ETHNOBOTANICAL STUDY OF MEDICINAL PLANTS IN WADLA *WOREDA*, NORTH WOLLO ZONE, AMHARA REGIONAL STATE, ETHIOPIA

M.Sc. THESIS

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As Thesis research advisors, we hereby certify that we have read and evaluated this Thesis prepared, under our guidance, by **Bogale Haile,** entitled**: Ethnobotanical Study of Medicinal Plants in Wadla *Woreda*, North Wollo Zone, Amhara Regional State, Ethiopia**. We recommend that it be submitted as fulfilling the thesis requirement.

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DEDICATION

This thesis is dedicated to my mother Yamrot Haile and my wife Hilina Gebeyaw for nursing me with affection and love and for their dedicated partnership in the success of my life.

STATEMENT OF THE AUTHOR

I hereby certify that this thesis is my bona fide work and all sources of materials used for the thesis have been duly acknowledged. This Thesis has been submitted in partial fulfillment of the requirements of the M.Sc. degree at Haramaya University. I solemnly declare that this thesis is not submitted to any other institution, elsewhere, for the award of any academic degree, diploma, or certificate. Brief quotations from this thesis are allowable without special permission provided that due acknowledgement of source is made. Request for permission for extended quotation from or production of this manuscript in whole or in part may be granted by the Dean of the School of Graduate Studies when in his or her judgment the proposed use of the material is in the interest of scholarship. In all other instances, however, permission must be obtained from the author.

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BIOGRAPHICAL SKETCH

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LIST OF ACRONYMS AND ABBREVIATIONS

EFAP	Ethiopian Food and Agricultural Program
FAO	Food and Agricultural Organization
FL	Fidelity Level
ICF	Informant Consensus Factor
IK	Indigenous Knowledge
IUCN	International Union for Conservation of Nature
JI	Jaccard Similarity Index
PR	Preference Ranking
TK	Traditional Knowledge
UNESCO	United Nations Education Science and Cultural Organization
WWAO	Wadla *Woreda* Administrative Office
WWFO	Wadla *Woreda* Financial Office
WWHO	Wadla *Woreda* Heath Office
WWRADO	Wadla *Woreda* Rural Agricultural Development Office

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ABSTRACT

Ethiopia has rich flora with different plant species having use in health care system based on local indigenous knowledge. However, documented ethnobotanical information was lacking in Wadla Woreda. Hence, the aim of this study was to identify and document ethnobotanical information of medicinal plants in Wadla Woreda, North Wollo Zone, Amhara Regional State, Ethiopia. A total of 100 informants aged 20 and above were selected to collect ethnobotanical data. Out of these, 21 key informants were purposively selected based on recommendations from local elders. Others were selected randomly. Data were collected using semi structured interview, group discussion, guided field walk and field observation. The data were analyzed using descriptive statistics such as percentage and frequency; preference ranking, informant consensus factor, fidelity level and Jaccard's similarity index. The results of the study showed that 55 plant species belonging to 54 genera and 40 families were commonly used to treat various human and livestock ailments. Among the families identified, Euphorbaceae and Solanaceae were represented by highest number (10%) of medicinal plants each, followed by the Asteraceae, Fabaceae and Lamiaceae each with 7.5% species. Out of the reported medicinal plants, 48.21% were obtained from forest; where as 37.5% of them were from homegarden and others were from farmland and road side. The most frequently used plant part was leaf (60.70%) followed by roots (12.5%). The most common route of administrations were oral administration constituting (42.250%) and dermal (28.8%), respectively. Disease categories with relatively higher ICF values were sensorial related problems (0.92); maternal and fertility problems (0.80). Among the four plant species, the most effective medicinal plants used to treat cough were Foeniculum vulgare followed by Schinus molle. The study area has a considerable number of traditional medicinal plants that are found from wild in the forest so that conservation measures should be taken to protect these plants in their habitats.

Keywords: Ethnobotany, Homegarden, Medicinal plants, Preference ranking, Wadla woreda

1. INTRODUCTION

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

In the direct and intimate relationships as well as indispensable dependency of human beings upon plants for their livelihood, plants provide multiple and diverse uses for indigenous societies (Njau, 2001; Endalew Amenu, 2007). Various plants and plant products have been closely associated with many social cultures, customs and mythological rituals such as personal decoration (cosmetics and tattooing) and entertainment (musical instruments), arts and crafts and even magico-religious beliefs (Jain, 1986). Plants have significant medicinal values both in developing and developed countries. Since ancient time; plants have been indispensable source of both preventive and curative traditional medicine preparations for human beings and livestock (Dery *et al*., 1991). About 70-80% of the world's population uses plants to solve basic medical problems (Farnsworth and Soejarto, 1991). Moreover, approximately 99% of veterinary care in developing countries is based on the use of plant extracts (Letchemo and Craker, 1996). It was estimated that 25,000 to 75,000 species of higher plants have been used in traditional medicine worldwide (Farnsworth *et al.,* 1985). About half of the world's medicinal compounds are still extracted from plants (Frankel *et al*., 1995). Due to this reason, medicinal plants play a significant role in the health care of local people.

Ethiopia is a country with various types of climatic, topographic, soil and altitudinal features. This makes the country to have a rich and diverse flora and fauna. However, although there

have been some attempts in investigating medicinal plants and indigenous knowledge on sustainable use and management of plant resources, little emphasis has been given to ethnobotanical (ethnomedicinal) studies over the past decades (Dawit Abebe, 2001; Mirutse Giday, 1999). It is reported that nearly 80% of the population in Ethiopia use plant-based traditional medicine as their primary health care system (Dawit Abebe, 2001). The majority of medicinal plants, with exceptions are harvested from wild habitats, which are currently under great threat (WCMC, 1992). There are reports indicating that many potentially useful plants are disappearing throughout the world, and Ethiopia is not exceptional.

Indigenous people around the world possess unique knowledge of plant resources on which they depend for food, medicine and general utility including tremendous botanical expertise (Martin, 1995). This implies that humans are dependent on other organisms for their lives. Although various animal and mineral products contribute to human welfare, the plant kingdom is the most essential to human well-beings especially in supplying his basic needs. The indispensable dependency of humans upon plants for their livelihood was primarily started by their domestication and this dates back to 10,000 years (Martin, 1995). Over centuries, indigenous people have developed their own locality specific knowledge on plant use, management and conservation (Cotton, 1996). Plants have been used as a source of traditional medicine in Ethiopia from time immemorial to combat different ailments and human sufferings (Asfaw *et al*., 1999). Due to its long period of practice and existence, traditional medicine has become an integral part of the culture of Ethiopian people (Pankhurst, 1965; Mirgissa, 1998). There is a large magnitude of use and interest in medicinal plants in Ethiopia due to acceptability, accessibility and biomedical benefits (Dawit Abebe, 2001). The continued dependency on herbal medicine along side with modern medicine is largely conditioned by economic and cultural factors (Aketch, 1992).

In present-day Africa, including Ethiopia, the majority of people lack access to health care and where available the quality is largely below standard (Abbiw, 1996). Indigenous people and the local communities' reliance on plant resources account for about 95% of their survival requirements (Archer, 1990; Nijar, 1996). Therefore, herbal remedies are the world's therapeutic means to act against diseases for a large proportion of people both in rural and urban centers of developing countries like Ethiopia (Abbiw, 1996). Thus, the need to

undertake ethnobotanical researches and to document medicinal plants and associated indigenous knowledge has come to be an urgent task as underlined by Pankhurst (2001) and Hamilton (2003). In Ethiopia, different researchers (Kebu Balemie *et al.*, 2004; Fekadu Fullas, 2007; Mirutse Gidey, 2009) have conducted ethnobotanical studies on medicinal plants from different parts of Ethiopia. However, such a study is lacking in Wadla *Woreda*, North Wollo, Amhara Regional State, Ethiopia. This study is, therefore, designed to carry out ethnobotanical study on medicinal plants used by local people of this *Woreda* with the following objectives.

The general objective of the study was:

- To conduct an ethnobotanical study on the medicinal plants used by the people living in Wadla *Woreda*, North Wollo Zone, Amhara Regional State, Ethiopia.

Specific objectives were:

- To collect, identify and document medicinal plants used for treating different human and livestock ailments;
- To describe and document plant parts used to treat various ailments, method of preparation and route of administration;
- To document indigenous knowledge of the local community on medicinal plants in the study area.

2. LITERATURE REVIEW

2.1. Origin and Development of Ethnobotanical Study

John Harshberger in 1895 brought up the term ethnobotany for the first time (Harshberger, 1896; cited in Cotton, 1996). He defined ethnobotany as “the use of plants by aboriginal people". Martin (1995) broadly defined ethnobotany as the subject dealing with the study of direct interactions between humans and plants. Balick and Cox (1996) included the use of plants as food, medicinal, forage and for any other economic purpose within field of ethnobotany. According to Cotton (1996), ethnobotany encompasses all studies that concern the mutual relationships between plants and traditional people.

As stated by Martin (1995) to achieve more detailed and reliable information of plants and plant use, ethnobotanical study needs involvement of specialists from various disciplines, such as plant taxonomists, plant ecologists, anthropologists, linguists, economic botanists, pharmacologists and others. With such interdisciplinary and multidisciplinary approaches, ethnobotany is aimed at gathering and documenting indigenous botanical knowledge, cultural practice, use and management of botanical resources and discovers benefits from plants. Ethnobotanical studies are often significant in revealing locally important plant species especially for the discovery of drugs.

2.2. Indigenous Knowledge and Medicinal Plants

Indigenous knowledge (IK) is, broadly speaking, the knowledge used by local people to make a living in a particular environment (Warren, 1991). Indigenous knowledge can be defined as "A body of knowledge built up by a group of people through generations of living in close contact with nature" (Johnson, 1992). Indigenous knowledge refers to the accumulation of knowledge, rule, standards, skills, and mental sets, which are possessed by local people in a particular area (Quanash, 1998). It is the result of many generations’ long years’ experiences, careful observations and trial and error experiments (Martin, 1995). Traditional people around the world possess unique knowledge of plant resources on which they depend for food, medicine and general utility including tremendous botanical expertise (Martin, 1995). Over

centuries, indigenous people of different localities have developed their own specific knowledge on plant resource use, management and conservation (Cotton, 1996).

