National workshop on Biodiversity Conservation and Sustainable use of medicinal plants in Ethiopia, 28 April-01 May 1998, pp. 23-33. IBCR, Addis Ababa.
- Tesfaye Awas and Zemed Asfaw (1999). Report on Ethno botanical Study Nations, of Nationalities and People in Gambella and Benishangul Gumuz Regional States. Progress Report to Research and Publication Office, Addis Ababa University, Addis Ababa.
- Thomas, H. (1995). Indigenous knowledge, Emancipation and Alienation. *Journal of knowledge Transfer and Utilization* **8**: pp. 63-73.
- UNESCO (2018). What does indigenous knowledge mean? A compilation of Attributes. Indigenous Corporate Training INC. [https://www.ictinc.ca/blog/what does](https://www.ictinc.ca/blog/what%20does).
- WHO (2000). *General Guidelines for Methodologies on Research and Evaluation of Traditional Medicine*; World Health Organization: Geneva, Switzerland.
- WHO (2002). *Traditional Medicines Strategy 2002-2005*. World Health Organization, Geneva WHO. PP. 1-3.
- Woyek, R. and Gorjestani, N. (1998). Indigenous knowledge for development: A Framework for Action World Bank. National Institute of Education, Nanyang Technological University Singapore.
- Yeneayehu Fenetahun and Girma Eshetu (2017). A review on ethno botanical studies of medicinal plants used by agro-pastoral communities in Ethiopia. *Journal of medicinal plants studies*. pp. 35-40.
- Zemed Asfaw (2001). The Role of Home Garden in Production and Conservation of Medicinal plants. **In:** (Medhin Zewdu and Abebe Demissie eds.). *Conservation and Sustainable Use of Medicinal plants in Ethiopia*. Proceeding of the National workshop Biodiversity conservation and Sustainable use of medicinal plants in Ethiopia, 28 April- 01 May 1998, pp. 76-91. IBCR, Addis Ababa.

9. Appendices

Appendix 1. English name, and local name of human and livestock diseases which are treated in the study area.

Serial No	English name	Local name
1	Amoeba	Ameba
2	Malaria	Aso
3	Gastritis	Chegora
4	Evil eye	Buda
5	Jaundice	Eshwa
6	Tooth ache	Sni himam
7	Head ache	Risi himam/merzen/
8	Nose bleeding	Nesri
9	Blood pressure	Tsekti dem
10	Cough	Se-al
11	Diarrhea	Wutsiat
12	Common cold	Gunfae
13	Abdominal pain	Kurtset
14	Wound	Kusli
15	Anthrax	Megerem
16	Fibril illness	mi-chi
17	Dandruff	Forofer
18	Herpes	Almaz bale chira
19	Night blindness	Hima
20	Eye diseases	Ayni himam
21	Rabies	Nksit himum kelbi
22	Back bone pain	Hiko himam
23	Rh-factor	Shitolay

24	Ascariasis	Wusifat
25	Tape worm	Kosso/habi/
26	Fire burn	Hawi blae
27	Constipation	Dirket
28	Swelling at finger	Lifi
29	Snake bite	Temen nksit
30	Scorpion bite	Enkrbit niksit
31	Retained placenta	Mizingae medhanit
32	TB/tuberculosis/	Tivi
33	Broken bone	Sbar atsmi
34	Swelling	Hibet
35	Abdominal parasite	Nay kebdi hasaku
36		Megli enchiwa
37	Diabete	Himam shikoriya
38	Wart	Adgi tub
39	Stabbing pain	Wug-at
40	Mouth clothed diseases	Af mlgum
41	Leech	Alekti
42	Bloating	Menfahti
43	Wound donkey & camel	Kusli adgin n beklin
44	Hen diarrhea	Derho witsat
45	Animal diarrhea	Wozwuz
46	Lice & fleas	Nikisit kumal kunchi
47		Lehasito
48	Pancreas disease	Tafia
49	Rheumatism	Kurtmat
50	Naked swelling in cattle	Zigag

Appendix 2. Scientific name, family name, local name, habit, habitat, condition used, disease treated, part used, method of preparation and dosage, route of application of traditional medicinal plants used for human, livestock and both human and livestock diseases.

