College of Natural and Computational Sciences Department of Biology

Ethnobotanical Study of `Medicinal Plants Used by Indigenous People of Munesa District, Arsi zone, Oromia Region, Ethiopia

A Thesis Paper submitted to Department of Biology, College of Natural and Computational Sciences for the fulfillment of M.Sc Degree in Biology

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The Thesis Paper Approval Sheet

As members of the Board of Examining for research paper defense, we certify that we have read and evaluated the research prepared by **Getu Hirpo** entitled as "Ethno botanical study of medicinal plants used by indigenous people of Munesa District" and recommend this research paper is accepted for fulfilling the research requirement for the M.Sc. degree in Biology.

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Abstract

Ethno botany is the scientific study of the way that people used plants to treat different human and livestock diseases. It includes all studies that concern with the mutual relationship between plants and people.The main objective of this study was to assess the traditional medicinal plants used by the indigenous people in selected kebeles of Munesa district. 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 simple to use and affordabily. Structured questionnaire, interview, observation, and document reviews were employed to collect both primary and secondary data. The data was analyzed and presented in qualitative and quantitative methods in that Paired comparison, fidelity level, preference ranking, informant consensus factor and direct matrix ranking were used during data analysis Medicinal healers of the study area gave treatment for different human and livestock diseases like: conjure, breast disease, snake bite, liver diseases, diabetic, cold sore, throat infections, sexually inactive male, allergy, epilepsy, antiseptics, diarrhea, bloat, endo and ecto parasite, Helminthiasis, Anthrax and others. The traditional healers prepare the traditional medicine by mechanisms like: crushing/grinding, squeezing, boiling, roasting. They used different route of administration such as: oral, tying, fitted to the target infected site by traditionally standardized dose. Leaf/pod and root/rhizome were highly used by more than half of the respondents (27%, 26% respectively) for the preparation of traditional medicine. The findings of this study showed that, many of effective medicinal plants in the study area were under risk of threatening or they endangered and any concerned body can give attention for conservation of these threatened medicinal plant species.

Keywords: Ailments, ethnobotany, herbal medicine, herbasists, herbs, traditional medicine

1. INTRODUCTION

1.1 Background of the Study

The use of medicinal plants is increasing worldwide in view of tremendous expansion of traditional medicine and growing interest in herbal treatments (WHO, 2001). Plants are used in medicine to maintain and augment health physically, mentally and spiritually. It has been found that countries in Asia and Latin America use traditional medicine for primary health care need (WHO, 2002). Traditional medicine has remained as the most affordable and easily accessible source of treatment in the primary health care system of mostly for poor communities (WHO, 2001).

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 simple to use and affordable (Tesfaye Hailemariam and Sebsebe Demissew, 2009). Particularly, traditional medicine has maintained its popularity in all regions of the developing world and its use is rapidly spreading in the industrialized countries (WHO, 2001). It includes as holistic knowledge and practices, oral and written functional and diagnosis preventive and curative aspects of illness to promote total well beings (Behura, 2003)

In developing countries favoring traditional medicinal plants is mainly due to inaccessibility of modern medicinal system, economic and cultural factors (Abbiw, 1996). Ethiopia has a diverse flora and some of these plants have potential chemical compounds of therapeutic value to treat some diseases (Ensarmu Kelbessa *et al.*, 2004).

In Ethiopia the use of traditional medicine is wide spread and about 90% of its population uses it for health care (WHO, 2002). In Ethiopia plants of medicinal value are estimated to be over 1000

species (Fassil Kebebew and Getachew Addis, 1996) and most of them are confined to the south western region of the country (Abbiw, 1995). There is a high expectation of enormous traditional knowledge and use of medicinal plant species in Ethiopia due to the existence of diverse cultures, languages and beliefs among the people. Knowledge about traditional medicinal plants in transferred through oral communications, endangering the traditional indigenous knowledge (Abebe Demissie and Ahadu Ayehu, 1993).

1.2. Statement of the problem

Due to natural (influenced by nature) and anthropogenic (influenced by human activity)factors, the biodiversity in general and medicinal plants in particular are being depleted at an alarming rate in the country. The current loss of medicinal plants and associated indigenous knowledge links with environmental degradation, deforestation, agricultural expansion, overexploitation, and population growth are the principal threat to medicinal plants and associated indigenous knowledge in Ethiopia. Loss of indigenous knowledge is also aggravated by the expansion of modern education, making the younger generation underestimate its traditional values (Zenebe *et al*., 2012).

Identification, documentation, and conservation of medicinal plants and the associated knowledge have been conducted in different parts of Ethiopia. In Oromia region, there is habitat and species loss due to continued deforestation and agricultural expansion, as well as loss of associated indigenous knowledge. However, study on medicinal plants is not enough when compared to the diverse vegetation and indigenous knowledge of region.

As it was reported by Munesa (District), knowledge of medicinal plants has been passed orally from one generation to the next by priests and traditional healers. There were no previous studies regarding the Ethno botanical study of medicinal plants used by indigenous people of Munesa District. Therefore, this study was proposed to assess the Ethno botanical medicinal plants to treat human and livestock ailments in selected kebeles of Munesa District, Arsi zone of Oromia region.

1.3. Research Questions

- Which parts of medicinal plants are used to treat disease affecting human and livestock?
- What are the traditional medicinal plants available in the selected kebeles of Munesa district?
- How are plants preserved by the indigenous people of Munesa District?
- What are the factors influencing traditional medicinal plants in Munesa?

1.4. Objectives of the Study

1.4.1. General objective

The general objective of the research is to assess the traditional medicinal plants used by the indigenous people and associated indigenous knoweledge in selected kebeles of Munesa district.

1.4.2. Specific objectives

- To identify plant species used for medicinal purposes in treating human and livestock ailments in Munesa district
- To identify plants parts used to treat diseases, methods of preparation, and route of administrations as used by the local people in study area
- To assess threats and local methods used by indigenous peoples to conserve medicinal plants species in the study area;
- To document indigenous knowledge of local peoples on medicinal plant species in the study area

1.5. Significance of the Study

The finding of this study helps people of the study area to have basic scientific information about the medicinal plant resources along with associated indigenous knowledge of the district and problems associated to medicinal plant conservation and utilizations. In addition, the documented indigenous knowledge on medicinal plants could be part of the information source for those who want to conduct research on the same study concern in the study area and related areas. Furthermore, the filed medicinal plants will be used for the development of modern drug.

1.6. Scope of Study

This study is limited to Munesa District, and focus on Ethno botanical study of medicinal plants used by indigenous people residing in the three Kebeles.

2. RELATED LITERATURE

2.1. The Development of Ethno-botanical Study

There has been an ever-increasing interest by anthropologists, botanists and explorers of the world to document the potential use or economic potential of plants used by indigenous people (Cotton, 1996). Christopher Columbus initiated this in 1442 when he discovered the use of tobacco plant (*Nicotiana spp*) by local people of Cuba. Around 1858, British explorer, R. Spuce noted for the first time the psychoactive properties of the vine plant *(Banisteriopsis cappi*) (Cotton, 1996). Such works gradually yielded a firm base for the study of direct interactions between human and other organisms through documenting, analysis and use of indigenous knowledge of biological entity. Eventually, the work on ethnobotany promoted this subject to be an independent field of study in biological sciences. Since then, different authors used various ways of defining ethnobotany (Kabu Balemie *et al*., 2004).

Research concerned with ethnobotany involves recording the knowledge on the cultural interaction of people with plants, finding out how local people have traditionally used plants for various purposes, and how they incorporate plants into their cultural tradition and religion (Balick and Cox, 1996). To get more detailed and reliable information, ethnobotanical investigation needs to involve scholars from various streams such as plant taxonomy, plant ecology, anthropology, linguistic, economic botany, pharmacology and the like (Martin, 1995).

There are several techniques of inquiry tools based on the aims and objectives of the ethno botanical study at hand (Martin, 1995; Alexiades, 1996). These inquiry techniques include participant observation, simulation, field interviews, and group discussion, checklist interview and market survey. According to Zemede Asfaw (1989), Martin (1995) and Grenier (1998), useful information on ethnobotany could also be obtained from collection and analysis of beliefs, rituals, songs, saying, verse, local names, and dances (Kindscher,1992).