Systematic application of indigenous knowledge is important for sustainable use of resources and sustainable development (Thomas, 1995). Various animal and mineral products contribute to human welfare; the plant kingdom is most essential to human well-being especially in supplying basic human needs. Since ancient times, human beings used plants for the purpose of disease control and prevention. It was believed to be the result of many generations long year's experiences, careful observations and trial and error experiments that early humans acquired the knowledge on the utilization of plants for disease prevention and curative purposes (Sofowora, 1982; Martin, 1995). So, the knowledge and application of traditional medicine is one of the widely used indigenous knowledge systems. This implies that humans are dependent on other organisms for their life. This close interaction and dependency of humans on plants is studied under the field of ethnobotany. Such knowledge, known as ethnomedicinal knowledge involves traditional diagnosis, collection of raw materials, preparation of remedies and its prescription to the patients. The documentation of traditional knowledge, especially on the medicinal uses of plants, has provided many important drugs of modern day (Balick and Cox, 1996).

The immediate and intimate dependence of indigenous people on local resources resulted in the accumulation of indigenous knowledge, which helps the people to adapt to and survive in the environments in which they lived (Martin, 1995). Indigenous knowledge on remedies in many countries including Ethiopia passed from one generation to the other generation verbally with great secrecy (Jansen, 1981). Such secrete and crude transfer makes indigenous knowledge or ethnomedicinal knowledge vulnerable to distortion and in most cases, some of the lore is lost at each point of transfer (Amare Getahun, 1976); hence, there is a need for systematic documentation of such useful knowledge through ethnobotanical research.

2.3. The Role of Medicinal Plants

Traditional medicinal plants play typical role in the lives of many people in terms of health support, financial income and livelihood security (Hamilton, 2003, 2004; Abdulhamid Bedri *et*

al., 2004). According to Fassil Kibebew (2001), about 75-90 % of the rural population in the world (excluding western countries) relies on traditional medicines as their only healthcare system. The majority of the populations in developing countries (for instance, 80% of the population in Africa) primarily rely on traditional medicinal plants for their health care (WHO, 2002). In northern Ethiopia, the major portion (87%) of the parts used in traditional medicine comes from plant sources, while animal parts and minerals contribute only a small supply (Dawit Abebe and Ahadu Ayehu, 1993). More than 35,000 plant species are being used around the world for medicinal purposes (Lewington, 1993) and, in Ethiopia there are 800 or more plant species employed as medicinal agents (Tesema Tanto *et al.,* 2002); which according to the data base of the National Herbarium has grown to 1000 and more will be added to the list as new studies bring as new medicinal plants from various cultures.

Traditional medicine remains the main resource for a large majority (80%) of the people in Ethiopia to treat their illnesses and maintain their health and a traditional medical consultancy including the consumption of the medicinal plants has a much lower cost than modern medical attention (Asfaw Debela *et al*., 1999). However, this is not only because of poverty where people cannot afford to buy expensive modern drugs, but traditional systems are also more culturally acceptable and meet the psychological needs in a way modern medicine does not. So, medicinal plants are the main source of traditional medicine for the rural population and are of high demand in the healthcare systems of this population when compared to modern medicine, ethnomedicine activities need special consideration and back-up (Abbiw, 1996).

Apart from their use in the traditional system of medical care at the local level, medicinal plants are currently used in the production of modern drugs as a source of direct therapeutic agents, as raw materials for the manufacture of complex semi-synthetic compounds and as taxonomic markers in the search for new compounds (WHO, 1998). Most pharmaceutical companies recently have developed mechanisms to involve indigenous people collect plant samples on the recommendation of traditional practitioners. This approach is reported to be more successful than random collection of sample of medicinal plants (Balick and Cox, 1996; Alexiades, 1996; Asfaw Debela *et al*., 1999).

Medicinal plants have got special attention and regional offices were established by World Health Organization to coordinate basic and applied research activities on medicinal plants (WHO, 1978). This was linked to the establishment to record medicinal plants to improve accessibility and dissemination of information on medicinal plants (Tsige Gebre Mariham and Kaleab Asres, 2001).

2.4. Importance of Medicinal Plants for Development of Modern Drugs

Historically**,** plants have provided a source of inspiration for novel drug compounds, as plants derived medicine have made large contribution to human health and well-being. Their role in the development of new drugs could be either by serving as a natural blue print for the development of new drugs, or as phytomedicine to be used for the treatment of diseases (Andrew *et al.* 2000). Rapid developments and advances in science, technology, and the world economy have drastically changed the world and environment. With remarkable improvement in human health care on one hand and environmental deterioration on the other, a growing demand for natural products and phytomedicine has shifted research and development works toward new drug discovery. Many research institutions in this field have turned to traditional medicine, mainly the use of plants as source of new drugs. Traditional medicines play a key role in the development and advancement of modern studies by serving as a starting point for the development of novelty in drug (Pramono, 2002).

In addition, an increasing reliance on the use of medicinal plants in the industrialized societies has been traced to the extraction and development of several drugs and chemotherapeutics from these plants as well as from traditionally used rural herbal remedies (UNESCO, 1998). Furthermore, chemical structures derived from plants can be used as models for synthetic compounds (WHO, 2000). Most of plant derived drugs were originally discovered through the study of traditional cures and folk knowledge of indigenous people (Balick and Cox, 1996).

In general, many investigations indicate the relevance of ethnobotanical information on medicinal plants to guide chemical screening for drug development. Traditional herbs, which have been proven for clinical efficacy and safety, were the first chosen for screening. Then plant materials collected and identified with reference to ethnobotanical information and

photochemistry analysis were screened in consultation with local users of the herbal medicines are tested through photochemistry, animal experiments and clinical trials. It is then possible to use them in the formulation of new medicines according to government regulations concerning new medicinal developments (Sheng-Ji, 2001).

2.5. Medicinal Plants in Ethiopia

Plants have played crucial role as a source of traditional medicine in Ethiopia from the time immemorial to combat different ailments and human sufferings (Asfaw Debela *et al*., 1999). It was the only system available for healthcare prior to the introduction of modern medicine for prevention, diagnosis and treatment of social, mental and physical illness (Dawit Abebe, 1986).

To date traditional medicine has become an integral part of the culture of the Ethiopian people due to its long period of practice and existence (Mirgisa Kaba, 1998). The antiquity of the traditional use of medicinal plants in Ethiopia could never be disregarded (Pankhurst, 1990; Mirutse Giday, 1999). Due to acceptability, accessibility and biomedical benefits there is a large magnitude of use and interest of medicinal plants in Ethiopia (Dawit Abebe, 2001). The long history of use of medicinal plants in Ethiopia is reflected in various medico- religious manuscripts produced on parchments and believed to have originated several centuries ago (Fassil Kibebew, 2001). Reviews of medical textbooks that have been written in Geez or Arabic between 17^{th} and 18^{th} centuries indicated that the majority of Ethiopians, with the exception of few privileged groups, starting from the time of the Italian occupation, have been depending almost entirely on the traditional medicine (Pankhurst, 1990).

2.5.1 Medicinal plants in human healthcare system

Plant diversity remains crucial for human well-being and still provides a significant number of remedies required in healthcare. Medicinal plants played a pivotal role in the treatment of various afflictions in Ethiopia (Fekadu Fullas, 2007). For the role-played by plant-derived products in human and livestock health, systematic scientific investigation is vital (WHO, 1998).

Pharmaceutical industries and western researchers on plant-based drugs have now rediscovered that plants have much to contribute to the discovery of new, effective, safe and profitable therapeutic agents (Pistorius and Van Wiik, 1993). Plants play a major role in providing prototype molecules for possible development into conventional drugs by the pharmaceutical industry (Fekadu Fullas, 2007). However, only small fractions of the world's plants have been investigated scientifically so far, but, human kind has already reaped enormous benefits from it (Farnsworth *et al*., 1985). According to Konno (2004), easy accessibility efficacy on treatment and affordable cost in getting health services are main reasons in preferring tradition medicine to modern medication.

2.5.2. Plants in ethno-veterinary medicine

Livestock disease has often been described as serious of constraints to both macro-level economic development in Africa and the well-being of millions of poor livestock keepers (Andy, 1999). The document also stated that disease related economic losses have been estimated at 4 billion US dollar annually for Africa as a whole**.** In Ethiopia, livestock production plays an important role in the lively hood and economy of majority of the population. Ethiopia is one of the leading countries of Africa in livestock population (Mirutse Giday and Gobena Ameni, 2003). Although Ethiopia is rich in its livestock population, it is one of the countries in the world with the lowest unit output. The poor health condition and of its livestock has partially been responsible for the low productivity (Mirutse Giday and Gobena Ameni, 2003). The ever declining provision of animal health services has resulted in the appearance of a number of epizootic diseases reducing the economic efficacy of livestock production in Africa (Mirutse Giday and Gobena Ameni, 2003). An ethnovetarinery medicine involves the use of medicinal plants surgical techniques and livestock management practices to prevent and treat a range of animal diseases (Mathias, 1996). The study conducted by (Wirtu *et al.,* 1997) revealed as animal health care were provided by the owners, traditional healers, and veterinary professionals. Besides, most modern drugs are expensive and as a result, not affordable by the majority of Ethiopian farmers and pastoralists, most of them rely on their traditional knowledge practices and locally available materials (mainly plants) in the control of diseases of their domestic animals (Mirutse Giday and Gobena Ameni, 2003).

In spite of its permanent importance as livestock health care system, the various traditional veterinary practices remained undocumented in Africa and Ethiopia (Dawit Abebe and Ahadu Ayehu, 1993). Thus creation of awareness on ethnoveterinary medicine emphasizing on useful plants used for treatment of livestock has paramount importance to live stock management. In addition, proper documentation and understanding of farmer's knowledge, attitude and practices about the occurrence, cause, treatments, prevention and control of various ailments is important in designing and implementing successful livestock production (Tafesse Mesfine and Mekonen Lemma, 2001).