Key: Habit (Ha): Tree (T); Shrub (Sh); Herb (H); Climber (Cl); Mistletoe (Mis). Habitat (Hab): Wild (W); Home garden (Hg); Crop field (Cf). Part used (PU): Leaf (L); Root (R); Stem (St); Bark (B); Seed (Se); Fruit (Fr); Bulb (Bu); Rhizome (Rh); Root & Bark (R & B); Leaf & Stem (L & St); Whole plant (Wp.). Condition used (Con. Used): Fresh (F), Dry (D), and Fresh or Dry (F or D). Used for (U. for): Human (H); Livestock (Ls); Human and Livestock (H & Ls); Route of Application (R. appl.).

No	Scientific name	Family name	Local name	H a	Ha b	P. U.	Con. used	Disease treated	U. for	Method of preparation	R. appl.
1	<i>Achyranthes aspera</i> L.	Amaranthaceae	Telenji	H	W	R	F or D	Anti-abortion	Hu	Root from 3 <i>Achyranthes aspera</i> tie in 3 sides and move 3 times from legs to head and finally tie at the backbone.	Dermal
						L	F	Noose bleeding	Hu	Put the leaf in the nose when bleeding	Nasal
2	<i>Allium cepa</i> L.	Alliaceae	Keyhs higurti	H	Hg	Bu	F	Hypertension	Hu	The bulb is crushed and immersed in little water for 1 day and then filtrate by clean cloth & drunk before food.	Oral
						Wp	F or D	Bloating	Li	The whole part is pounded, mix with water and then the pure solution is drunk.	Oral
3	<i>Allium sativum</i> L.	Alliaceae	Tsaidashigurti	H	Fc	Bu	F	Cough	Hu	The bulb of <i>Allium sativum</i> , boiled leaf of <i>Citrus limon</i> in water and honey mix together. And then eating morning for 3 days.	Oral

4	<i>Anogeissus leiocarpa</i> (Dc.) Guill and Perr.	Combretaceae	Hanse	T	W	Ba	F	Abdominal pain	Hu	Grind & swallow the liquid.	Oral
						L & Ba	F	Jaundice & Malaria	Hu	Its bark or new leaf boiled with milk & drink 1 coffee cup morning with empty stomach.	Oral
5	<i>Artemisia abyssinica</i> Sch. Bip.	Asteraceae	Chukugn	H	W	L	F or D	Common cold	Hu	The leaf is pounded and sniffed.	Nasal
						R	F	Evil eye	Hu	The root is crushed and squeezed through nasal.	Nasal
6	<i>Azandirachta inindica</i> A. Juss.	Meliaceae	Nimhumer	T	Hg	L	F	Hen diarrhea	Li	Crushing the leaf a bottle cup of the solution drink to the hen.	Oral
7	<i>Boscia angustifolia</i> A. Rich.	Capparaceae	Kerm	T	W	R	F or D	Dislocated Backbone	Hu	Tying the root to backbone part for 7 consecutive days.	Dermal
8	<i>Calotropis procera</i> (Ait.) Ait. F.	Apocynaceae	Ginda	T	W	R	D	Snake bite	Hu	If you tie the root not bite snake but if you bite heat in fire and touch the biting area.	Dermal
						La	F	Wart	Hu	Make to bleed the wart & add the latex.	Dermal
							F	Zigag (In Tigrigna)	Li	Collect the latex and mix with none water touching butter & cream circle the swelling part "Zigag"	Dermal
9	<i>Capparis tomentosa</i> (Lam.)	Capparaceae	Andel	T	W	R	F or D	Evil eye & headache	Hu	Crush the root and take the juice drop it nasally in the morning & evening for 3 days.	Nasal
10	<i>Capsicum annum</i> L.	Solanaceae	Shirba berber	H	Fc	Fr	F or D	Abdominal parasites	Hu	Eat the fresh with Enjera or crush the dried fruit then a	Oral