2.1.1. Traditional medicinal plants

Since ancient times, human being used plants for the purpose of disease control and prevention (Giday Yirga, 2011). Physical evidence gathered from burial sites of Neanderthal man discovered in Iraq revealed that the use of medicinal plants in the area goes back to some 6000 years (Solace, 1975, cited in Sofowora, 1982). It was believed to be through trial and error that early man acquired the knowledge on the utilization of plants for disease prevention and curative purposes (Sofowora, 1982). It is not absolutely clear how the knowledge was first started, but it is assumed that the early attempts were based on speculations and superstitions." Evil eye" for instance, causes the individual to be ill. Thus, it was necessary to find substance that would make the body resistant (Hill, 1972). Among early men, medicinal practitioners were considered as knowledgeable groups than the others for the source and use of various medicinal plants (Pankhurst, 1990).

According to Hill (1972), starting from 5000-4000 B.C several drugs were in use in most parts of China. Traditional plant medicines were well popular as early as 1600 B.C among Syrians, Babylonians and ancient Hebrews (Moa Megersa, 2010). The antiquity of the traditional use of medicinal plants in Ethiopia could never be disregarded (Pankhurst, 1990; Mirutse Giday, 1999).

Reviews of medical textbooks that have been written in Geez or Arabic between 17th and 18th 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).

Mechanisms of knowledge transfer among social groups most medicinal plant knowledge is transferred orally, as was reported by 71 study participants (96%) in the study sites (Berhane Kidane *et al*., 2014). This is the dominant mechanism of traditional knowledge transfer system in Africa, although this type of transfer cannot guarantee continuity under the current circumstances, where plant resource degradation and loss is severe. Most people (82%) obtained their knowledge from their (grand) parents, which is similar to the percentage found by a study in Wonago district, Ethiopia (Fisseha Mesfin *et al.*, 2009).

The great majority of the study participants preferred to transfer their medicinal plant knowledge to their children or grandchildren, who favour knowledge conservation and continuity mostly within the family line, demographic factors influencing medicinal plant knowledge Gender significantly, predicted medicinal plant knowledge (Berhane Kidane *et al*., 2014). Male study participants knew a higher number of medicinal plants than female ones (Berhane Kidane *et al*., 2014). This is probably associated with the perception and culture of both ethnic communities to favour males in transferring medicinal plant knowledge (Berhane Kidane *et al*., 2014). This must have implications for the cultivation of medicinal plant species in home gardens as women play a major role in managing these gardens. Moreover, site also strongly influenced the number of medicinal plants known and used (Gadisa Demie *et al*., 2018).

Religion, family size and education did not influence plant knowledge (Berhane Kidane *et al*., 2014). Older members of the community in Male knew more medicinal plants than youngsters, which may also reflect an ongoing gradual knowledge loss of knowledge in the study community (Berhane Kidane *et al*., 2014). Hence, it is important to include traditional knowledge in the school curricula to raise awareness as recommended by (Tesfaye Awas, 2007).

Marketing of medicinal plants was not common at the studied markets, apart from the well-known *Hagenia abyssinica* flowers and *Embelia shimperi* seeds (both wild collected) and the cultivated *Allium sativum* and *Artemisia absinthium* that are also used as spices (Tigist Wondimu *et al*., 2007). The commercialization of other wild and semi-wild species is hampered by the fact that medicinal knowledge is only held by few people (Etkin, 2002).

Etana Tolassa (2007) also found only a few species (*Thalictrum rhynchocarpum*, *Piper capense* and *Echinops kebericho*) at Gimibi and Gaba Senbeta markets, in western Ethiopia, while Meaza Giday et *al.,* 2009 found that the few species sold by Bench communities in south-western Ethiopia doubled as spices. The market chains were short and medicinal plants were directly sold by harvesters without further processing (VanAndel and Havinga, 2008). The economic importance of the trade was limited: the price of *Embelia shimperii* seeds was only 2 Ethiopian Birr (0.10 $) per glass (about 250 ml) (Yebirzaf Yeshiwas *et al*., 2019). The product was not always available and marketed in small quantities (Levitt, 1980).

The practice of traditional medicine in Ethiopia consists of the use of herbs, cupping, bleeding, cauterisation, steam bath, spiritual healing, holy water, bone setting and minor surgical procedures (GebreMichael Habtom, 2015). Most of knowledges on traditional medicinal plants are orally transmitted, although few are available in written records (Wilson and Wolde Gabre Mariam, 1979; cited in Pankhurst, 1990). Many practitioners of traditional medicine widely use a large number of plants well known to them (Mesfin Tadesse and Sebsebe Demissew, 1992).

Nevertheless, many are less cooperative to show their knowledge and skill on traditional to others. According to Pankhurst (1990), the knowledge on medicinal plants and method of use circulated mainly among practitioners and the beneficiaries of such practice. This has made the knowledge and skill on traditional medicinal plants and traditional medicine more hidden but less available to the public (Abbink, 1995).

2.2 Ethno medicine studies in Ethiopia

Traditional medicine has been practiced for the last several thousand years but only found its legitimate place in the WHO program only about 35 years ago (WHO, 1978). Furthermore, 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). Most pharmaceutical companies recently have developed mechanisms to involve indigenous people collect plant samples on the recommendation of traditional practitioners (Baker, 1995).

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). Since medicinal plants are the main, often only source of traditional medicine for the rural population and are of high demand in the health care systems of this population when compared to modern medicine, ethno medicine activities need special consideration and back-up (Abbiw, 1996). This is partly because modern medicinal services are either unaffordable or unavailable to the vast majority of local people due to their skyrocketing cost coupled to lack of transport to and from health care centers (Giday Yirga, 2010). World Health Organization (WHO) established a worldwide program to promote and develop basic and applied research in traditional medicine (WHO, 1978).

Medicinal plants then have got special attention and regional offices were established by World Health Organization to coordinate basic and applied research activities on medicinal plants (Dawit Abebe, Giday Yirga, 2011). This was linked to the establishment to record medicinal plants to improve accessibility and dissemination of information on medicinal plants (Tsige Gebremariam and Kaleab Asres, 2001).

To preserve indigenous knowledge of plants use in general and of traditional medicine in particular, an ethnobotanical survey of lesser-studied socio-cultural groups is very crucial. However, in Ethiopia research and documentation on medicinal plants have been started only very recently (Mesfin Tadesse and Sebsebe Demissew, 1992). Limited number of these papers dealt with specific socio- cultural groups in specific areas (Searle and Ward, 1990).

When compared to the country's varied flora and the socio-cultural diversity, these studies are incomplete as medicinal plant healing systems differed from culture to culture (Hareya Fassil, 2005). Hence, attention should be given to the field of ethnomedicine of the country with all necessary endeavors to have a full picture of the country's medicinal plants potentials (Zewide Kassa *et al*., 2020)

2.3. Preparation Methods, Dosage and Route of application

Medicinal preparations of plants contain many things such as powdered plant materials, extracts and purified active substances isolated from plant materials (Bandaranayake, 2006). In certain cases, materials of animal or mineral origin may also be included in such preparations (Williamson, 2013). The medicinal plant preparation and application are accomplished in various forms (Azwanida, 2015). However, according to most literature sources have shown that simple crushing and pounding a particular plant part(s) and homogenizing it in water are the commonly used form of herbal preparation for both human and livestock health problems (Habtom Agisho *et al*., 2014).

An ethnobotanical study of medicinal plants in Fentale area, in Ethiopia (Kebu Balemie *et al.*, 2004), revealed that various routes of applications are available: oral 51.7%, dermal 31%, nasal and other 0.1% each. In the same study, Kebu Balemie *et al.* (2004) found that there are variations in amount, unit of measurement of medicinal plants used by healers for the same kind of health problems. There were lack of precision and standardization as a drawback for the recognition of the traditional healthcare system Amare Getahun (1976), Sofowora (1982) and Dawit Abebe (1986).

2.4 Uses of medicinal plants and knowledge by indigenous people

Considering the role-played by plant-derived products in human and livestock health, the effective conservation of these resources (i.e. medicinal plants and associated indigenous knowledge), needs to be initiated as a matter of urgency (Cragg and Newman, 1999). Plant diversity remains indispensable for human wellbeing in providing a significant number of traditional and modern remedies required in healthcare. However, it is a matter of great concern to realize that the annual extinction rate of plant species is estimated to be about 3,000 (Cunninghum, 1992).