2.6. Threats to and Conservation of Medicinal Plants in Ethiopia

2.6.1. Threats to Traditional Medicinal Plants

Ethiopia's traditional medicine as elsewhere in Africa is faced with problems of continuity and sustainability (Ensermu Kelbessa *et al*., 1992). Nowadays herbal practitioners have to walk greater distances for herb collections 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 (Cunninghum, 1996). The primary causes of this problem are loss of taxa of medicinal plants, loss of habitats of medicinal plants and loss of indigenous knowledge (Ensermu Kelbessa *et al*., 1992). In support of this Mirutse Giday (1999) found out that the practice of using plant remedies by Zay people to treat different ailments has been declining from time to time mainly as a result of continued deforestation in the area. In addition, Zemede Asfaw (2001) argues that medicinal plants are considered to be at conservation risk due to over use and destructive harvesting (roots and barks collection). The problem is further compounded by the fact that traditional knowledge on traditional medicine is also being lost at an alarming rate (Tewolde Berhan Gebre Egziabher, 1991). Disturbance and over exploitation by humans are causing major global reduction of plant diversity (Bownder, 1987; IUCN, 1991). According to IUCN (1978) an average of one out of species of vascular plants known are rare or are under sever threat. There are two sources of threats to medicinal plants, i.e. human-made and natural causes. Rapid increase in population, the need for fuel, urbanization, timber production, over harvesting, destructive harvesting, invasive species, commercialization, honey harvesting,

degradation, agricultural expansion and habitat destruction are human caused threats to medicinal plants.

People use many wild species of plants for food, medicines, clothing, shelter, fuel, fiber, income generation and the fulfilling of cultural and spiritual needs throughout the world (Zemede Asfaw, 2001). Likewise, natural causes include recurrent drought, bush fire, disease and pest out breaks (Ensermu Kelbessa *et al*., 1992). In addition to this, most of the medicinal plants utilized by Ethiopian people are harvested from wild habitats (Mirutse Giday, 1999). Hence, this aggravates the rate of loss of taxa with related indigenous knowledge and loss of widely occurring medicinal plant species. The consequence is also bad in such a way that, when the plants that have been serving as the raw material for the preparation of different remedies are being destroyed, the traditional practices associated with them would also diminish. Environmental degradation, deforestation, agricultural expansion, over exploitation and population growth are the principal threats to medicinal plants in Ethiopia (Ensermu Kelbessa *et al*., 1992; Mirutse Giday, 2001; Zemede Asfaw, 2001; Kebu Balemie *et al*., 2004).

2.6.2. Threats to indigenous knowledge on medicinal plants

According to Jansen (1981), in Ethiopia, even though the traditional medicinal partitions are the best source of information about the knowledge of medicinal plants, it was found very difficult to obtain their traditional medicinal information as they considered their indigenous knowledge as a professional secrete, only to be passed orally to their elder sons at oldest age. According to Amare Getahun (1976), practitioners do not want to tell the use of medicinal plants because they believe the healing power of the plant losses its curative and healing virtues; therefore it should be secrete (that is, the name of the plant and its reputed use should not be disclosed). In addition to the knowledge on traditional medicine are commonly passed from generation to generation orally, valuable information can be lost whenever a medicinal plant is lost or when a traditional medical practitioner dies without passing his/her indigenous knowledge to others (Cunningham, 1993; Cunningham, 1996; Cunningham 2001; Getachew Birhan and Shiferaw Dessie, 2002). Gebre Markos Wolde Sillessie (1998), showed that the drought and famine that repeatedly visited Ethiopia for the last few decades and punished many lives of humans, animals and plant species by causing shortage of rain fall and change of

weather conditions is related to deforestation and environmental degradation (EFAP, 1994). In addition to migration from rural areas to towns and resettlement of people from drought-stricken regions to fertile areas has also resulted in the deterioration of traditional practices (Phillips *et al*., 1992).

According to Debela Hunde *et al.,* (2004), modern education has an impact on the knowledge. On the other, hand loss of knowledge is also aggravated by the expansion of modern education, making the younger generation underestimate its traditional values. He pointed out that those students who attended modern schools are showing unwillingness to learn from their parents, which is an evidence for the gradually disappearing traditional knowledge. The study conducted by Tesfaye Hailemariam *et al.,* (2009), showed that most of the knowledge on herbal remedies is handled by elders who are 41-50 years old. This hints at the fact that ethnomedicnal knowledge is concentrated in the elderly members of the community and the relative difficulty in its transfer from the elders to the young generation.

According to (Mirutse Giday *et al*., 2009), the finding of revealed as acculturation of the young generation has become a major threat to the continuation of traditional medicinal knowledge and practice. Ethnomedicinal knowledge diminishes with the death of elderly knowledgeable members of society since only a few young people are willing to acquire the knowledge. In addition, invention of alien weeds like Parthenium has adverse impact on medicinal plants and climate change e.g. Increase temperature year by year and severe drought lead to difficulty to survive the more water consuming medicinal plants in the future (Muthuswamy and Solomon, 2009). Therefore, ethnobotanical study is useful in documenting, analyzing and disseminating knowledge on the relationship between medicinal plants and human society.

According to Pankhurst (1990), the knowledge on medicinal plants and method of use circulated mainly among practitioners and the beneficiaries of such practice. Because of the impact of modern education, increase in health coverage and urbanization, indigenous knowledge and usage of medicinal plants are being lost globally at a fast rate (WHO, 2002). This has made the knowledge and skill on traditional medicinal plants and traditional medicine more hidden and less available to the public (Abbink, 1995). The issue is being even more

serious in developing countries where such important information is not recorded in writing but passed on from one generation to the other orally; few are available in written records. To make matters worse, the younger generations of today, unfortunately, often have different ambitions and priorities. As a result, this traditional skill is doomed to be lost even faster than the plants themselves (Sofowora, 1982).

2.6.3. Conservation of traditional medicinal plants

Homegarden is commonly defined as land use system involving deliberate management of multipurpose trees and shrubs in intimate association with annual and perennial agricultural crops and invariably livestock within the compounds of individual houses, the whole tree-crop animal unit being intensively managed by family labor (Fernandes and Nair, 1986; Christanty, 1990). It also defined as a small scale, supplementary food production system by and for household members that mimics the natural, multilayered ecosystem (Hoogerbrugge and Fresco, 1993). Homegardens have been variously named in English language as agroforestry homegardens, backyard gardens, village forest gardens, dooryard gardens, house gardens, mixed, kitchen, farmyard, roof top garden, household or homestead farms, compound farms or gardens (Talukder *et al*., 2001). In Ethiopia, a very common Amharic vernacular name equivalent for the term homegarden is "Yeguaro-ersha" or a closer alternative might be "Yeguaro Meret*"* meaning a land at the backyard of a house (Zemede Asfaw, 2001).

Homegardens are agricultural spaces that typically contain wide plant diversity, including crops with excellent micronutrient properties. They are usually located close to the homestead; homegardens can accommodate women's food production and household responsibilities (FAO, 2005). The homegarden agro ecosystem in Ethiopia maintains a wide range of taxa of perennial and annual crop plants. According to Zemede Asfaw (2001), medicinal plants can be conserved using appropriate conservational methods in gene banks and botanical gardens. This type of conservation of medicinal plants can also be possible in homegardens, as the homegarden is strategic and ideal farming system for the conservation, production and enhancement of medicinal plants. For poor rural people, medicinal plants represent affordable and locally available resources to address many diseases and health problems.

Documentation of indigenous knowledge and making herbaria for future use is also recommended to conservation of the declining medicinal plants (Muthuswamy and Solomon, 2009). It was pointed out that young generation has no interest to know about medicinal plants and efforts should be made to incorporate traditional medicine in school curricula so that younger people appreciate its usefulness (Mirutse Giday *et al*., 2009). Conserving the diverse cultures with indigenous medicinal and other knowledge that exists with the traditional communities has also contributed greatly in giving value to the biodiversity and maintains the resource for generation (Medhin Zewdu, 2002).

There are some conservation actions that have been undertaken around the world designed to protect threatened medicinal plants from further damage (Cunningham, 1996). Thus for the conservation of plant biodiversity, both in-situ and ex-situ conservation methods can be applied (Frankel *et al.,* 1995). Medicinal plants can also be conserved by ensuring and encouraging their growth in special places, as they have been traditionally (Zemede Asfaw, 2001), this can be possible in places of worship (churches, mosques, grave yards, etc), scared grooves, farm margins, river banks, road sides, live fences of gardens and fields.

2.7 Vegetation and Major Cultivated Crops of the Study Area

The vegetation of the study area consisted of various trees, shrubs and herbaceous species. Some of the common plant species include *Olea europea*, *Juniperus procera*, *Calpurnea aurea*, *Acacia spp*, *Ocimum spp*, *Ficus spp*, *Phoenix reclinata*, *Carissa edulis*, *Podocarpus falcatus*, *Eucalyptus spp*, etc. Major crops grown in the study area include *Eragrostis teff*, *Hordeum vulgare*, *Pisum sativum*, *Solanum tuberosum*, *Allium cepa*, and *Brassica spp* (WWRADO).

3. MATERIALS AND METHODS

3.1. Description of the Study Area

Wadla *Woreda* is found in North Wollo Zone, Amhara Regional State, Ethiopia. It extends between $11^0$31’32’’ to$11^0$49’45’’ North latitudes, and $38^0$44’58” to $39^0$14’ 50” East longitudes. It is located 641 km to the North of Addis Ababa and about 120 km from Woldiya (capital of North Wollo). The altitude of the *woreda* ranges from 1501 to 3000 m a.s.l. The total area of the *Woreda* is 823, 681.86 hectare (WWFO). The Woreda is bordered with Meket *Woreda* in the north, Delanta and Gubalafto in the east, Dawunt in the south and Meket in the west.

The average annual rainfall of the Woreda is 800-1200 mm. The average mean annual temperature of the area is 20.8^0C. Agro-ecologically, Wadla *Woreda* is classified as 34.6% Weina Dega (wet-midland), 53.9% Dega, 3.8% kolla (lowland) and 7.7% Wurch. The total population of the *Woreda* was 131,168 in 2016/17, of whom 68,453 were men and 64715 women; 39,663 or 16.3% of its population were urban dwellers. Almost all the *woreda* population speaks Amharic language as their first language (WWAO).