										powder of it is added with milk & drink.	
11	<i>Cordia Africana</i> Lam.	Boraginaceae	Awhi	T	W	L	F or D	Herpes & Fire burn	Hu	The leaf is roasted & crushed, add butter & cream the affected part until cure.	Dermal
						L	F	Dandruff	Hu	Crush the leaf and add butter & the head.	Dermal
						Fr	F	Amoeba	Hu	By eating the fruit & swallow the seed.	Oral
12	<i>Carica papaya</i> L.	Caricaceae	Papaya	T	Hg	L	D	Wound donkey & camel	Li	First, wash the wound with water & soup. After that crush the leaf & cover the wound by fine powder of it.	Dermal
13	<i>Carissa spinarum</i> L.	Apocynaceae	Agam	T	W	R	F or D	Evil eye	Hu	The root is crushed and sniffed during sickness time.	Nasal
14	<i>Casimiroa edulis</i>	Rutaceae	Dimma	T	W	R	F or D	Backbone pain	Hu	Attaching & tying the root on the backbone.	Dermal
15	<i>Citrus limon</i> (L.) Burm. F.	Rutaceae	Lemin	T	Hg	L	F	Amoeba	Hu	Boiling the leaf with water, half cup of the decoction is taken orally in the morning in empty stomach.	Oral
16	<i>Clerodendrum myricoides</i> (Hochst.) Vatke.	Lamiaceae	Surbetri	Sh	W	St	F	Eye disease	Hu	Crush and mix with butter & fumigate.	Optical
						Mis	F or D	Hemorrhoids & Wart	Hu	Immersed the mistletoe in boiling butter & touch the hemorrhoid and wart 3 times for 3 days.	Dermal
17	<i>Coffea Arabica</i> L.	Rubiaceae	Buna	Sh	Hg	Se	D	Fire burn	Hu	The seed is roasted, crushed and applied on the wound area.	Dermal
						Se	D	Diarrhea	Hu	The seed is roasted, crushed, and boiled	

										with water add 1 cup of tea & drop of oil and drink.	Oral
18	<i>Croton macrostachyus</i> (Hochst. Ex Delile)	Euphorbiaceae	Tambok	T	W	L	F	Jaundice	Hu	Take 6 leaf of <i>croton macrostachyus</i> & <i>Justicia schimperiana</i> dry & crush by finger 3 times to cup add water & half cup of it drink for 3 morning. Drink when repeatedly. If it is severe the condition, eat 'chanchira derho' or 'siksi wot'.	Oral
						B	F	Mouth closed	Hu	Crush the bark & add a little water & press via nose.	Nose
19	<i>Cucumis dipsaceus</i> (Ehrenb) ex. Spach.	Cucurbitaceae	Hafalfo	Cl	W	R	F	Mouth closed	Hu	Crush and add water, the liquid part give via the mouth.	Oral
						Wp	F	Fibril illness	Hu	Boil mixing with eucalyptus leaf & wash the body by the boiled water.	Dermal
						R	F	Anthrax	Hu	Crush and add honey and then eat. Amount by bottle cup. And tie at the swelling part.	Oral & Dermal
						R	F or D	Rheumatism	Hu	Root of <i>Cucumis dipsaceus</i> , <i>Euphorbia tirucalli</i> mistletoe and root of <i>Withania somnifera</i> together crushed & cream by adding butter for 7 days.	Dermal
20	<i>Datura stramonium</i>	Solanaceae	Mezerbae	H	W	L	F	Leech	Li	Crush and add the liquid through the nose.	Nasal