It is now being widely reported that herbal practitioners have to walk increasingly greater distances for herbs that once grew next door to their homes. 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). Traditional herbal practitioners are skilled 'botanists' and have a great talent for locating the correct plant from among the many plants species found around them (Pandey and Tripath, 2017). To make matters worse, the younger generations of today, unfortunately, often have different ambitions and priorities (Guthridge *et al*., 2008). As a result, this traditional skill is doomed to be lost even faster than the plants themselves (Sofowora, 1982).

Ethnobotanists compare the death of an experienced herbal practitioner to the loss of a whole library and they invest a tremendous effort in documenting these precious sources as a written account. Ethnobotany is a broad and complex term referring to the study of direct interactions and interrelations between humans and plants (Martin, 1995). Local communities especially in rural developing countries are dependent on herbal medicines.

This indispensable dependency of human communities upon plants for their livelihood was primarily started by domestication and dates back to 10,000 years (I bid). Globally, the estimate of medicinal plants ranges from 35,000–50,000 species and out of this about 4000–6000 species have entered the world market of medicinal plants (Balick, 1996). However, only about 100 species have been used as a source of modern drugs. Ethiopia has rich floristic composition and is among few mega diverse countries in the world. The Ethiopia flora has 6027 vascular plants of which 27 of them are sub species Out of the estimated 6027 vascular plant species in Ethiopia, about 10% are estimated to be edible (Asfaw Debela *et al.*, 2001). And over 10% (about 600 to 1,000 species) have medicinal values.

The country is also home to many languages, cultures and beliefs which have in turn contributed to the high diversity of traditional knowledge and practices (Meaza Giday *et al.,* 2003). Following the concentration of biological and cultural diversity, the greater concentration of medicinal plants is found in the south and south western parts of Ethiopia (Fisseha Mesfin *et al*., 2014). Medicinal plants and traditional medicine play an important role in the healthcare system of most developing countries (Pathak and Das, 2013). Traditional medicinal plants have been used in Ethiopia as a source of medicine since antiquity to treat various health problems (Fenetahun and Eshetu, 2017).

It is estimated that about 80% of the rural people in Ethiopia and about 90% of the livestock population rely on traditional medicine to meet their primary healthcare needs (Yeshiwas, 2019). The wide spread use of traditional medicine in Ethiopia could be due to cultural acceptability, efficacy against certain types of diseases, physical accessibility and economic affordability as compared to modern medicine (Debela Hunde *et al.,* 2006).

According to Ensermu Kelbessa (2000), in Ethiopia, traditional medicine has been facing challenges of sustainability and continuity mainly due to the loss of taxa of medicinal plants as well as habitats and cultures. Other studies also showed that the diversity of plants in Ethiopia is on the process of being eroded mainly due to human induced pressures. Habitat destruction and deforestation for commercial timber, encroachment by agriculture and other land uses have resulted in the loss of some thousand hectares of forest that harbour useful medicinal plants, annually over the past several decades (Kumar and Saikia, 2020)). Indigenous and local communities have developed their own locality specific knowledge on plant use, management, and conservation (Balick and Cox, 1996).

Plants are indispensable and most important sources of both preventive and curative traditional preparations for human beings and for their animals since ancient times. Indigenous knowledge and practices have been major factors for the use and domestication of many multipurpose species (Lulekal *et al*., 2008). Herbal medicines, because of their decentralized nature, are easily and quickly available, relatively cheaper and sustainable alternative to synthetic drugs and pharmaceuticals (Aziz *et al*., 2018; Tigist Wendimu *et al*., 2007). Ethnobotanical studies have been widely recognized as critical to identify threatened plants so that appropriate conservation measures are taken in time (Lulekal *et al*., 2008). However, conservation status of these plants has become a serious concern in many rural areas.

The current loss of medicinal plants in the country due to climate change and anthropogenic factors has also negative impacts on indigenous knowledge of the communities that has been associated with these plants and their habitats (Sharma *et al*., 2020).

Deforestation and forest degradation, agricultural expansion, loss of grasslands and woodlands, over-harvesting, agricultural practices in marginal lands, overgrazing and urbanization are some of the major factors threatening biodiversity in general and medicinal plants and their ecosystems in particular (Darkow, 2018).

Although these factors are common in most parts of Ethiopia, the situation in Munesa is unique in suitability of the agro-ecology has attracted many farmers from different regions of the country further exacerbating conversion of grasslands, woodlands and forest ecosystems into agricultural fields for crop cultivation. Other major factors causing loss of biodiversity in the area include illegal logging and timber production.

In the face of these threatening factors, there has been high need to document indigenous knowledge of local communities on the taxonomy, use and applications of medicinal plants. In Ethiopia, documentation of medicinal plantsgiven to ethnobotanical studies over the past decades (Meaza Gidey, 1999). However, there have been some efforts in investigating medicinal plants and indigenous knowledge on Ethno botanical study of medicinal plant resources in recent years. We noted that limited data is available on medicinal plants and their uses in Munesa District.

Therefore, this study aimed at contributing to filling existing gap in data and knowledge on ethno botany and local phytomedicine preparations and applications in Munesa District, Arsi Zone of Oromia Regional National State, Ethiopia with the objectives of documenting medicinal plants and their conservation status; compiling data on uses of medicinal plants; documenting indigenous knowledge of local communities and collecting voucher specimen of medicinal plants thereby contributing to enriching collections in the National Herbarium of Ethiopia.

3. METHODOLOGY

3.1 Description of the study area

Munesa is one of the woredas in the Oromia Region of Ethiopia. Munesa is part of the Arsi Zone located in the Great Rift Valley and is bordered on the south and west by the West Arsi Zone and Lake Langano, on the northwest by Ziway Dugda, on the north by Tiyo, on the northeast by Digelu and Tijo, and on the east by Bekoji. Munesa situated at 7° 29' 59.99" N latitudes and 38° 49' 59.99" E longitude in central Ethiopia 232km south west of Addis Ababa. The capital town of Munesa district is called Kersa. The area covers 121,730 Hectar topographically. Munesa district has high land escarpment and small low land areas. The altitude of the area ranges from 1500-4100m a.s.l. The highest point in this woreda is Mount Chiqe (4193m); another notable peak is Kulsa.

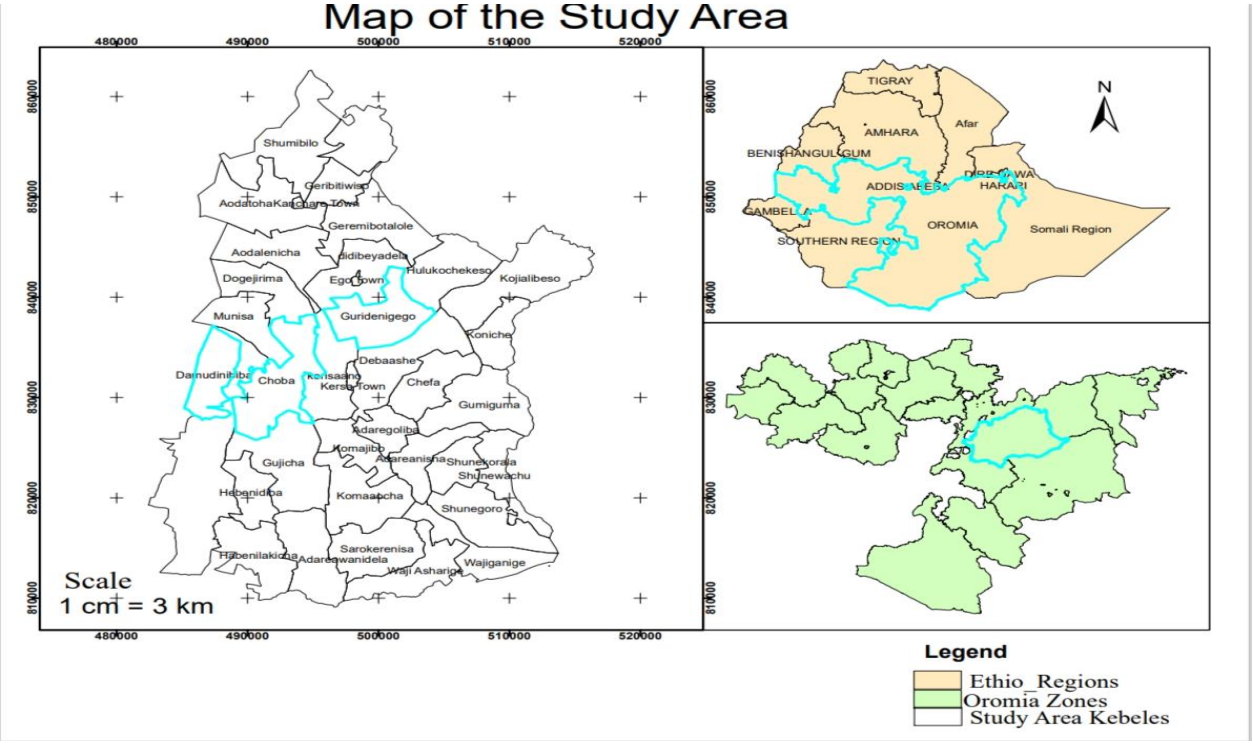

Figure 1: Map of the Study Area (Munesa woreda). Source Committed based research.