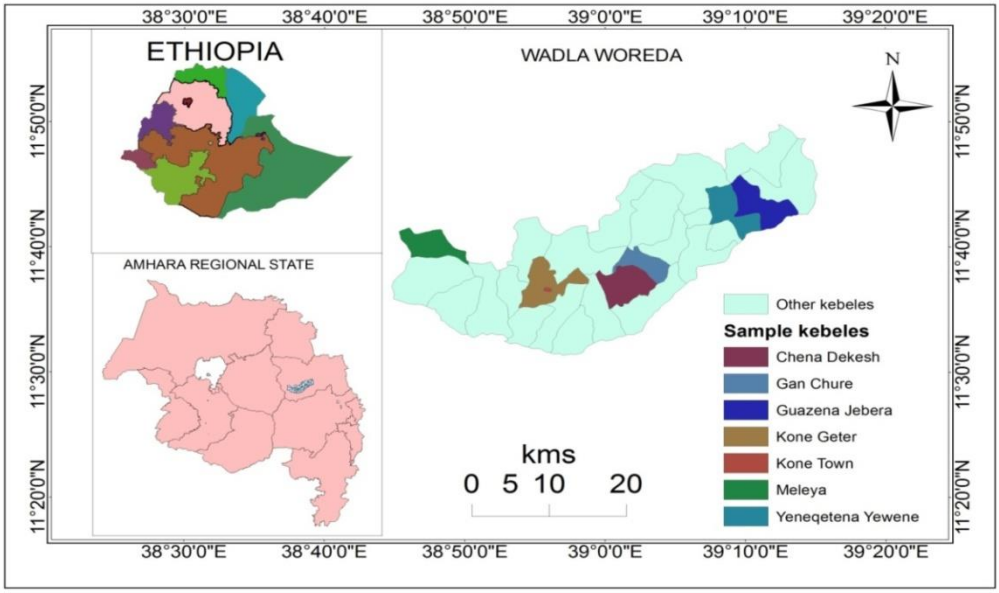

Figure 11 Map of the study area (Wadla *Woreda*)

3.2. Ethnobotanical Data Collection

Prior to ethnobotanical data collection, reconnaissance survey was conducted to purposively select 7 *Kebeles (*out of 29 *kebeles)* namely Kone town, Kone geter, Meley, Gan-chare, Chena, Guaza-jebera and Yeneqetena-yewoyne based on traditional medicine use history. After that, 100 non-traditional medicine practitioners (aged ≥20) and all available traditional medicine practitioners (healers) that serve as key informants were considered as respondents. Non-traditional medicine practitioners were selected randomly while key informants were selected purposively. Ethnobotanical data collection methods were through semi-structured interviews, group discussions, and guided field walks with key informants for field observations. Key informants were first interviewed individually to mention about the local names of the plants they used to treat diseases, diseases treated, part (s) of plants used, methods of preparation, route of administration, route of application, dosage and side effects of the treatment, threats to and conservation of methods. Similar procedures were also applied with randomly selected non-practitioners. Voucher specimens were collected, pressed, and dried for identification. For some species, preliminary identification was done in the field using keys and illustrations (diagrams). In addition, further identification of all specimens was done by comparison with authentic specimens, illustrations and taxonomic keys from Flora of Ethiopia and Eritrea edited by different authors (Gilbert, 1995; Friis and White, 2003, and Friis, 2009) and with the assistance of experts at Haramaya University. The identified specimens were deposited in Haramaya University Herbarium.

3.3. Data Analysis

A descriptive statistical method such as percentage and frequency were employed to analyze and summarize the ethnobotanical data obtained on reported medicinal plants from interviewees including habitat, habit, part used, methods of preparation, route of administration, route of application, disease treated, dosage and side effect of treatment and its antidote, threats and conservation methods. Moreover, data were analyzed following analytical tools for ethnobotanical methods recommended by Martin (1995), Alexiades (1996) and Cotton (1996). Accordingly, ethnobotanical ranking and scoring methods such as

preference ranking, fidelity level, informant consensus techniques and Jaccard's similarity index were employed to test consistency of responses and to obtain more rigorous results.

Informant consensus factor (ICF) was calculated for categories of ailments to identify the agreements of the informants on the reported cures for the group of ailments using the formula used by Heinerich *et al*. (1998), Tilahun Teklehaymanot and Mirutse Giday (2007). The ICF was calculated as follows: number of use citations in each category (N_{uc}) minus the number of species used (N_s), divided by the number of use citations in each category (N_{uc}) minus one.

$$\mathrm{ICF} = \frac{\mathrm{Nuc} - \mathrm{Ns}}{Nuc - 1}$$

Where, Nuc is the number of use citations in each illness category and Ns is the total number of species used by all informants for this illness category. The ICF values range from 0 to 1, with high values (i.e. close to 1) indicating that relatively few plants are used by a large proportion of informants, while low values (< 0.5) indicate that informants do not agree on the plant species to be used to treat a category of ailments.

Fidelity level (FL) values were calculated for most commonly used medicinal plant species obtained from the study kebelles on the fact that the medicinal plants that had the highest FL values could be an indication of their good healing potential and commonly used ones. The FL quantifies the importance of a species for a given purpose. Most commonly used medicinal plants have high fidelity level value. Friedman *et al*. (1986) used a technique designed to highlight species that have healing potential for specific major purposes and merit further biomedical research. Fidelity Level index (FL**)** were calculated using the following formula indicated in Alexiades (1996) as follows.

$$\mathrm{FL}\ (\%) = \frac{\mathrm{IP}}{\mathrm{IU}} \times 100$$

Where, IP is the number of informants who independently suggested the use of a species to treat a particular disease category and IU is the total number of informants who mentioned the plant for any major disease.

Preference ranking (PR) of four available medicinal plant species were conducted for those plant species more frequently mentioned to treat cough. In ranking exercise, 8 key informants were randomly selected and asked to rank plants based on their perceived effectiveness to cure the disease by assigning the highest value (4) for the most efficacious plant and lowest value (1) for the least efficacious plant following Martin (1995) and Cotton (1996).

In addition, ranking of six highly cited threats to medicinal plant species was also undertaken by eight randomly selected key informants to find out the most serious threats to medicinal plants. Preference or priority ranking was done by asking people to give score to a set of short-listed items and make a list of the most valuable or most threatening items and present in rank order following Martin (1995). Preference ranking was also computed to analyze methods of conservation and protection of medicinal plants using seven randomly selected key informants by assigning the highest value (5) for their preference and the lowest value (1) for their least preference.

Jaccard's similarity index was calculated to compare similarity of medicinal plant knowledge between kebeles of different altitude. For this, presence of a given plant species and its utility as medicine or its absence / not considered as medicine are used as data sets.

JCS was calculated as follows using the formula given by Kent and Coker (1992) and Höft *et al*. (1999).

$$\text{JI} = \frac{c}{a + b + c}$$

Where JI is the Jaccard similarity index, 'c' is the number of species shared by the study sites, 'a' is the number of species in study site A only and 'b' is the number of species in study site B only. The JI values range between 0 and 1, whereby a value of 1 indicates complete similarity.

4. RESULTS AND DISCUSSION

4.1. Medicinal Plants of the Study Area

A total of 55 medicinal plants were reported by the local informants from the study area as being used for the treatment of human and livestock ailments. These plants are distributed in 54 genera and 40 families. Of these, about 71.43, 5.36 and 23.21% medicinal plants were reported to treat only human, livestock, and both human and livestock ailments, respectively. The most diverse families in terms of species composition were Euphorbiaceae and Solanaceae each represented by 4 species followed by Asteraceae, Fabaceae and Lamiaceae each represented by 3 species; Acanthaceae, Aloaceae, Apiaceae, Cucurbitaceae, Lamiceae, Phytolaccaceae, Polygonaceae and Rosaceae each represented by 2 species. The remaining families are each represented by 1 spp. (Appendix 2).

4.2. Plant Habitat, Habit, Part(s) Used and Preparation of Remedies and their Dosages

Most (27 spp.) of the medicinal plants were collected from wild in the forest. Considerable number (21 spp.) was also obtained from home gardens; few of them were also collected from farm land as weed (6 spp.) and road side (2 spp.). This observation tells that the knowledge of local people in conserving and cultivating medicinal plants was low. In terms of habit, the majority (46.43%) of the medicinal plants were herbaceous followed by shrubs (25%), tree (23.21%) and climber (5.36%). This report indicates that herbaceous plants were easy and accessible to use in the study sites. In most other researches also, herbaceous plants are reported to dominate medicinal plants (Mulugeta Kuma, 2013; Dula Yirga, 2015). Leaves (60.71 %) and roots (12.5%) are the predominant plant parts used for remedy preparation. Fruits (7.1%), the entire plant part (5.4%), latex (5.4%) and seeds (3.6%) were also used for in remedy preparation. Moreover, bark, bulb and stem are also used and each accounted for 1.8% of the reports. The finding shows that leaves were the easiest and accessible plant parts for remedy preparation. This finding is in line with the results of other ethnomedicinal studies Endalew Amenu (2007); Etana Tolasa (2007); Haile Yineger and Delenasaw Yewhalaw (2007) who reported that leaves were the most cited plant parts used in remedy preparations.

Remedies are prepared mainly (78.45%) from a single plant although reports show that about 21.55% were made from parts from different plant species put together. The result is in agreement with the findings of Dawit Abebe (1986) and Debela Hundie (2001) in which the single plant preparation were reported to be high and disagrees with works of Mirutse Giday (1999) and Bayafers Tamene (2000) in which the combined plant materials were reported to have high proportion in herbal preparation.

Preparations involve mainly pounded and mixed together are used internally as a form of drink/food. External application by creaming on the skin or rubbing against the skin is also forms of application of the remedies. This finding agrees with the works of Dawit Abebe & Ahadu Ayehu (1993) that showed the leading route of application of all the reported herbal remedies in Ethiopia were oral, which accounted for 42%. In general, route and forms of uptake depends on the site and nature of ailments. Honey, butter, 'dorro' wote, milk, lemon juice and boiled coffee are some of the reported additives meant to improve the flavor and efficacy of the remedies.

Remedies were administered with no precise dosage, but locals estimate the amount to be taken particularly, the ones to be taken internally through mouth, nose, ear and eye based on the age and severity of the disease. Traditional measuring units such as spoon, coffee cup, tea cup, count or number, tin cane and glass cups are commonly used to determine the dosage. Lack of precise dosage is known to be the major drawback of using traditional medicine (Dawit Abebe and Ahadu Ayehu, 1993).

4.3. Informant Consensus Factor (ICF)

All cited human diseases were categorized into 10 categories: namely sensorial problems; hemorrhoid and cardiovascular related problems; musculoskeletal, wart, body swelling related problems; respiratory system and throat related problems; headache, evil eye, fever and febrile illness related diseases; diarrhea and gastrointestinal related diseases; viral diseases; bacterial diseases; maternal and fertility problems and psychological problems. These diseases are categorized based on nature of diseases, conditions that cause them, place of attack, symptoms and sign of diseases. Computation of ICF values showed that sensorial related problems were with the highest values (0.92); followed by maternal and fertility problems (0.80); musculoskeletal, wart, body swelling related problems (0.63); hemorrhoid and

cardiovascular related problems (0.6); diarrhea, gastrointestinal related diseases (0.6); bacterial diseases and psychological problems (0.5). This may indicate the common occurrence of these diseases so that more number of people are exchanging information and agree on plant species that can be used to treat these diseases than the rest. The medicinal plants that are effective in treating certain ailments and well known by community members have higher ICF values Mengistu Gebrehiwot (2010) and Eskedar Abebe (2011). On the other hand, respiratory system and throat related problems and headache, evil eye, fever and febrile illness related diseases were with values less than 0.5, suggesting less common occurrences of these diseases for which people have less knowledge on their treatment.