	<i>m L.</i>					L	F	‘Lehacito’	Li	Crush the leaf and add butter, cream the infected part for 5 days.	Dermal
21	<i>Dichrosta chrys cinerea</i> (L.) Wight and Arn.	Ranunculaceae	Gonok	Sh	W	Mis	F or D	Headache	Hu	Tie the mistletoe in the head at front and at 2 sides.	Dermal
22	<i>Diospyros mespiliformis</i>	Ebenaceae	Aye	T	W	Fr	F	Constipation	Hu	Eating the fruit.	Dermal
23	<i>Ficus palmata</i> Forssk.	Moraceae	Beles	T	W	L	F or D	External wound	Li	Crush and cover the wound of cattle & camel.	Dermal
						La	F	Wound, wart	Hu	Collect the milky of <i>ficus palmata</i> Forssk and cover the wound or the wart with it.	Dermal
24	<i>Hagenia abyssinica</i> (Bruce) J. F. Gmel.	Rosaceae	Koso	T	W	Se	F or D	Tape warm	Hu	The seed is crushed, powdered mix with milk and boiled & drink for 5 days.	Oral
25	<i>Justicia schimperiana</i> (Hochst. Ex Nees)	Acanthaceae	Shimeza	Sh	W	L	F	Jaundice	Hu	Crushing the leaf and add small amount of water in a cup and drunk with empty stomach only 1 day. Dosage tip part of finger in cup.	Oral
						L	F	Malaria	Hu	Boil the leaf in water and fumigate until sweat.	Dermal
26	<i>Lactuca sativa</i> L.	Asteraceae	Selata	H	Hg	L	F	Night blindness	Hu	Add the leaf in to boiled water, wait for a while and expose the eye to the vapor during	Optical

										sleeping	
27	<i>Linum usitatissimum</i>	Linaceae	Entate	H	Fc	Se	D	Gastritis	Hu	The seed is crushed, powder and mix with water & sugar and then drink during feeling pain.	Oral
						Se	D	Retained placenta	Li	The seed is crushed, mix with water and boiled and then drink the solution.	Oral
28	<i>Lobelia rhynchopetalum</i> Hemsl.	Lobeliaceae	Jibara	H	W	R & B	F or D	Evil eye	Hu	The root is crushed and sniffed during sickness time.	Nasal
29	<i>Lycopersicon esculentum</i> Mill.	Solanaceae	Tsebh i-abun	H	Hg	L	F	Leech	Li	Crushing the leaf, take the thick juice and drink 4 cup of the solution.	Oral
30	<i>Maytenus senegalensis</i> (Lam.) Excell.	Celastraceae	Argudi	T	W	L	F	Ascariasis in calf	Li	Crush the leaf and add water, drunken half'' cubaya'' to the calf.	Oral
31	<i>Moringa oleifera</i>	Moringaceae	Shiferaw	T	Hg	L	F or D	Gastritis, Hypertension, Diabetes	Hu	Eating the leaf as it is or dry and crush the leaf and add 1 tea spoon to different drinks and drink it.	Oral
32	<i>Ocimum lamiifolium</i> (Hochst. Ex Benth)	Lamiaceae	Dema kessie	H	Hg	L	F	Fibril illness	Hu	The leaf is squeezed and added in tea or coffee and drink.	Oral
33	<i>Otostegia integrifolia</i> (Benth.)	Lamiaceae	Chien dog	Sh	W	L & St	F or D	Lice & fleas	Li	Placing the leaf & stem in fire and fumigate.	Dermal
						St	F or D	Stabbing pain	Hu	Heat the stem in fire & touch the pain sites.	Dermal

34	<i>Phytolacca dodecandra</i> (L Herit).	Phytolaccaceae	Shibti	Sh	W	R	F or D	Rabies	Hu	Crush the root and add water and then drink it by tip part of finger. And drink whey repeatedly.	Oral
						L	F	Rabies	Li	Crush the leaf and add water, drink a cup of it.	Oral
35	<i>Plumbago zeylanica</i> L.	Plumbaginaceae	Aftuh	H	W	R	F	Anthrax	Hu	Crush and squeeze the liquid on the affected part.	Dermal
						R	F	Anthrax	Li	Crush the root, add water and drink 4 coffee cup.	Oral
						R	F	Scorpion bite	Hu	Chewing and swallow the liquid.	Oral
36	<i>Rhamnus prinoides</i> L'Herit.	Rhamnaceae	Gesho	Sh	Hg	L	D	Bloating	Li	Half mert crushed <i>Rhamnus prinoides</i> leaf is added to 1 liter water and drink.	Oral
37	<i>Rumex abyssinicus</i> (Jacq.)	Polygonaceae	Moqu moko	Sh	Fc	R	F or D	Tuberculosis (TB)	Hu	Boiling the root with water and drink a cup the decoction.	Oral
38	<i>Securidaca longepedunculata</i> Fresen.	Polygalaceae	Shitor a	T	W	R & B	F or D	Evil eye	Hu	Root and bark are crushed and sniffed through nasal or fumigate.	Nasal
39	<i>Senna singueana</i> (Del.) Lock.	Fabaceae	Hambahambo	Sh	W	B	F or D	Abdominal pain	Hu	Grind and swallow the liquid.	Oral
						R	F or D	Nose bleeding	Hu	By smelling the fresh root through nasal.	Nasal
						St	F or D	Bloating	Li	Hitting the bloating area 3 times by the stem.	Dermal
40	<i>Sida ovata</i> Forssk.	Malvaceae	Dekidairo	H	W	L	F	Swelling called	Hu	Crushing the leaf and cover by a cloth the	Dermal