3.1.1 Climate (Rainfall and Temperature)

It characterized by mid sub-tropical temperature ranging from 5^{o}c-20^{o}c generally weather conditions are dega; 54%, woinadega; 43% and kola; 3% (CSA of Munesa District, 2013). The annual average rainfall is 800mm-1200mm and mostly clay type of soil and rare case black soil.

3.1.2 Vegetation

Vegetation of the area changes with altitude and rainfall ranging from scattered trees and bushes to dense shrubs and bushes. Friis in 1992 described the vegetation of the area as"undifferentiated Afromontane Forest", including varies upland forests with Podocarpus. Mixed broad-leaved deciduous and evergreen trees characterize the forest vegetation in Munessa natural forest. The dominant tree species are *Podocarpus falcatus* (Thumb.) example Mirb., *Prunus africana* (Hook.f.) Kalkm, *Croton macrostachyus* Del., *Maytenus addat* (Loes.) Sebsebe and Nuxia congesta example Fresen. The vegetation of Munesa includes Dry evergreen Afromontane type in the high altitude areas that reach highest peak at chiqe Mt. (4193m). The soil texture is predominately a slightly acidic and nutrient rich clay-loam that was evolved from volcanic parent material and it was classified as Mollic Nitisols (Fritzsche *et al*., 2007)

3.2 Research Design

In this research, descriptive research design was employed which uses to make investigations about the Ethno botanical study of medicinal plants by Munesa district communities. Both quantitative and qualitative research approaches were applied during analysis.

3.2.1 Selection of the Study Sites

From the total of thirty two Munesa kebeles, about three kebeles namely: Damu dimbiba, Choba and Guri dangago were selected purposely. The criterion for selecting these study sites is due to higher coverage of vegetation and prominent practice compared to the others, logistical purpose, and ease of communication with participants and for accessibility of data.

3.3 Data type, Source of data and Data collection Methods.

In order to reach the main goal of the research, primary data was collected. The primary data was collected from primary sources through household survey, in-depth interview and observations.

Data was collected between April and May 2023. Primary data was used to supplement the gap where secondary data failed. A semi structured questionnaires were used to collect data from the respondents/households. The questionnaires were translated to local language (Afan Oromo), pre-tested and re-structured based on the result obtained during a pre-test. Interview was used as a tool to collect primary data from households.

3.3.1. Informants selection

Three kebeles namely, Damu dimbiba, Choba and Guri dangago were selected purposively based on agroecology, accessibility, vegetation cover and availability of traditional medicinal plant practitioners. Following, from the selected sampled kebeles, a total of 100 respondents (aged > 20), which are ordinary residents (both healers and non-traditional healers or general informants), all available traditional healers and elders from both males and females were selected.

They were selected by purposive sampling techniques based on the information gathered from the local. From the total respondents 10 key informants were selected purposively based on recommendation from elders and local authorities (Development) Agent and kebele administration.

3.4. Data Collection Tools / instruments

Different data gathering instruments have been used to collect data for the study. Accordingly, structured questionnaire, interview, observation, and document reviews were employed to collect both primary and secondary data. Therefore, using different data collection instruments enable the researcher to analyze the result and enhance the reliability of the data or information.

3.4.1. Survey Questionnaires

The primary data from households was collected by using questionnaires. Open and close ended questionnaires were distributed. More over questionnaires have distributed to 100 household. The secondary data were also taken from all available written documents.

3.4.2. Interviews

Interviews were conducted using semi-structured and unstructured questions. In order to understand about the use and management of traditional medicinal plants, the researcher had conduct in-depth interviews with elders and concerned bodies.

3.4.3. Observation

These field observations were carried out with the guidance of the local people who have deep knowledge about the long history of the forests and their values to the communities. During the field observation necessary points such as the former and current status of the medicinal plants in each forest, plants community, indigenous knowledge that help to cultivate medicinal plants by the local people and ways of conservation and management strategies were well recorded.

3.4.4. Plant specimen collections and identifications

To supplement data obtained through other methods, field observations was performed with the help of local guides and interpreter, as well as interviewee's informants in the study area and the status, habit, and habitat characteristics of the plants was recorded on site. Photo of the study plant were taken and then comparison of the collected data was made. After the collection of plant samples from the respondent's resident, the local names, habits and associated knowledge were recorded for each of the species and identified the botanical name using different methods of identification such as using herbarium specimens and Ethiopia and Eritrea flora books.

3.5. Methods of Data Analysis

The ethnobotanical data were collected and analysed by statistical analysis method. A descriptive statistical method was applied to compute the (percentage and/or frequency) of medicinal plants species, their growth forms, proportion of plant parts harvested, mode of preparation and routes of administration. Microsoft Excel spreadsheet 2007 was applied to analysis ethno botanical data in the form of percentage, tables, graphical representations and frequency values.

The data was also analyzed by using ethno botanical analysis method such as Informant consensus factor (**ICF**), Fidelity level (**FL**), Direct matrix ranking (**DMR**) and preference ranking (**PR**) following Martin (1995).

3.5.1. Descriptive statistics

3.5.1.1 Qualitative Analysis of medicinal plants

Qualitative method is preferred to describe the existing conditions of traditional medicinal plants' management in the study area and by using qualitative data, options that are hold and processes that are going on regarding to the use of traditional medicinal plants in Munesa district and surrounding area.

3.5.1.2 Quantitative Analysis of medicinal plants

Quantitative data analysis was employed to describe the number respondents replied towards the questions raised on the functions of medicinal plans used for the treatment of human and animal ailments. The quantitative analysis was employed through the following different techniques.

3.5.1.2.1 Preference Ranking

A ranking question is a type of survey question that asks respondents to compare a list of items with each other and arrange them in order of preference. It is used by market researchers to understand the order of importance of items from multiple items. A ranking scale is a close-ended scale that allows respondents to evaluate multiple row items in relation to one column item or a question in a ranking survey and then rank the row items. It is the scale used by market researchers to ask ranking questions.

3.5.1.2.2 Informed Consent Form (ICF)

Informed consent is a process by which a participant voluntarily confirms his or her willingness to participate in a particular study, after having been informed of all aspects of the study that are relevant to the decision to participate. It is the main source of information to those considering participation in a clinical research study and is used to document a participant's informed consent.

The ICF used to analyze the agreement degree of the informants' knowledge about each category of ailments. ICF was then computed by using: ICF= nur- nt/ nur-1

Where: nur = the number of use citations in each disease category, nt = the number of times a species is used for a certain category, nur-1 = the number of use citations in each category minus one (Heinrich, 1998)

3.5.1.2.3 Fidelity Level Index

The fidelity level (FL), the percentage of informants claiming the use of a certain plant for the same major purpose, Many plant species were used in the same use category that necessitated to determine the most preferred species used in treatment of a particular ailment, which can be done with the fidelity level . The fidelity level (FL), is the percentage of informants claiming the use of a certain plant species for the same major purpose.

FL (%) =Np∗ 100/NFL (%) =Np∗ 100/N

Where Np is the number of respondents that claimed a use of a species to treat a particular disease and N is the number of respondents that use the plants as a medicine to treat any given disease.

The range of fidelity level (FL) is from 1 to 100%; high values indicate that this particular plant species is used by large number of people, while a low value shows that respondents disagree on the use fullness of species in treating ailments.