Table 1 Informant consensus factors by categories of human only diseases

Human only disease category	Ns	% of Ns	Nuc	% of Nuc	ICF
Sensorial problems	2	4.88	13	16.05	0.92
Maternal and fertility problems	2	4.88	6	7.41	0.80
Musculoskeletal, wart, body swelling related problems	14	34.15	25	30.86	0.63
Diarrhea and gastrointestinal related diseases	5	14.63	11	13.58	0.60
Hemorrhoid and cardiovascular related problems	3	7.32	6	7.41	0.60
Bacterial diseases	2	4.88	3	3.70	0.50
Psychological problems	2	4.88	3	3.70	0.5
Respiratory system and throat related problems	3	7.32	4	4.94	0.33
Headache, evil eye, fever and febrile illness related diseases	4	9.76	5	6.17	0.25
Viral diseases	4	9.76	5	6.17	0.25

4.4. Fidelity Level of Medicinal Plants

In this study FL values varied from 20 to 100%. Most of the recorded species of plants including *Asparagus africanus, Hagenia abyssinica, Podocarpus faclcatus, Olea europaea, Calotropis procera, Urtica simensis, Acacia abyssinica,* and *Carissa edulis* have a fidelity level of (100%) and the others have below 100% (Table 2). The most preferred species, *Zehneria scabra* which is used to treat many ailments, was found to have only 20% FL value.

Table 2 Fidelity level index of most commonly used medicinal plants

Species	Ailment treated	Ip	Iu	FL	FL (%)
Acacia abyssinica	Goiter	1	1	1	100
Hagenia abyssinica	Bone fracture, tapeworm	8	8	1	100
Ocimum lamiifolium Benth.	Febrile illness, wound		7	0.8571	85.71
Croton macrostachyus	Anthrax, evil eye, snake bite, swelling and itch	10	12	0.8333	83.33
Laggera crispata	Gastritis, stomach ache and tapeworm	3	4	0.75	75
Clematis simensis	Hemorrhoid, Wound	8	15	0.533	53.33
Datura stramonium	eye infection, tooth disease and louse infestation	9	20	0.45	45
Zehneria scabra	Febrile illness, ear mites, eye dust particle, bone fracture and wart	5	25	0.2	20

4.5. Preference Ranking of Medicinal Plants Used to Treat Cough

When there are different species prescribed for the same health problem, people show preference to one over the other. In this study, some cited human diseases were reported to be treated by multiple plant species. Of these diseases, cough was a communicable disease reported to be treated by 4 plant species. Therefore, preference ranking of these 4 medicinal plant species that were reported as effective for treating cough was conducted after selecting 8 key informants. *Foeniculum vulgare* stood first among the four plant species, hence, is the most effective medicinal plant to treat cough followed by *Schinus molle* and *Withania somnifera* as 2nd and 3rd, respectively, whereas *Ruta chalepensis* was found to be the least preferred species (Table 3). This indicates that though people have alternative plant species to treat a given disease, they do have preference to one over the other based on their long time experience on the relative curative power of the plants. Further pharmacological test of this species against cough might reveal promising results.

Table 3 Preference ranking of four available medicinal plants based on the degree of their curative power against cough as perceived by informants.

Species	**Respondents (R_1-R_8)**									
	R_1	**R_2**	**R_3**	**R_4**	**R_5**	**R_6**	**R_7**	**R_8**	**Total**	**Rank**
Foeniculum vulgare	4	4	4	3	4	4	3	4	30	1st
Schinus molle	4	3	4	3	3	4	3	4	28	2nd
Withania somnifera	2	3	2	3	3	3	4	3	23	3rd
Ruta chalepensis	3	3	2	2	3	4	1	4	22	4th

4.6. Jaccard's Similarity Index

The finding shows that study kebelles, Kone town and Guaza-jebera have a JI value of 0.81 which indicates that the local peoples of these area shared common knowledge of medicinal

plants whereas study areas Kone-geter and Guaza-jebera have 0.31 JI value, Kone town and Kone-geter have 0.30 as Chena-denkesh and Gan-chare. Other kebelles have a JI value of below 0.30 which indicated that they shared less knowledge of medicinal plants (Table 4).

Table 4 Jaccard's similarity index between each study kebelles

	Study *kebelles*						
	Kone town	Kone geter	Chena-denkesh	Gan-chare	Meley	Yenqtetna-yewoyne	Guaza-jebera
Kone town	1						
Kone geter	0.30	1					
Chena-denkesh	0.23	0.20	1				
Gan-chare	0.20	0.24	0.30	1			
Meley	0.24	0.22	0.23	0.29	1		
Yeneqetena yewoyne	0.28	0.27	0.28	0.26	0.26	1	
Guaza-jebera	0.81	0.31	0.29	0.29	0.29	0.27	1

4.7. Threats to and Conservation of Medicinal Plants

In the study, several factors both human and natural were found to contribute to the threats that affect survival of medicinal plants species in the study area. The reports of eight key respondents' preference ranking of six highly cited threats of medicinal plants suggested that scarcity of rain (drought) were mentioned as the leading factor that threatens medicinal plants followed by agricultural expansion and grazing animals (Table 5). This finding disagrees with the results of other ethnomedicinal study Yeshambel Birhanu (2017) that agricultural expansion was the major threatening factor followed by firewood and charcoal production, over grazing by domestic animals and harvesting for medicinal purpose.

Table 5 preference ranking of threats to medicinal plants

Threats	Respondents (R_1 - R_8)								Total	Rank
	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8		
Scarcity of rain (drought)	6	4	5	6	5	4	6	6	42	1st
Agricultural expansion	5	6	4	5	3	5	4	3	35	2nd
Grazing animals	4	3	5	4	4	3	5	4	32	3rd
Fire wood	4	4	3	4	2	3	2	1	23	4th
Charcoal production	3	2	1	3	3	2	3	2	19	5th
House construction	1	2	3	2	1	1	2	1	13	6th

The preference ranking of six methods of conserving and protecting medicinal plants revealed that cultivating them around the homegarden which accounts about 22.79% was mentioned as a prior method to conserve and protect medicinal plants followed by replanting (Table 6).

Table 6 Preference ranking of methods of conservation and protection of medicinal plants

Methods	Respondents (R_1 – R_6)							Total	Percentage (%)	Rank
	R_1	R_2	R_3	R_4	R_5	R_6	R_7			
Cultivating around homegarden	5	4	5	4	5	3	5	31	22.79	1st
Replanting	5	4	3	4	3	3	4	26	19.12	2nd
Watering	4	3	4	3	3	4	3	24	17.65	3rd
Fencing	4	4	3	4	3	2	1	21	15.44	4th
Education	3	2	4	3	2	1	3	18	13.24	5th
Protecting from grazing	3	1	2	2	1	3	2	16	11.76	6th

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary and Conclusion

A study on ethnobotany of medicinal plants in Wadla *Woreda*, Amhara Regional State, Ethiopia was conducted. The study aimed at identifying and documenting the plants used to treat human and livestock diseases. The study included 100 informants aged 20 and above years. Ethnobotanical data were collected using semi-structured interviews, field observations, group discussion and guided field walk. Descriptive statistics i.e. percentage, preference raking, informants consensus factor, fidelity level and Jaccard's similarity index were used to summarize and analyze data. Results showed that totally 56 medicinal plant species were recorded. Of these, about 71.43, 5.36 and 23.21% of the medicinal plants were reported to treat only human, only livestock, and both human and livestock ailments, respectively. The majority of medicinal plant species were obtained from forest followed by homegardens, farmland and roadside.

Analysis of habits (life forms) of medicinal plants revealed that herbs constituted the largest category followed by shrubs, trees and climbers.

The most cited plant parts used for the medicinal preparations were leaves followed by root, fruits, whole parts and latex, and seeds. The major internal routes of administrations include oral, nasal, through the eyes and through the ear canal while the major external route was dermal application.

Disease categories with relatively higher ICF values were sensorial related problems (0.92); maternal and fertility problems (0.80); Musculoskeletal, wart, body swellings related problems (0.63); hemorrhoid and cardiovascular related problems (0.6); diarrhea, gastrointestinal related diseases (0.6); bacterial diseases and psychological problems each (0.5). This may indicate the common occurrence of these diseases so that more number of people are exchanging information and agree on plant species that can be used to treat these diseases than the rest.

Result of preference ranking showed that *Foeniculum vulgare* ranked first among the four plant species reported to treat cough followed by *Schinus molle* and *Withania somnifera* as 2nd and 3rd, respectively, whereas *Ruta chalepensis* was found to be the least preferred species.

The finding shows that study kebelles, Kone town and Guaza-jebera have a JI value of 0.81, which indicates that similar medicinal plants were found in different areas and the local peoples of the areas were shared common knowledge of medicinal plants where as study areas Kone-geter and Guaza-jebera have 0.31 JI value, Kone town and Kone-geter have 0.30 as Chena-denkesh and Gan-chare.

The reports of eight key respondents' preference ranking of six highly cited threats of medicinal plants suggested that scarcity of rain (drought) were mentioned as the leading factor that threatens medicinal plants followed by agricultural expansion and grazing animals.

The preference ranking of six methods of conserving and protecting medicinal plants revealed that cultivating them around the homegarden which accounts about 22.79% was mentioned as a prior method to conserve and protect medicinal plants followed by replanting.

Overall, local people of the study area use traditional medicine of plant origin in fighting against some ailments of humans and livestock, and those plant species with the highest ICF, FL and preference ranking should be considered for further study *in vitro* and chemical compositions.

5.2. Recommendations

Based on the findings of the study, the following recommendations can be forwarded.