								“Lifi”		swelling area.	
41	<i>Solanum incanum</i> L.	Solanaceae	Engule	Sh	W	R	F	Scorpion bite	Hu	Chewing the root and swallowing the liquid.	Oral
						R	F	Nose bleeding	Hu	Smelling the root and tying at the neck.	Nasal
						R	F	Anthrax	Hu	The root is crushed and eaten by honey. Amount by bottle cup.	Oral
42	<i>Stereospermum Kunthianum</i> Cham.	Bignoniaceae	Adgizana	T	W	B	F	Broken bone	Hu & Li	The broken area tying with fresh bark for 3 days.	Dermal
43	<i>Terminalia brownii</i> Fresen.	Combretaceae	Weyba	T	W	L	F or D	Wound	Hu	Crush and apply on the affected part.	Dermal
44	<i>Thymus schimperi</i> Ronniger	Phytolaccaceae	Tosng	H	W	Wp	F or D	Epilepsy	Hu	The whole part add to teje and boiled after that sniffed through nose and drink for 7 days. Crush and sniffed via nasal.	Nasal & Dermal
45	<i>Verbascum sinaiticum</i> Benth.	Scrophulariaceae	Tirnak	H	W	R	F or D	Fibril illness	Hu & Li	Crushed the root and add water and drink 1 cup of the solution.	Oral
							R	F or D	Evil eye	Hu	Crush and sniffed via nasal.
46	<i>Vicia faba</i>	Fabaceae	Balonga	H	Fc	Se	F or D	“megli enchwa”	Hu	3 seeds chewing and tying on the swelling part.	Dermal
47	<i>Withania somnifera</i> (L.) Dunal.	Solanaceae	Agol	Sh	W	L	F	Eye disease	Hu	The leaf is boiled in water and expose the eye to the vapor.	Optical
48	<i>Zehneria scabra</i> (Linn. f.) Sond.	Cucurbitaceae	Haregresa	Cl	W	L	F	Dandruff	Hu	The fresh leaf is crushed and squeezed to produce juice and cream the affected part.	Dermal

						W p	F	Eye disease	Hu	Boiling in water and fumigate the eye to the heat of it.	Optical
49	<i>Zingiber officinale</i>	Zingiberacea e	Jinjibl e	H	Hg	Rh	F or D	Abdominal pain	Hu	Chewing the rhizome and swallow the liquid part.	Oral
50	<i>Ziziphu spina- christi (L.) Desf.</i>	Rhamnaceae	Gaba	T	W	L	F	Scabies & dandruff	Hu	The leaf is crushed & mix with butter and cream the infected part	Dermal
						Mi s	F or D	Headache	Hu	Tie 3 mistletoe 1 at front and 2 at the two sides.	Dermal
51	<i>Cyphoste mma junceum</i>	Vitaceae	Etse zewye	H	W	R	F or D	Snake bite	Hu	Crushed and eating with honey.	Oral
52	<i>Cucurbita pepo</i>	Cucurbitacea e	Duba	Cl	Fc	Se	D	Tape warm	Hu	Roasting the seeds and eating with empty stomach.	Oral
53	<i>Ricinus communis</i>	Polygonacea e	Gulie	H	Fc	Se	D	Tooth ache	Hu	The seed put in fire and fumigate the tooth.	Oral

Appendix 3. English name and local name of diseases, number of plant species used and the corresponding percentage of plant species used to treat those diseases.