3.5.1.2.4 Direct Matrix ranking

A direct matrix ranking draws, explicitly up on multiple dimensions. The criteria used and the names of items are listed on X and Y directions respectively on a table. Informants then rank items according to each criterion using a numerical scale in which the highest number is equal to the best object and the lowest number to the worst. The results of numerous individual responses were added together to create a matrix that is representative of the community.

3.5.1.2.5 Paired Comparison

Paired comparison is the process of comparing a set of options using head to head pairs to judge which one is most preferred over all. Also known as “paired ranking”, it is a popular research method used for ranking peoples preferences, informing strategic decisions, and conducting voting at scale. This tool helps to compare ideas in pairs. We have to compare one idea with the other and evaluate which of the 2 is better. Hence, it is a Paired comparison.

4. RESULT AND DISCUSSION

During the study period, the numbers of participant were identified in that (34%) was from Guri Dangago kebele, (33%) from Damu Dimbiba and 33% from Choba.

Table 1: The selected three kebeles from munesa district

Name of kebeles	Frequency	Percent
Damu Dimbiba	33	33.0
Choba	33	33.0
Guri Dangago	34	34.0
Total	100	100.0

4.1 Socio-demographic characteristics of Study Participants

The distribution of the respondents by gender showed that 54 (54%) of them were males and 46 (46%) represented females (Table 2). The age of the informants were included from the smallest age of 20 years old to the largest 85 years old and highest respondent were included in the age above 51 years old. This result very agreed with the study conducted by Berhane Kidane *et al*, (2014) older members of the community in Male knew more medicinal plants than youngsters, which may also reflect an ongoing gradual knowledge loss of knowledge in the study community. Hence, it is important to include traditional knowledge in the school curricula to raise awareness as recommended by (Tesfaye Awas, 2007). Marital status of the respondents showed that 75 (75%) were married and 21 (21%) were un-married (Table 2). Older members of the community in Male knew more medicinal plants than youngsters, which may also reflect an ongoing gradual knowledge loss of knowledge in the study community. Hence, it is important to include traditional knowledge in the school curricula to raise awareness as recommended by (Tesfaye Awas, 2007).

Table 2: Socio-demographic characteristics of Study Participants

Characteristics of respondents	Descriptive alternatives	Frequency	Percentage%
Sex	Male	54	54.0
	Female	46	46.0
Age	20-30	13	13.0
	31-40	12	12.0
	41-50	29	29.0
	51-60	31	31.0
	>61	15	15.0
Religion	Orthodox	41	41.0
	Muslim	52	52.0
	Protestant	7	7.0
Marital status	Single	21	21.0
	Married	75	75.0
	Divorced	4	4.0
Education status	Illiterate	43	43.0
	1-8 level	30	30.0
	9-12 level	11	11.0
	Diploma and above	3	3.0
Occupation	Farmer	92	92.0
	Civil servant	5	5.0
	merchant	3	3.0
	Student	-	-
	Carpenter	-	-
	Other specify	-	-
Economic status	Poor	20	20.0
	Middle income	77	77.0
	Rich	3	3.0

Education level demographics indicated that 43(43%) of the respondents did not have formal education, 30(30%) had up to primary school education, 13 (13%) had elementary education and 11(11%) had high school education. Whereas three (3%) of the educational status of the respondent is diploma and above (Table 2). Majority (92) (92%) of the respondents are farmers, about 5(5%) are government employer and three (3%) of them were primary trader (Table 2). This is similar with the study conducted by (Martin, 1995) Local communities especially in rural developing countries are dependent on herbal medicines. Domestication and dates back to 10,000 years primarily started this indispensable dependency of human communities upon plants for their livelihood.

This result is very similar with study conducted by Berhane Kidane *et al*, (2014) the great majority of the study participants preferred to transfer their medicinal plant knowledge to their children or grandchildren, who favor knowledge conservation and continuity mostly within the family line, demographic factors influencing medicinal plant knowledge Gender significantly, predicted medicinal plant knowledge. Nevertheless, many are less cooperative to show their knowledge and skill on traditional to others. According to Pankhurst (1990), the knowledge on medicinal plants and method of use circulated mainly among practitioners and the beneficiaries of such practice. This has made the knowledge and skill on traditional medicinal plants and traditional medicine more hidden but less available to the public (Abbink, 1995).

4.2 Diversity and Composition of Medicinal Plants Used to Treat Human and Animal Ailments

The local community of the study area used a total of 30 different species, representing 29 genera belongs to 24 families. Of total 30 species of medicinal plants, 11 species belonging to 16 genera and 15 families were used to treat human ailments while 13 species belonging to 19 genera and 14 families were used to treat livestock ailments. About 6 species belonging to 6 genera and 5 families were used to treat both human and livestock ailments. These commonly used medicinal plants are: *Alium sativum, Carissa spinarum, Croton macrostachys, Ricinus communis, Rosa abyssinica* and *Solanum incanum* (Table 13 and Appendix 1). Different people from different parts of Ethiopia also reported most of the plant species reported as medicinal plants in this study as having medicinal properties Endalew Amenu (2007).

4.3 Willingness to transfer the knowledge

Regarding of willingness to transfer knowledge, about 94 (94%) of the respondents transfer their knowledge to the eldest son. The rest 6 % of the respondents transfer their knowledge to the eldest daughter, to all family and to close relatives (Table 3). This result is very similar with study conducted by Berhane Kidane *et al*, (2014) the great majority of the study participants preferred to transfer their medicinal plant knowledge to their children or grandchildren, who favor knowledge conservation and continuity mostly within the family line, demographic factors influencing medicinal plant knowledge Gender significantly, predicted medicinal plant knowledge.

Table 3: Willingness of practitioners to transfer the ethnomedicinal knowledge (N=100)

Medicinal plant knowledge transfer	Number of respondents	Percent
To the eldest son	94	94.0
To the eldest daughter	2	2.0
To all family	2	2.0
To close relatives	2	2.0
Total	100	100.0

4.4 Sources of Traditional of Knowledge

The findings show that most farmers 82 (82%) received knowledge of traditional healing from their fathers. Some have received 7(7%) from their Grand Father, 6 (6%) from their Grand Mother and 5(5%) from their mother (Table 4).

Mechanisms of knowledge transfer among social groups most medicinal plant knowledge is transferred orally from parents to children, as was reported by (Berhane Kidane *et al*., 2014). Most people (82%) obtained their knowledge from their (grand) parents, which is similar to the percentage found by a study in Wonago district, Ethiopia (Fisseha Mesfin *et al.,* 2009).

Table 4: Major sources of Traditional Knowledge (N=100)

Sources of Traditional Knowledge	Number of respondents	Percent
Mother	5	5.0
Father	82	82.0
Grand Father	7	7.0
Grand Mother	6	6.0
Total	100	100.0

4.5 The Medicinal Plants used for the treatment of human and livestock ailments

As to respondents' response whether they used medicinal plants for human ailments all of them have used medicinal plants for human ailments like internal and external cancer, epilepsy, snake bite, uterus and other and livestock ailments such as diarrhea, Skin problems, Trypanosomiasis, anthrax, Mastitis/Dhukkubbii harmaa/mucha horii, Cow driasis and Emesis/ ol-deebisaa (Table 5 appendix 1). Medicinal plants and traditional medicine play an important role in the healthcare system of most developing countries (Pathak and Das, 2013). Traditional medicinal plants have been used in Ethiopia as a source of medicine since antiquity to treat various health problems (Fenetahun and Eshetu, 2017). It is estimated that about 80% of the rural people in Ethiopia and about 90% of the livestock population rely on traditional medicine to meet their primary healthcare needs (Yeshiwas, 2019).

Table 5: The data recorded from using medicinal plants for different ailments

Have you ever used the medicinal plants for different ailments?	Number of respondents	Percent
Yes	100	100.0

4.6 Plant habit of used to treat both human and livestock ailments

From a total of 30 plant species used to treat both human and livestock ailments in Munesa Woreda, 12 are Tree, 13 are shrubs, herbs are 2 and 3 are climbers. Majority of the plant species used to treat different ailments of human and livestock in the study area were shrubs and Trees (Figure 2). Similar habit distributions of medicinal plants have also been reported by Endalew Amenu (2007).The results of this study suggested that plant medicine can be obtained from all sorts.