- Medicinal plants that appear to be rare in the area should be cultivated in homegardens;
- There is a need of coordination of traditional healers of the area together by certification or by organizing them in a community at *Woreda* level that popularize their indigenous knowledge on medicinal plants' use;
- Attention should be given to standardization of measurements and hygiene of the medicines made from plants by training both the healers and other members of the local community;
- Young generation needs raising awareness to avoid negative impacts on the medicinal plants and associated knowledge in the area

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7. APPENDIX

Appendix table 11 List of medicinal plants used to treat human and/or livestock health problems

Scientific Name	Plant local name	Diseases/ Ailments/ treated	Family	Habit	Plant part used for remedy and preparation methods	Routes of application
Acacia abyssinica Hochst. ex Benth.	Girar	Goiter	Fabaceae	T	Leaf: leaf is pounded mixed with water and drunk	Oral
Acanthus sennii Chiov.	Kusheshilie	Evil eye	Acanthaceae	Sh	The roots will be Crushed/powdered with that of *Justicia schimperiana* and whole parts of *Ruta chalepensis*, Bulb of *Allium sativum* then mixed with water	Oral, dermal and nasal
Achyranthes aspera L.	Telenj	Ear mites	Amaranthaceae	H	Dropped the powdered leaves of *Zehneria scabra* and *Datura stramonium* mixed with water	Ear
		Excessive menstrual flow			Root will be crushed and mixed with water and then the mixture will be decanted and drunk	Oral
		Eye dust particle			Leaf will be pounded and mixed with water and the suspension will	Eye

		removal			be dropped in the eye	
		'Lifie			Leaf will be crushed and tied on the affected area	Dermal
		** *'Wugit'* (*aynenas*)			Fresh root will be smoked and inhaled	Nasal
					Fresh root will be tied around the neck	Dermal
					Root will be crushed, mixed with water and drunk	Oral
Allium sativum	Nech Shinkurt	Rabies	Alliaceae	H	Bulb *Allium sativum* chewed and eaten	Oral
Aloe sp. Tod.	Eret	Face allergy (*'madiat'*)	Aloaceae	H	Fresh leaf latex: The latex will be Painted onto the affected part	Dermal
		**Wound			Fresh leaf latex: The latex will be painted onto the affected part	Dermal
Artemisia abyssinica Jack. ex Willd.	Chikugn	Severe headache	Asteraceae	H	Pounded *Silene macrosolen* mixed with water then drunk	Oral

Asparagus africanus Lam.	Yesiet kest	*'Likift'*	Asparagaceae	Sh	Root will be crushed, mixed with butter and creamed	Dermal
Brassica carinata A. Br.	Gomen	**Antrax	Brassicaceae	H	Seed: seed will be ground, mixed with water and given to animals to drink	Oral
		Stomach ache			Seed: seed will be ground mixed with water and drunk	Oral
Buddleja polystachya Fresen.	Anfar	Intestinal parasite	Loganiaceae	H	Leaf will be crushed/ powdered, mixed with water and drunk	Oral
		Tonsillitis			Leaf will be crushed with that of *Rhamnus prinoides* and put on the affected area	Dermal
Calotropis procera Latex Hu.	Tobia	Hemorrhoids	Asclepiadaceae	H	Crushed root will be mixed with the leaf latex of *Euphorbia abyssinica* and *Calotropis procera* and creamed onto the affected area	Dermal
*Calpurnia aurea (*Ait.) Benth.	Digita	Erythroblastosis (*shotelay*)	Fabaceae	Sh	Fruit will be crushed/ powdered with roots of *Ferula communis* and *Gardenia ternifolia* mixed with honey and consumed and also creamed	Oral and Dermal

		*External parasites	Fabaceae		Crushed leaf will be used to wash the infested animal	Dermal
Capparis tomentosa Lam.	Gumero	Evil eye	Capparidaceae	T	Root will be smoked and inhaled	Oral or Nasal
Carissa spinarum L.	Agam	Evil eye	Apocynaceae	T	Crushed/powdered roots will be mixed with water and drunk	Oral, Nasal & Dermal
Cavratica gracilis (Guill.&Perr.) Suesseng	Aserkush tebetbkush (milas golgul)	* *'Gofita'*	Vitaceae	Sh	The roots pounded and mixed with water to form the juice	Nasal /ear
		'Kunchir'			Root powder mixed with water and creamed onto the skin	Dermal
Chenopodium ambrosioides L.	Amedmado	Fire burn	Chenopodiaceae	Sh	Fresh leaf will be tied onto the affected area	Dermal
Cirsium englerianum O. Hoffm.	Dendero (Yahya kusheshilie)	*Hitted (*'Bitr*)	Asteraceae	Sh	Root will be crushed mixed with water and drenched to the animal	Oral
		* *'Gofita'*	Asteraceae	Sh	Root will be pounded mixed with water and added into nostrils or ear	Nasal /ear
Clematis simensis Fresen.	Azo hareg	Hemorrhoids	Ranunculaceae	Cl	Pounded/crushed leaf will be tied on the affected area of the skin	Dermal
						Dermal

		Wound				
Clutia lanceolata .	Fiyelefeji	Dandruff	Euphorbiaceae	T	Leaf or bulb will be crushed mixed with water and put on the head	Dermal
		Diarrhea			Crushed leaf will be tied on the neck of babies	Dermal
Cordia africana Lam.	Wanza	Ear mites	Boraginaceae	T	Leaf will be rubbed and squeezed and the sap will be dropped into the ear	Ear
		Failure to retain Urine			Holding the organ with fresh leaf	Dermal
Crinum ornatum	Yejib Shinkurt	Rheumatism	Amaryllidaceae	H	Fresh bulb juice is mixed with lemon juice and applied on the affected area	Dermal
Croton macrostachyus	Bissana	Anthrax	Euphorbiaceae	T	Pounded leaf is mixed with water and drunk	Oral
		Evil eye			Root will be crushed/powdered together the the bulb of *Allium sativum* and roots of *Asparagus africanus, Capparis tomentosa* and *Carissa spinarum* and tied on the neck. And also smoked to fumigate house and for inhalation	Dermal and Oral/nasal
		Snake bite			Pounded leaf will be concocted with water,/coffee or juice and	Oral

					drunk	
		Itch			Leaf will be pounded and mixed with butter and creamed onto the skin	Dermal
		Swelling	Euphorbiaceae		Its leaves will be pounded together with that of *Schinus molle* and *Justicia schimperiana* and drunk with water	Oral
Cucumis ficifolius A. Rich.	Yemidr enbuay	Ear mites	Cucurbitaceae	H	Leaf will be crushed and its sap will be dropped into the ear	Ear
		Evil eye			Crushed fruit will be tied on the neck	Dermal
Datura stramonium L.	Astenagir	*Expelling of plastics and other harmful materials from animals'	Solanaceae	H	Leaves will be pounded with that of *Achyranthes aspera* mixed with water and animals will be drenched	Oral
		Eye infection			Leaves will be pounded with that of *Achyranthes aspera* mixed with water the suspension will be dropped into the eye	Eye

		Tooth disease			Fruit will be chewed	Oral
		*Louse infestation			Leaf will be crushed mixed with water and applied on the head	Dermal
Discopodium penninervum Hochst.	Almit	Swelling	Solanaceae	Sh	Leaves will be pounded together with that of *Clutia lanceolata* and *Leonotis ocymifolia and drunk with water*	Oral
Dodonaea angustifolia L.f.	Kitkita	Eczema	Sapindaceae	T	Leaf will be crushed and mixed with butter, and creamed	Dermal
		Tape worm deworming	Sapindaceae		Pounded leaf will be drunk with water	Oral
Eucalypthus globulus	Nech bahrzaf	Itching	Myrtaceae	T	Crushed leaf will be used to wash the body with water	Dermal
		Febrile illness			Leaves together with that of *Zehneria scabra* will be boiled and inhaled	Nasal
		Foot fungal infection			Fresh leaf will be put in the shoe	Dermal
Euphorbia abyssinica Gmel.	Kulkual	*Rabies	Euphorbiaceae	H	The latex will be drunk with milk	Oral
		Wart			Ground root and mix with its milky latex then cream the affected part	Dermal

		Stomach complaints			Crushed fresh root will be eaten with bread	Oral
Foeniculum vulgare	Ensilal	Cough	Apiaceae	H	Fresh intact leaf soaked in milk and drunk	Oral
		Stomach-ache			Ground fresh fruit will be eaten with food	Oral
Ferula communis L.	Dog	Evil eye and sprit	Apiaceae	H	Whole part will be crushed and smoked/fumigated	Dermal
Hagenia abyssinica	Kosso	Bone fracture	Rosaceae Rosaceae	T	Ground leaf will be put on the skin and tied	Dermal
		Tapeworm deworming			Fruit will be powdered and drunk	Oral
Hypericum quartinianum A.Rich	Amuja	Stomach ache	Hypericaceae	Sh	Fresh leaf will be chewed and the sap will be drunk	Oral
Justicia schimperiana (Hochst. ex Nees) T.Anders.	Smiza	Anthrax	Acanthaceae	Sh	Leaves will be powdered and drunk with water	Oral
		Foot fungal infection			Pounded fresh leaf will be mixed with water and washed foot	Oral

		Liver			Pounded leaf will be drunk with water	Oral
		Rabies			Pounded leaf will be drunk with water	Oral
		Stomachache			Pounded leaf will be drunk with water	Oral
Laggera crispata (Vahl) Hepper & Wood	Alashume	*Gastritis stomach complaint	Asteraceae	H	Pounded leaf will be drunk with water	Left nose/ ear/ for livestocks and oral for humans
		Gastritis, stomach ache			Pounded leaf will be drunk with water	Oral
		Tape worm deworming			Pounded leaf will be drunk with water	Oral
Leonotis ocymifolia (Burm.f.) Iwarsson	Fereszeng	Swelling	Lamiaceae	Sh	Pounded leaf will be drunk with water	Oral
Malva verticillata	Lut	Eye dust particle removal	Malvaceae	H	Pounded leaf will be mixed with water and the mixture will be dropped in to the eye	Eye
Ocimum lamiifolium Hochst.	Damakesie	Wound	Lamiaceae	Sh	Fresh bark paste will be dressed onto the affected skin part	Dermal