No	English name	Local name	No of plant species used	Percentage
1	Amoeba	Ameba	2	2.41
2	Malaria	Aso	2	2.41
3	Gastritis	Chegora	2	2.41
4	Evil eye	Buda	6	7.23
5	Jaundice	Eshwa	3	3.61
6	Tooth ache	Sni himam	2	2.14
7	Head ache	Risi himam/merzen/	3	3.61
8	Nose bleeding	Nesri	3	3.61
9	Blood pressure	Tsekti dem	1	1.2
10	Cough	Se-al	2	2.41
11	Diarrhea	Wutsiat	1	1.20
12	Common cold	Gunfae	1	1.20
13	Abdominal pain	Kurtset	4	4.82
14	Wound	Kusli	1	1.20
15	Anthrax	Megerem	5	6.02
16	Fibril illness	mi-chi	3	3.61
17	Dandruff	Forofer	3	3.61
18	Herpes	Almaz bale chira	1	1.20
19	Night blindness	Hima	1	1.20
20	Eye diseases	Ayni himam	3	3.61
21	Rabies	Nksit himum kelbi	1	1.20
22	Back bone pain	Hiko himam	2	2.41

23	Rh-factor	Shitolay	1	1.2
24	Ascariasis	Wusifat	2	2.41
25	Tape worm	Kosso/habi/	2	2.41
26	Fire burn	Hawi blae	2	2.41
27	Constipation	Dirket	1	1.20
28	Swelling at finger	Lifi	1	1.20
29	Snake bite	Temen nksit	3	3.61
30	Scorpion bite	Enkrbit nksit	2	2.41
31	Retained placenta	Mizingae medhanit	1	1.20
32	TB/tuberculosis/	Tivi	1	1.20
33	Broken bone	Sbar atsmi	1	1.20
34	Swelling	Hibet	2	2.41
35	Abdominal parasite	Nay kebdi hasaku	1	1.20
36		Megli enchiwa	1	1.20
37	Diabetes	Himam shikoriya	1	1.20
38	Wart	Adgi tub	3	3.61
39	Stabbing pain	Wug-at	1	1.20
40	Mouth clothed	Af mlguam	2	2.41
41	Rheumatism	Kurtmat	3	3.61
Total			83	100

Appendix 4. Livestock ailments, local name, plant species used and the corresponding percentages of medicinal plants used to treat those ailments.

Serial No.	Ailments	Local name	No. of plant species used	Percentage
1	Anthrax	Megerem	1	6.67
2	Bloating	Menfahti	3	20
3	Diarrhea	Wozwz	1	6.67
4	Diarrhea hen	Derho wits-at	1	6.67
5	Fibril illness	Michi	1	6.67
6	Ichiting wound	Lehasito	1	6.67
7	Leech	Alekti	2	13.33
8	Lice & fleas	Kumal & kunichi niksit	1	6.67
9	Pancreas disease	Tafia	1	6.67
10	Rabies	Himam nikisit ebud kelbi	1	6.67
11	Wound donkey & camel	Kusli adge & gimel	1	6.67
12	Swelling naked cattle	Zigag	1	6.67
Total		12	15	100

Appendix 5. List of informants participated and their sex, age, marital status, educational level, religion, *Kebeles* and occupation of the study area.