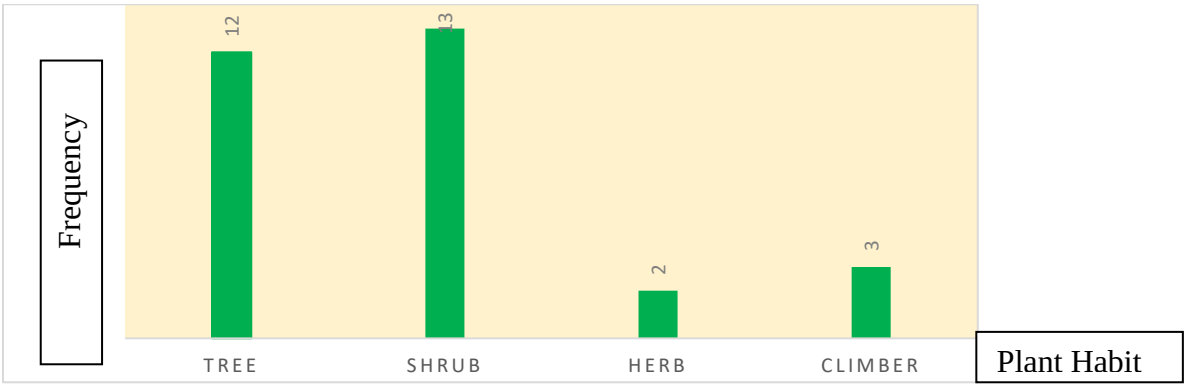

Figure 2: Plant habit of used to treat both human and livestock ailments

4.7 Part of medicinal plants

Respondents of the study used different plant parts for the preparation traditional medicines those are used to treat human and livestock ailments. Accordingly plant parts such as: leaf/pod, root/rhizome, stem, and bark are widely used for the medicine preparation. From those used parts, leaf/pod and root/rhizome were highly used by more than half of the respondents (27%, 26% respectively) (Table 6). Many ethnobotanical studies carried out elsewhere in Ethiopia reported that leaves are the most widely used parts in the preparation of plant remedies. The wide use of leaves in the preparations of plant remedies may be attributed to the fact that leaves are much easier to process quickly as compared to other plant parts.

Collection of leaves does not pose a great danger to the survival of individual plants as compared to the collection of underground parts, stems, and whole plants. Removal of up to 50% of leaves of plants does not significantly affect their growth (Alemayehu Geda *et al*., 2015).

Table 6: Part of medicinal plants used (N=100)

Part of medicinal plants used	Number of responde	Percent
Leaf/pod	27	27.0
Root/Rhizome	26	26.0
Stem	19	19.0
Bark	17	17.0
All parts used	11	11.0
Total	100	100.0

4.8 Mode of preparation of medicinal plants

Concerning the preparation of traditional medicine, local people employed various methods of preparation of traditional medicines. The preparations vary based on the type of ailments treated and the actual site of the ailments. The principal method of traditional medicine preparation reported was pounding (40%), crushing (29%), squeezing (11%) and cooking (9%) (Figure 3). This may be due to the possibility of extraction of plant ingredients when pounded and squeezed, so that its curative potential would increase. Preparations might be involved using a single plant part or mixtures of different organs of the same plant. In contrast, Araya Solomon *et al*, (2015) in Tigray reported most of the medicinal plant species were reported to be processed through crushing followed by pounding and chewing.

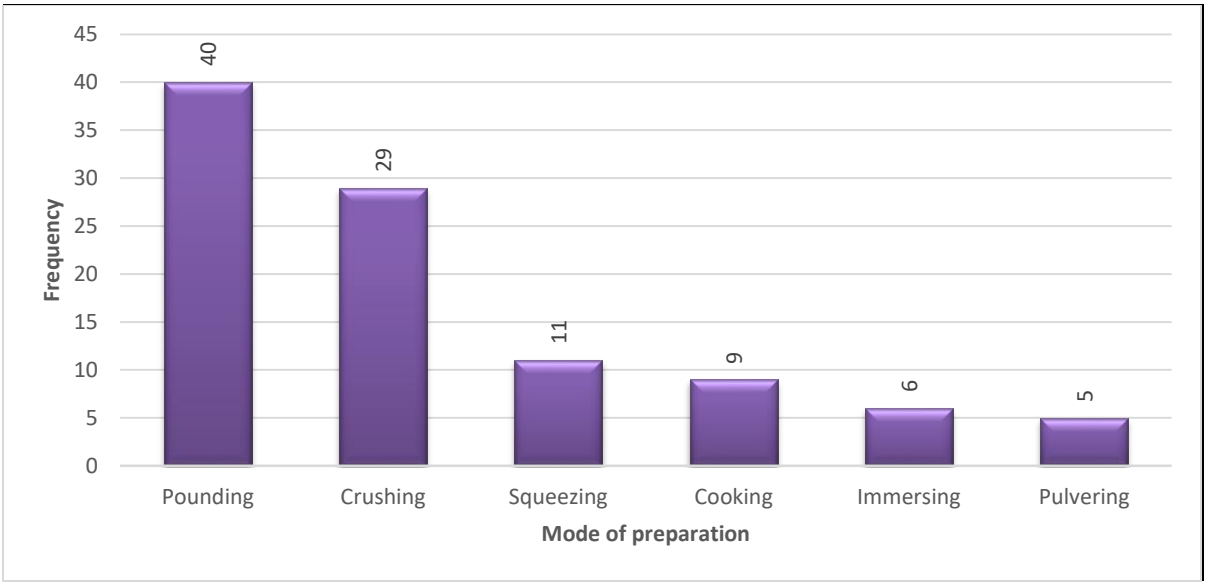

Figure 3: Ways of preparation of medicinal plants

4.9 Route of Administration and Application

In general the amount of traditional medicines to be administered for certain duration was given by estimating the age and physical strength of the patient and the severity of diseases. The reported administration routes were oral, dermal, ear canal, through the eye, anal, nasal of which oral administration was reported as a dominant with (45%) preparations followed by dermal route with (28%) preparations (Figure 4). Both oral and dermal routes permitted rapid physiological reaction of the prepared medicines with the pathogens and increase its curative power (Merera Teso and Mesfin Woldearegay, 2023).