		Febrile illness			Pounded leaf will be drunk with coffee/water	Oral
Olea europaea subsp.cuspidata L.	Woira	*'Likift'*	Oleaceae	T	Pounded leaf will be mixed with water wash the body	Dermal
Phytolacca dodecandra L'Herit.	Endod	*Leech	Phytolaccaceae	T	Leaf powder will be mixed with water and drenched	Nasal
Podocarpus falcatus	Zigba	Vomiting	Podocarpaceae	H	Pounded leaves of *Podocarpus falcatus* will be drunk with water	Oral
Rhamnus prinoides	Gesho	Eczema	Rhamnaceae	T	Fresh leaf powder mixed with butter and creamed on the affected area	Dermal
		Liver			Ground fresh root will be mixed with water and drunk	Oral
		Almaz balechira (Herpes)			Ground leaf fluid will be creamed on the skin	Dermal
Ricinus communis L.	Gulo	*Calf diarrhea	Euphorbiaceae	H	Crushed fruit will be mixed with water and given to the calf	Oral
Rosa abyssinica Lindley.	Kega	Depression	Rosaceae	T	Fresh fruit will be eaten	Oral

Rumex nepalensis Spreng.	Tult	*Anthrax	Polygonaceae	H	Crushed root will be mixed with water and drunk	Oral
		Stomach ache	Polygonaceae		Fresh root will be chewed and swallowed	Oral
Rumex nervosus	Embacho	Eye infection	Polygonaceae	H	Crushed leaf will be mixed with water some will be dropped into the eye	Eye
		Rheumatism			Crushed leaf will be used to wash the body with water	Dermal
		Wart			Stem will be heated and hold onto the affected are	Dermal
Ruta chalepensis L.	Tenadam	Cough	Rutaceae	H	Pounded leaf will be drunk with water	Oral
		Evil eye			Leaf crushed with that of *Artemisia abyssinica* and bulb of *Allium sativum* and sniffed	Nasal
Sansevieria erythraeae Mattei.	Chiret	Ear mites	Agavaceae	H	Pounded stem will be mixed with water and the suspension will be dropped into the ear	Ear
Schinus molle L.	Kundoberbere	Cough	Anacardiaceae	T	Fruit pounded, cooked with food and eaten	Oral
		Wound			Crushed leaf will be put on the wound	Dermal

Solanum nigrum L.	Awut	*'Lifie'*	Solanaceae	H	Fresh leaf will be tied on the affected area	Dermal
Stephania abyssinica	Yeayit hareg	Almaz balechira (Herpes)	Menispermaceae	Cl	Fresh leaf will be pounded and the sap will be applied onto the skin	Dermal
		* *'Kuro'*			Pounded Leaf will be drenched to the animals	Nasal
Thymus schimperi	Tosgn	Asthma	Lamiaceae	H	Dried or fresh leaf will be boiled and drunk with water	Oral
		Blood Pressure			Boiled with water then drunk	Oral
Urtica simensis Steudel.	Sama	Eczema	Urticaceae	H	Ground leaves will be rubbed against the skin	Derma
Verbena officinalis	Atuch	Evil eye	Verbenaceae	H	Smelling of aroma of fresh root	Nasal
Vicia faba L.	Bakela	*'Bigunji'*	Fabaceae	H	Fresh seed will be chewed	Oral
Withania somnifera (L.) Dunal in DC.	Giziewa	Cough	Solanaceae	Sh	Leaf crushed and boiled with milk and drunk	Oral
		Evil eye			Pounded and mixed with water then drunk Crushed and burn the fruit	Oral Nasal

Zehneria scabra	Haregresa	Febrile illness	Cucurbitaceae	Cl	Boiled leaf in water then fumigated	Nasal
		*Expelling of plastics and other harmful materials from animals'			Pounded and mixed together with water and leaves of *Achyranthes aspera* and *Datura stramonium* then drunk	Oral
		Eye dust particle removal			Pounded leaves of *Datura stramonium L* and *Achyranthes aspera L.* and mixed together with water then dropped into eye	Eye /optical
		Ear mites			Pounded and mixed together with water and *Achyranthes aspera* and *Datura sramonium* leaves and dropped into ear	Ear
		Eye dust particle removal			Pounded and mixed together with water and *Achyranthes aspera* and *Datura stramonium,* then dropped	Eye /opticl
		Febrile illness			Pounded and mixed together with water and *Achyranthes aspera* and *Datura stramonium* and creamed the body	Dermal

		Wart			Pounded and mixed together with water and *Achyranthes aspera* and *Datura stramonium* and painted / creamed on the affected part	Dermal
		Bone fracture			Pounded and mixed together with water and *Achyranthes aspera* and *Datura stramonium* and drunk	Oral
		Ear mites			Pounded and mixed together with water and *Achyranthes aspera* and *Datura stramonium* and droppped	Ear
		Febrile illness			Pounded and mixed together with water and *Achyranthes aspera* and *Datura stramonium* and drunk	Oral

Keys: H-herb, Cl-Climber, Sh-Shrub, T –Tree

* Both human and livestock diseases

** Livestock diseases

Appendix table 22 Family and number of species

No.	Family	Number of species	No.	Family	Number of	No.	Family	Number of species	No.	Family	Number of species
1	Acanthaceae	2	11	Asparagaceae	1	21	Fabaceae	3	31	polygonaceae	2
2	Agavaceae	1	12	Asteraceae	3	22	Hypericaceae	1	32	Ranunculaceae	1
3	Alliaceae	1	13	Boraginaceae	1	23	Lamiaceae	2	33	Rhamnaceae	1
4	Aloaceae	2	14	Brassicaceae	1	24	Loganiaceae	1	34	Rosaceae	2
5	Amaryllidaceae	1	15	Cactaceae	1	25	Malvaceae	1	35	Rutaceae	1
6	Amaranthaceae	1	16	Capparidaceae	1	26	Menispermaceae	1	36	Sapindaceae	1
7	Anacardiaceae	1	17	Chenopodiaceae	1	27	Myrtaceae	1	37	Solanaceae	4
8	Apiaceae	2	18	Cucurbitaceae	2	28	Oleaceae	1	38	Urticaceae	1
9	Apocynaceae	1	19	Dracaenaceae	1	29	Phytolaccaceae	1	39	Verbenaceae	1
10	Asclepiadaceae	1	20	Euphorbiaceae	4	30	Podocarpaceae	1	40	Vitaceae	1

Appendix table 33 Personal information of the respondents

No.	Name of respondents	Sex	Age	Marriage status	Village	Kebele code	Occupation	Religion	Educational Background
1	Ayal Abate	F	>50	Married	Kone town	01	House wife	Orthodox	Uneducated
2	Mullu Masrie	F	31-40	Married	Kone town	01	House wife	Orthodox	5-8
3	Woldakal Feleke	M	41-50	Married	Kone town	01	Gov't worker	orthodox	5-8
4	Birtukan Ashagrie*	F	20-30	Married	Kone town	01	House wife	orthodox	>8
5	Belay Damtie*	M	>50	Married	Kone town	01	Farmer	Orthodox	1-4
6	Tesfaye Ayenew	M	31-40	Married	Kone town	01	Gov't worker	Orthodox	>8
7	Megabi Alemu	M	31-40	Married	Kone town	01	Gov't worker	Orthodox	>8
8	Yirga Biyabeyin	M	31-40	Married	Kone town	01	Gov't worker	Orthodox	>8
9	Mezgebe Yirga	M	31-40	Married	Kone town	01	Gov't worker	Orthodox	>8 & Religious edu.
10	Mebre Kassa	M	31-40	Married	Kone town	01	Gov't worker	Orthodox	>8
11	Taddesse Mengistu	M	31-40	Married	Kone town	01	Gov't worker	Orthodox	>8
12	Berihun Degu*	M	41-50	Married	Kone town	01	Merchant	Orthodox	1-4& Religious edu.
13	Abate Worku	M	>50	Married	Gan-chare	08	Farmer	Orthodox	1-4
14	Demlie Admasie	M	>50	Married	Gan-chare	08	Farmer	Orthodox	1-4
15	Atalele Abebe	M	20-30	Married	Gan-chare	08	Farmer	Orthodox	5-8

16	Geta Asnake	M	>50	Married	Gan-chare	08	Farmer	Orthodox	Uneducated
17	Yemata Amare	F	>50	Married	Gan-chare	08	House wife	Orthodox	Uneducated
18	Molaja Aberu	M	>50	Married	Gan-chare	08	Farmer	Orthodox	1-4
19	Mekuriya Endayew	M	>50	Married	Gan-chare	08	Farmer	Orthodox	1-4
20	Enanu Tareke*	F	>50	Married	Gan-chare	08	House wife	Orthodox	Uneducated
21	Mullu Tekie*	M	>50	Married	Gan-chare	08	Farmer	Orthodox	Religious education
22	Aragaw Kassie*	M	>50	Married	Gan-chare	08	Farmer	Orthodox	Religious education
23	Abera Sisay	M	>50	Married	Gan-chare	08	Farmer	Orthodox	1-4
24	Akilo Woday	M	>50	Married	Gan-chare	08	Farmer	Orthodox	Religious education
25	Dessie Alemu*	F	>50	Married	Gan-chare	08	House wife	Orthodox	Uneducated
26	Mekuriya Zegeye	M	>50	Married	Meley	017	Farmer	Orthodox	Uneducated
27	Tigist Kassa*	F	31-40	Married	Meley	017	House wife	Orthodox	1-4
28	Ergoye Masrie*	F	>50	Married	Meley	017	House wife	Orthodox	Uneducated
29	Kassaye Kebadu	M	>50	Married	Meley	017	Farmer	Orthodox	Uneducated
30	Mullugeta Getu	M	>50	Married	Meley	017	Farmer	Orthodox	Uneducated
31	Kassa Gobezie*	M	>50	Married	Meley	017	Farmer	Orthodox	Uneducated
32	Assefa Ayalew	M	>50	Married	Meley	017	Farmer	Orthodox	Uneducated
33	Mezgebe Bayleyegn	M	31-40	Married	Meley	017	Farmer	Orthodox	Religious education