S. No	Name	Sex	Age	Marital status	Edn. level	Religion	Kebele	Occupation
1	Abera Haftu*	M	46	Married	Read & write	Orthodox	Tsaidakerni	Farmer
2	Aberu Dagneu	F	28	Single	8	Orthodox	Adiwesene	Merchant
3	Abrahaley Birhaney	M	21	Single	10	Orthodox	Hayelom	Student
4	Adane Ayenew	M	36	Married	Degree	Orthodox	Hayelom	Teacher
5	Aderagew Fantay*	M	52	Married	6	Orthodox	Hayelom	Merchant
6	Adisey G/wahid	M	45	Married	8	Orthodox	Hayelom	Merchant
7	Adugna Alemu	M	34	Married	4	Orthodox	M/shila	Farmer
8	Agete kassahun	M	38	Married	10	Orthodox	Tsaidakerni	Farmer
9	Alemaw G/medhin	M	40	Married	4	Orthodox	M/shila	Farmer
10	Ambachew Dessaley	M	64	Married	Illiterate	Orthodox	Tsaidakerni	Farmer
11	Asfaw Mizan*	M	47	Married	Degree	Orthodox	M/shila	Teacher
12	Atalay Alemu	M	32	Married	6	Orthodox	Adiwesene	Farmer
13	Belayneh Mengstu*	M	33	Married	Diploma	Orthodox	M/shila	Healer
14	Berhe K/Mariam	M	63	Married	Illiterate	Orthodox	Adiwesene	Farmer
15	Birhane Mulaw	M	64	Married	Diploma	Orthodox	Tsaidakerni	Security
16	Birhaney Getahun*	M	54	Married	Illiterate	Orthodox	Hayelom	Farmer
17	Bizen Yirga	F	42	single	Read % write	Orthodox	Tsaidakerni	Merchant
18	Dejen Ambaw	M	37	Married	Degree	Orthodox	Hayelom	Teacher
19	Eshetu Shishay	M	52	Married	Read & write	Orthodox	M/shila	Merchant
20	Ethiopia Beyene*	F	60	Single	Illiterate	Orthodox	Tsaidakerni	Farmer

21	Etsub Berhe*	M	72	Single	Religious	Orthodox	M/shila	Healer
22	Eyasu W/Mariam*	M	36	Married	Diploma	Orthodox	M/shila	Healer
23	Fatuma Mekonen	F	25	Single	9	Orthodox	Adiwesene	Googs
24	Fisha W/Mariam	M	32	Married	6	Orthodox	Adiwesene	Farmer
25	G/meskel Teka	M	32	Married	4	Orthodox	Adiwesene	Farmer
26	G/wahid G/her*	M	81	Single	Religious	Orthodox	Adiwesene	Farmer &
27	Gebrhud Fisha	M	51	Married	5	Orthodox	Adiwesene	Farmer
28	Getahun Mebrat	M	34	Married	Degree	Orthodox	M/shila	Teacher
29	Girmay Alemu	M	55	Married	Illiterate	Orthodox	Adiwesene	Farmer
30	Goitom Gezay	M	48	Married	6	Orthodox	Hayelom	Guard
31	Kasahun Alemayoh*	M	72	Married	Illiterate	Orthodox	Adiwesene	Farmer
32	Kefialew Hailu	M	52	Single	10	Orthodox	Hayelom	Merchant
33	Kelemwork Endrias	M	56	Married	Diploma	Orthodox	M/shila	Guard
34	Keria Mehamed	F	50	Married	Read & write	Muslim	M/shila	Merchant
35	Kidane Belay	M	28	Married	10	Orthodox	Adiwesene	Farmer
36	Kiros G/medhin	M	73	Married	Religious	Orthodox	Hayelom	Farmer
37	Mebrat Haile	M	62	Married	Illiterate	Orthodox	Adiwesene	Farmer
38	Mekonen Mesfin*	M	50	Married	Read & write	Orthodox	Hayelom	Farmer
39	Mekuria Chidie*	M	65	Married	Diploma	Orthodox	Tsaidakerni	Healer
40	Melaku Demssie	M	53	Married	Read & write	Orthodox	M/shila	Farmer
41	Melese Zeleke	M	58	Married	Religious	Orthodox	Adiwesene	Farmer
42	Mengesha Demlew	M	68	Married	Illiterate	Orthodox	Tsaidakerni	Farmer
43	Misganaw Kiflea	M	44	Married	10	Orthodox	Hayelom	Farmer
44	Mogos Fasil	M	55	Married	4	Orthodox	Tsaidakerni	Farmer
45	Mola Mengste	M	60	Married	Read &	Orthodox	Adiwesene	Farmer