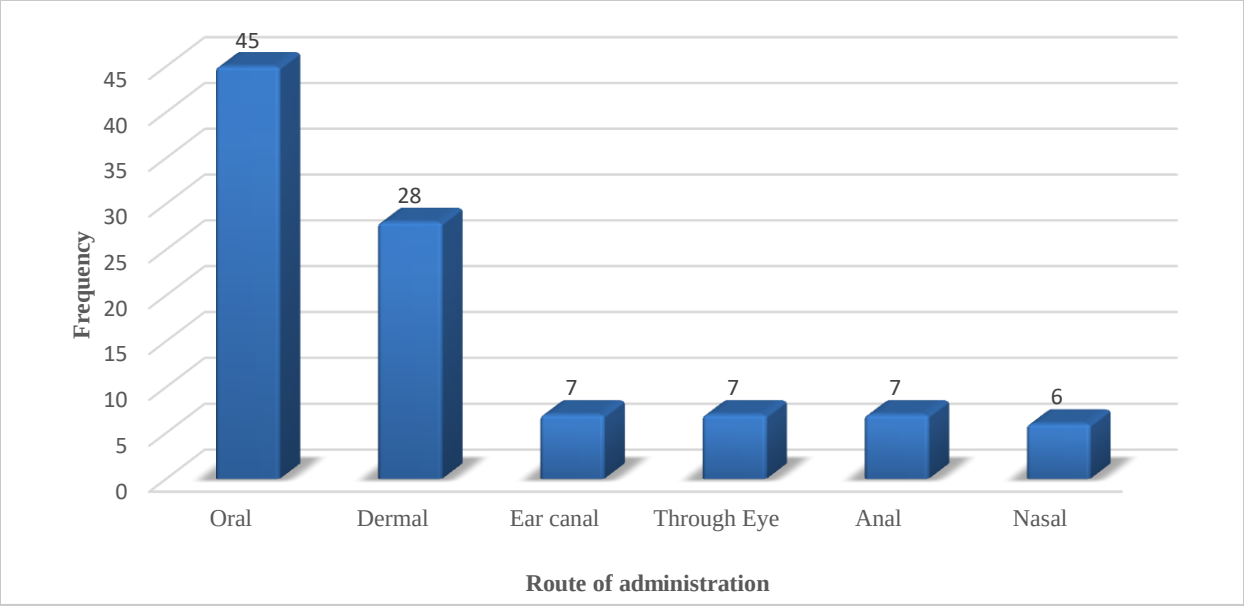

Figure 4: Route of administration of plant remedies

4.10 Medicinal Plant Dosage and Antidotes

Dosages of plant remedies varied among traditional healers, posing a challenge as per Munesa Local people in the study area employed various measurements such as the local unit 'Melekia' coffee cups, spoons, glasses, and bottles. Additives like honey, salt, sugar, and milk were used to enhance flavor. The dosage of medicine was adjusted based on the patient's age. Frequency of traditional medicine recommended for patients were depend on the type of disease, may be three times, twice or once per day for 3, 5 or 7 consecutive days (Table 13 and Appendix 1). The side effects of certain traditional medicine included diarrhea, gastric burning, nausea, vomiting, excessive toxicity, and a bitter taste during administration. To counteract these adverse effects, various antidotes were used by the local communities. This included sugar, honey, coffee, tea, water, butter, milk, yoghurt, bulla, besso, and broth. Among these, water emerg ed as the most frequently used solvent for preparing remedies. If this very similar with the result of the study conducted by (Merera Teso and Mesfin Woldearegay, 2023).

The dosage of medicine was adjusted based on the patient's age. Most medicinal plant preparations encountered in the study area were derived from a single plant or plant part. Some involved pounding in a pestle with a mortar to extract juice, while others chewed and administered it to patients. Adolescents received a full cup of medicine, whereas children were given half a cup. The inclusion of such details in the administration of traditional medicine reflects the nuanced approach taken by local healers in the study area.

4.11 The most effective therapeutic value of medicinal plants for human (N=100)

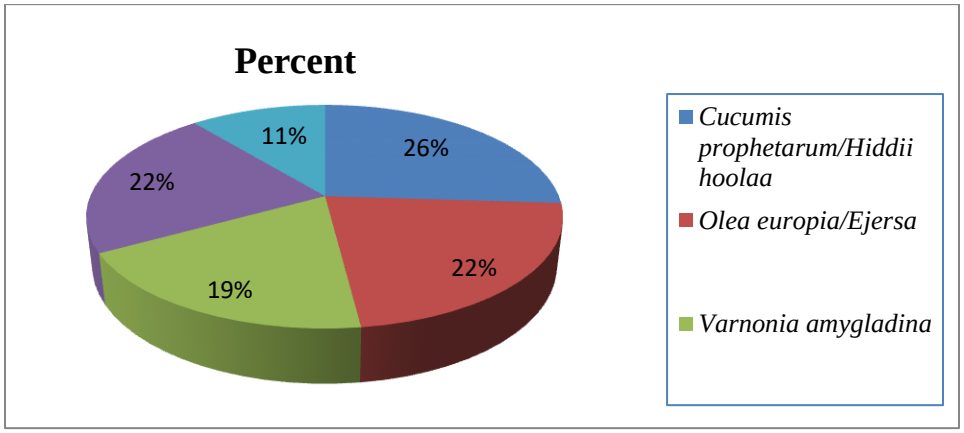

Figure 5: Medicinal plants those have high effective therapeutic value to treat human ailments

4.12 The most effective therapeutic value of medicinal plants for Livestock

Respondents listed 5 effective medicinal plants used to treat livestock ailments as follows; *Croton macrostachys* 54 (54%), *Alium sativum* 15(15%), *Prunus africana* 13(13%), *Ficus sycomoros* 10(10%) and *Carissa spinarum* 8(8%) have effective therapeutic value (Table 7).

Table 7: The most effective therapeutic value of medicinal plants for Livestock (N=100)

The most effective therapeutic value of medicinal plants for Livestock	Number of respondents	Percent
Croton macrostachys	54	54.0
Prunus africana	13	13.0
Ficus sycomoros	10	10.0
Carissa spinarum	8	8.0
Alium sativum	15	15.0
Total	100	100.0

4.13 Major Threats of medicinal plants

Respondents were asked about the listed effective medicinal plant whether they are endangered or not. About 37(37%) of respondent replied that medicinal plants are threatened for the purpose of deforestation for charcoal, fire wood, and material culture, whereas about 26(26%) of the respondents said that medicinal plants are threatened for the purpose of agricultural expansion. The rest 21 (21%), 11(11%) and 5(5%) of the respondents replied that the medicinal plants were threatened for the purposes of overgrazing, urbanization and invasive species respectively (Figure 6). This is very agreed with the following result: the current loss of medicinal plants in the country due to climate change and anthropogenic factors has also negative impacts on indigenous knowledge of the communities that has been associated with these plants and their habitats (Sharma *et al*., 2020). Deforestation and forest degradation, agricultural expansion, loss of grasslands and woodlands, over-harvesting, agricultural practices in marginal lands, overgrazing and urbanization are some of the major factors threatening biodiversity in general and medicinal plants and their ecosystems in particular (Darkow, 2018).

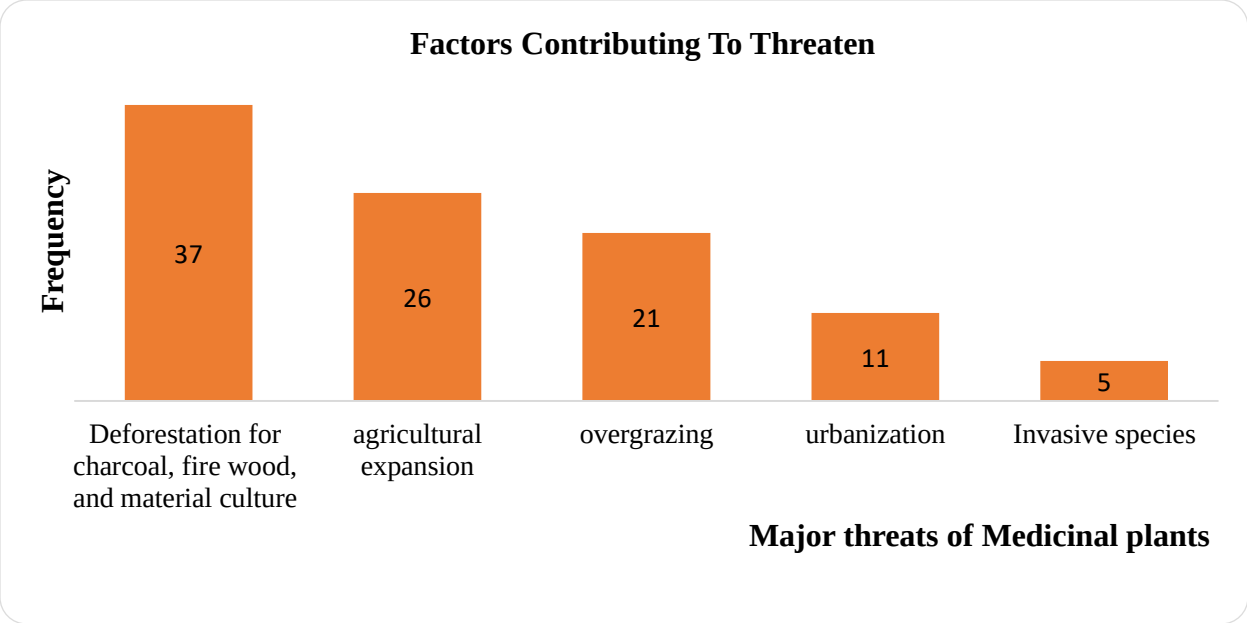

Figure 6: Threatened medicinal plants

4.14 The local community preference from traditional and modern

According to the data collected from the respondents 89(89%) of respondents prefer traditional medicine than modern medicine and 11(11%) of respondents prefer modern medicine than traditional medicine (Table 8). The wide spread use of traditional medicine in Ethiopia could be due to cultural acceptability, efficacy against certain types of diseases, physical accessibility and economic affordability as compared to modern medicine (Debela Hunde *et al.*, 2006).