34	Berihun Gelawuye	M	>50	Married	Meley	017	Farmer	Orthodox	Uneducated
35	Assefa Alene	M	41-50	Married	Meley	017	Farmer	Orthodox	1-4
36	Enanaw Damtie	M	31-40	Married	Meley	017	Farmer	Orthodox	1-4
37	Belete Ayele	M	31-40	Married	Meley	017	Farmer	Orthodox	Religious education
38	Feleke Sefi	M	31-40	Married	Meley	017	Farmer	Orthodox	Uneducated
39	Kassaw Fetene	M	>50	Married	Meley	017	Farmer	Orthodox	1-4
40	Yalew Aschilo	M	41-50	Married	Yenqetna yewoyne	022	Farmer	Orthodox	Religious education
41	Tesfa Astewale	M	41-50	Married	Yenqetna yewoyne	022	Farmer	Orthodox	Religious education
42	Assefa Tigabie	M	41-50	Married	Yenqetna yewoyne	022	Farmer	Orthodox	1-4
43	Tsehay Tebeje*	F	41-50	Married	Yenqetna yewoyne	022	House wife	Orthodox	Uneducated
44	Hailu Adera *	M	41-50	Married	Yenqetna yewoyne	022	Farmer	Orthodox	5-8 &Religious education
45	Degu Birhan *	M	>50	Married	Yenqetna yewoyne	022	Farmer	Orthodox	Religious education
46	Tesema Alemu	M	41-50	Married	Yenqetna yewoyne	022	Farmer	Orthodox	Religious education
47	Temesgen Fikade	M	41-50	Married	Yenqetna yewoyne	022	Farmer	Orthodox	Religious education

48	Tesfaw Mekonnen	M	41-50	Married	Yenqetna yewoyne	022	Farmer	Orthodox	1-4
49	Assefu Tigabe	F	41-50	Married	Yenqetna yewoyne	022	House wife	Orthodox	Uneducated
50	Birtukan Abebe	F	31-40	Married	Yenqetna yewoyne	022	House wife	Orthodox	1-4
51	Sefi Amare	F	>50	Divorced	Yenqetna yewoyne	022	House wife	Orthodox	Religious education
52	Yeshiwas Alemnew	F	>50	Married	Yenqetna yewoyne	022	House wife	Orthodox	Uneducated
53	Besfat Semaw	M	>50	Married	Yenqetna yewoyne	022	Farmer	Orthodox	1-4
54	Shibesh Yalelet*	M	41-50	Married	Yenqetna yewoyne	022	Farmer	Orthodox	1-4
55	Mesafint Beru	M	>50	Married	Yenqetna yewoyne	022	Farmer	Orthodox	Uneducated
56	Fentie Andebet	M	>50	Married	Guaza-jebera	021	Farmer	Orthodox	Religious education
57	Assefu Dildil	F	41-50	Married	Guaza-jebera	021	House wife	Orthodox	Uneducated
58	Semay Alemayehu*	M	41-50	Married	Guaza-jebera	021	Farmer	Orthodox	5-8 & Religious education
59	Tegaye Moges	M	31-40	Married	Guaza-jebera	021	Farmer	Orthodox	1-4
60	Semagn Seteye	M	41-50	Married	Guaza-jebera	021	Farmer	Orthodox	1-4

61	Abebu Gulma	F	41-50	Married	Guaza-jebera	021	House wife	Orthodox	Uneducated
62	Adera Abera	M	>50	Married	Guaza-jebera	021	Farmer	Orthodox	1-4 & Religious edu.
63	Moges Bisetegn	M	41-50	Married	Guaza-jebera	021	Farmer	Orthodox	Religious education
64	Derb Legesse	M	>50	Married	Guaza-jebera	021	Farmer	Orthodox	Religious education
65	Habtamu Getie	M	>50	Married	Guaza-jebera	021	Farmer	Orthodox	1-4
66	Abera Melese	M	>50	Married	Guaza-jebera	021	Farmer	Orthodox	Uneducated
67	Mekuriaw Mesay*	M	>50	Married	Guaza-jebera	021	Farmer	Orthodox	Uneducated
68	Adem Setegn	M	>50	Married	Guaza-jebera	021	Farmer	Muslim	Religious education
69	Mohammod Hussen *	M	>50	Married	Guaza-jebera	021	Farmer	Muslim	Religious education
70	Ageritu Asfaw*	F	>50	Divorced	Guaza-jebera	021	House wife	Orthodox	Uneducated
71	Fasil Amare	M	41-50	Married	Chena-Dekesh	06	Farmer	Orthodox	1-4
72	Habtamu Addis	M	41-50	Married	Chena-Dekesh	06	Farmer	Orthodox	1-4
73	Faris Endalew *	M	41-50	Married	Chena-Dekesh	06	Farmer	Orthodox	Uneducated
74	Ayenew Sete	M	41-50	Married	Chena-Dekesh	06	Farmer	Orthodox	1-4 & Religious edu.
75	Mareg Habtie	M	41-50	Married	Chena-	06	Farmer	Orthodox	Religious

					Dekesh				education
76	Mekete Esubalew	M	41-50	Married	Chena-Dekesh	06	Farmer	Orthodox	Religious education
77	Serkie woday	F	41-50	Married	Chena-Dekesh	06	House wife	Orthodox	1-4
78	Habtie Tigab	M	41-50	Married	Chena-Dekesh	06	Farmer	Orthodox	Uneducated
79	Alemu Guangul	M	41-50	Married	Chena-Dekesh	06	Farmer	Orthodox	1-4
80	Girma Kebede	M	41-50	Married	Chena-Dekesh	06	Farmer	Orthodox	Uneducated
81	Dilidil Yalew	F	41-50	Married	Chena-Dekesh	06	House wife	Orthodox	Uneducated
82	Bisetegn Kindu	M	41-50	Married	Chena-Dekesh	06	Farmer	Orthodox	Uneducated
83	Estemech Ebabu	M	41-50	Married	Chena-Dekesh	06	Farmer	Orthodox	Uneducated
84	Zewdie Destaw	F	41-50	Married	Chena-Dekesh	06	House wife	Orthodox	Uneducated
85	Asmare Gelaw*	M	>50	Married	Kone –Geter	01	Farmer	Orthodox	1-4
86	Serkie Damtew	F	41-50	Married	Kone –Geter	01	House wife	Orthodox	Uneducated
87	Aregash Getu	F	>50	Married	Kone –Geter	01	House wife	Orthodox	Uneducated
88	Kassaye Masrie	F	>50	Married	Kone –Geter	01	House wife	Orthodox	Uneducated
89	Tsegaw Bezie	M	41-50	Married	Kone –Geter	01	Farmer	Orthodox	Uneducated

90	Gessesse Gelaw	M	>50	Married	Kone –Geter	01	Farmer	Orthodox	1-4
91	Ayenew Gelaw	M	>50	Married	Kone –Geter	01	Farmer	Orthodox	1-4
92	Ayenew Misganew	M	>50	Married	Kone –Geter	01	Farmer	Orthodox	Uneducated
93	Gedefie Gelaw	M	>50	Married	Kone –Geter	01	Farmer	Orthodox	Religious education
94	Nega Tegegne	M	>50	Married	Kone –Geter	01	Farmer	Orthodox	Religious education
95	Tesfa Emagne	M	>50	Married	Kone –Geter	01	Farmer	Orthodox	Uneducated
96	Gedefaw Emagne*	M	>50	Married	Kone –Geter	01	Farmer	Orthodox	Religious education
97	Hailu Teshome	M	>50	Married	Kone –Geter	01	Farmer	Orthodox	Uneducated
98	Getie Gelaw	M	>50	Married	Kone –Geter	01	Farmer	Orthodox	1-4
99	Eshetnew Tigabu	M	>50	Married	Kone –Geter	01	Farmer	Orthodox	1-4
100	Haymnot Abebe	M	41-50	Married	Kone –Geter	01	Farmer	Orthodox	5-8

* = key informants

Appendix 4 Research interview questions for respondents

HARAMAYA UNIVERSITY

POSTGRADUATE PROGRAM DIRECTORATE

Ethnobotaical Study of Medicinal Plants in Wadla *Woreda*, North Wollo Zone, Amhara Regional State, Ethiopia

Research interview

Format for collecting ethnobotanical data using a checklist of questions to conduct semi-structured interviews for Ethnobotanical study of Medicinal plants

- **Personal information**

1. Name of respondent _____

Sex: - 1) male 2) female

Age: - a) 20-30 b) 31-40 c) 41-50 d) above 50

2. Residence area (village) _____ Keble code_____

2.1. Marital status: - a) single b) married c) divorced

2.2. Occupation (main job):- a) farmer b) government worker c) merchant d) other

2.3. Religion: a) Orthodox b) Muslim c) Protestant d) Others

2.4. Educational background (grades):-

a) 1-4 b) 5-8 c) above 8 d) 1-4 & religious education c) 5-8 & religious education

d) >8 & religious education e) Uneducated

- **Ethnobotanical data for medicinal plants**

3. What are the most common diseases of humans, livestock's and both of them in your area?

Human diseases_____

Livestock diseases_____

Both human and animal diseases_____

4. How do people prevent and control disease in the area? _____

_____

5. Mention medicinal plants used to treat human, livestock and both human and livestock diseases in your area?

_____

_____

6. Where do these plants grow / cultivate (the most common habitats of medicinal plants)?

A) Wild /forest B) Homegarden C) Others

7. What is the habit (life forms) of the plant? Tree (T) shrub(s) herbs (h)

Climber (CL) Others (O)

8. What part/s of the medicinal plant(s) is/are used?

Leaf (L) Roots (R) Tuber (T) Rhizome (R) Bark (B) Stem (St)

Fruit (Fr) Seed (Sd) Whole plant (Wp) Bulb (B) Others (O)

9. What is the method of preparation of the medicinal plants? (Would you explain the details for preparation of the remedies?

Fresh (F) Dried (D) Crushed(C) Boiling (B) Grinding (G) Burning (B) Powdered (P) Mixed with others or water (Mw) Used alone (Ua) Others (O)

10. How are the prepared remedies taken by the patient(s) (route of administration)?

Internal: Dermal (D) Oral (O) Nasal (N) Ear (E) Eye (E) Tooth (T) Anal (A) Others (O)

External: Fumigation (F) Washing (W) Putting on (P) Smoking (S)

Rubbing (R) Brushing (B) Others (O)

11. What are the routes of application of medicinal plants?

Drinking	Eat	Tied	Chewing
Put-on	Painting	Washing	Others

12. Does the medicine has any specific measurement (Dosage) and vary among age groups and sex?_____

_____

13. Is there any side effect of the medicine? If yes, is there any antidote and mention?

_____

_____

14. How is the knowledge of medicinal plants use transferred from elders to the young generation?_____

_____

15. Mention the threats that affect the indigenous knowledge of the local healers.

16. Which plant species are the most preferred in their uses as medicinal? Why?

_____

17. Are there treats to medicinal plants? If so, how they conserved/ preserved in the area?

Threats_____

_____

Conservation _____

_____

I Thank You in Advance for Your Time and Cooperation. **Bogale Haile**