					write			
46	Nega Kiros*	M	36	Single	10	Orthodox	Hayelom	Healer
47	Shegaw Demsew*	M	47	Married	Religious	Orthodox	M/shila	Healer
48	Shete Abohey	M	36	Married	Illiterate	Orthodox	Tsaidakerni	Farmer
49	Shete Asmamaw*	M	36	Married	10	Orthodox	Hayelom	Healer
50	Shiferaw Birhaney	M	52	Married	Religious	Orthodox	M/shila	Farmer
51	Sisay Malefiaw*	M	47	Married	5	Orthodox	Tsaidakerni	Farmer
52	Sisay Muley	M	41	Married	9	Orthodox	Tsaidakerni	Merchant
53	Solomon Kidie	M	35	Married	Diploma	Orthodox	Tsaidakerni	Teacher
54	Tafere Mulaw	M	38	Married	3	Orthodox	Adiwesene	Farmer
55	Tejey Abrha	F	19	Single	10	Orthodox	Hayelom	Student
56	Tesfay Belay*	M	80	Single	4	Orthodox	Tsaidakerni	Farmer
57	Teshager Negash	M	71	Married	Illiterate	Orthodox	Tsaidakerni	Farmer
58	Tsehaynesh Demlew	F	62	Married	Illiterate	Orthodox	Tsaidakerni	Farmer
59	Tsige Yeneta*	M	81	Married	Religious	Orthodox	Adiwesene	Healer
60	Werkey Menayeh	F	58	Single	Illiterate	Orthodox	Hayelom	Merchant
61	Werkey Miruts	F	73	Single	Illiterate	Orthodox	M/shila	Farmer
62	Yalem Abate	F	48	Single	Illiterate	Orthodox	M/shila	Farmer
63	Yeshey Aferesew*	F	56	Single	Illiterate	Orthodox	Hayelom	Farmer
64	Zinabey Mebrat	M	22	Married	10	Orthodox	M/shila	Farmer

Key: Informants with * indicate key informants.

Appendix 6. List of semi-structure interview questions for collecting information on medicinal plants and the corresponding uses.

I) General Information

1. Information on Respondents:

Name of Respondent _____ Gender M ___ F ___ Age _____

Religion Orthodox _____ Muslim _____ Protestant _____ and other _____

Educational level _____ marital status _____ *Kebele* _____ Occupation _____

II) Data on prevalent diseases and use of medicinal plants:

1. What are the most common human diseases in your area?

2. What are the main livestock diseases in your *kebele*?

3. How do communities prevent and cure a given disease in your area?

4. List the medicinal plants used to treat human, livestock, and both human & livestock diseases?

5. Which medicinal plants species is commonly used to treat for both human & livestock diseases in your local area?

6. Which part of the plant is used for medicinal values?

a) Leaf, root, bark, stem, fruit, flower, seed, or whole plants and other.

7. How do you use these parts?

a) Methods of preparation?

b) Dose of remedy use?

c) Mode of administration?

d) Conditions of preparations? A) Fresh B) Dried C) Fresh or Dried

8. Is there any side effect on the use of traditional medicine? If yes, what is the solution?

9. What is the habit of the plant?

10. Where do medicinal plants grow? (From where do you collect it)?

11. Are the medicinal plants easily accessible? If not, why? _____

12. Are there threats to medicinal plants? If so, what are the major threats/problems in the area?

13. Are there traditional medicinal plants conservation methods in your area? If so, how?

14. How can you manage and conserve medicinal plants through your traditional practices?

15. Have you ever domesticated medicinal plants? If so, how? If not, why not?

16. Have you ever propagated medicinal plants? If so, how? If not, why not?

17. Have you ever cultivated medicinal plants? If so, how? If not? Why not?

18. Don't you think that actions listed under 15, 16 and 17 are essential for conserving and developing medicinal plants? If so, why did you not act?

19. Give the deleterious effect of climate change on vegetation in general, and on medicinal plants in particular, are you willing to seek advice on the active domestication, propagation and cultivation of these vital resources? If yes, how? If not, why not?

20. What are the communities' level of awareness on the disappearance of medicinal plants and knowledge in the propagation of these?

Appendix 7. Sample Photograph of respondents contacted in (A) interviews; (B) field observations and (C) group discussions.



(A)



(B)



(C)

Appendix 8. Photograph of some common domesticated TMPs and their names at (a) *Ocimum lamiifolium*, (B) *Justicia schimperiana* and (C) *Plumbago zeylenica*.



(A)



(B)



(C)