Table 8: Medicine preference of local community: traditional or modern (N=100)

Medicine preference of local community	Number of respondents	Percent
Traditional	89	89.0
Modern	11	11.0
Total	100	100.0

4.15 The reason why farmers prefer the traditional medicine

The majority of respondents chose traditional medicine than modern medicine and they are asked why they prefer the traditional medicine; 3(3%) of the respondent chose traditional medicine because it is more affordable to buy and more effective and 2(2%) of respondents choose traditional medicine because it is easily accessible in their environment and 81 (81%) say that traditional medicine because is more affordable, more effective in treating various diseases and traditional medicines are more readily available (Figure 7). This result has in line agreement with the result of study conducted by Abbiw, (1996) since medicinal plants are the main, often only source of traditional medicine for the rural population and are of high demand in the health care systems of this population when compared to modern medicine, ethno medicine activities need special consideration and back-up. This is partly because modern medicinal services are either unaffordable or unavailable to the vast majority of local people due to their skyrocketing cost coupled to lack of transport to and from health care centers (Giday Yirga, 2010)

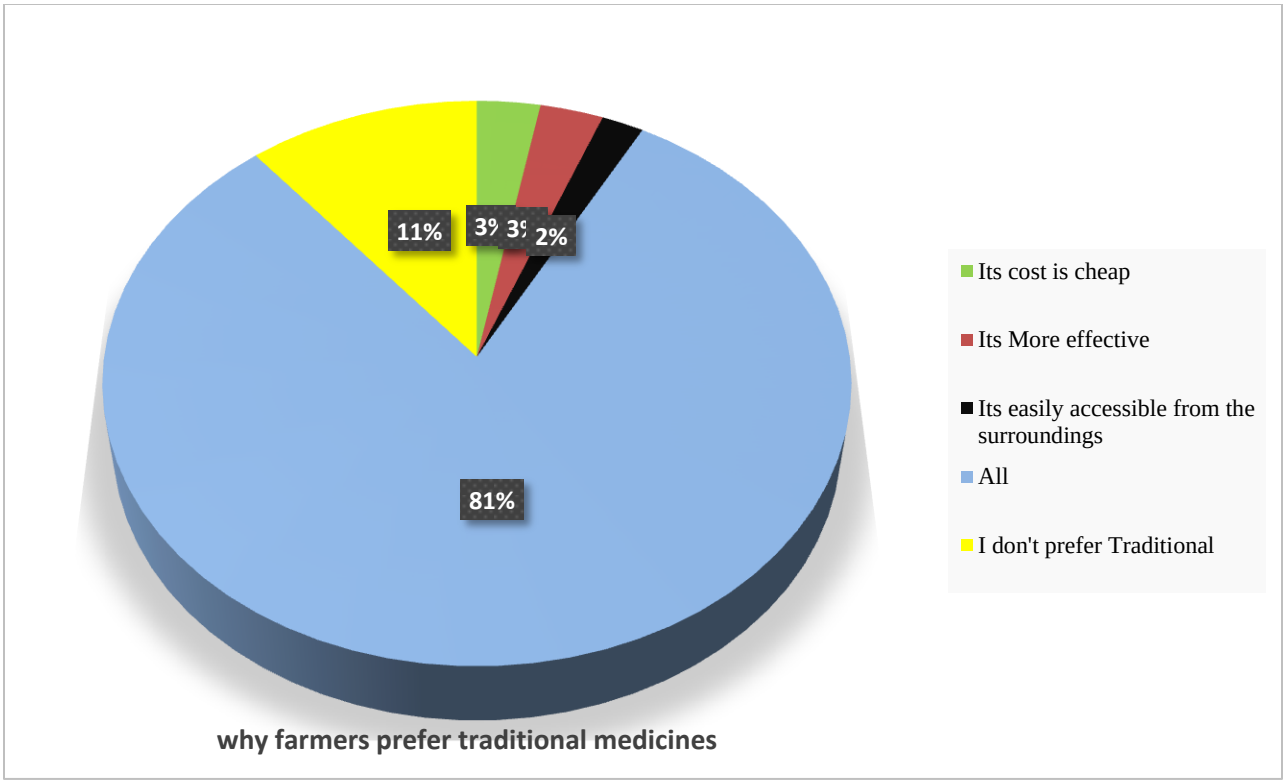

Figure 7: The reason why farmers prefer the traditional medicine

4.16 The reason why farmers prefer the modern medicine

Respondents were asked why they preferred modern medicine over traditional medicine, respondents who chose modern medicine gave the following answers: and 1 (1%) of respondents said modern medicine have a well-known dose than the traditional medicine, 2 (2%) of respondents preferred modern medicine because modern medicine have more therapeutic value, 8(8%) respondents said modern medicine has well known dose and it has more therapeutic value and 89 (89%) of respondents don't prefer modern medicine (Table 9).

Table 9: The reason why farmers prefer the modern medicine (N=100)

The reason why farmers prefer the modern medicine	Number of respondents	Percent
Its dose is well known than the traditional	1	1.0
It has more therapeutic value	2	2.0
Both	8	8.0
I don't prefer Modern	89	89.0
Total	100	100.0

The respondents replied that many medicinal plants are used to treat human ailments. Medicinal healers of the study area gave treatment for the following different diseases: conjure, breast disease, snake bite, liver diseases, diabetic, cold sore, throat infections, sexually inactive male, allergy, epilepsy etc. They prepare the medicine by using different mechanisms like: crushing/grinding, squeezing, boiling, roasting etc. They used different route of administration such as: oral, tying, fitted to the target infected site by traditionally standardized dose (Table 16). Ethiopia has rich floristic composition and is among few mega diverse countries in the world. Out of the estimated 6000 vascular plant species in Ethiopia, about 10% are estimated to be edible (Asfaw Debela *et al.*, 2001). And over 10% (about 600 to 1,000 species) have medicinal values.

This result also very similar with: Medicinal preparations of plants contain many things such as powdered plant materials, extracts and purified active substances isolated from plant materials (Bandaranayake, 2006). In certain cases, materials of animal or mineral origin may also be included in such preparations (Williamson, 2013).

The medicinal plant preparation and application are accomplished in various forms (Azwanida, 2015). However, according to most literature sources have shown that simple crushing and pounding a particular plant part(s) and homogenizing it in water are the commonly used form of herbal preparation for both human and livestock health problems (Habtom Agisho *et al*., 2014). An ethnobotanical study of medicinal plants in Fentale area, in Ethiopia (Kebu Balemie *et al.*, 2004), revealed that various routes of applications are available: oral 51.7%, dermal 31%, nasal and other 0.1% each.

4.17 Quantitative Analysis of medicinal plants

4.17.1 Preference Ranking

Preference ranking analysis was conducted on seven medicinal plants that were reported for treating Cancer disease. Based on this the result of analysis revealed that, *Cucumispro phetarum* (Hiddi Hola A/O) to be the most preferred medicinal plant followed by *Aloe monticola* Reynolds and *Vernonia amygdalina* Del.(Ebicha A/O) (Table 10). While, *Citrus arbutifolia* obtained the lowest mark and ranked 7th indicating that it is less effective and hence, least preferred plant in treating the disease Cancer.

Table 10: Preference ranking of medicinal plants used to treat Cancer in the study area

No	Medicinal Plant Spp	R1	R2	R3	R4	R5	R6	Total	Rank
1	*Aloe monticola* Reynolds	6	6	7	7	6	6	38	2
2	*Cucumis prophetarum* (Hiddi Hola A/O)	7	7	6	6	7	7	40	1
3	*Vernonia amygdalina* Del.(Ebicha A/O)	5	5	4	5	5	5	29	3
4	*Olea europea ssp.* Cuspid ata	4	4	5	4	4	3	24	4
5	*Allium sativum*	3	2	3	2	3	4	17	5
6	*Croton macrostachus*	2	3	1	3	1	2	12	6
7	*Citrus arbutifolia*	1	1	2	1	2	1	8	7

R= Represent Respondent

4.17.2 Informant consensus factor

Informant consensus calculated to identify medicinal plant species most effective and well known by the community in treating different human diseases as presented in the following. In addition, ICF was also calculated to identify the disease most frequent in the area and result presented in (Table 11).

Accordingly, the result revealed that the disease diabetic has the highest informant consensus factor value (0.909) (90.9%) of ICF and uterus disease had the lowest value (0.393) (39.3%) of ICF (Table 11). In general this result indicated that diabetic is the disease that is most frequent in the study area and *Aloe monticola* Reynolds is the most effective and the most widely known medicinal plant in treating this disease.

Informant consensus values give good indication about particular species that serve for particular health problems and about specific medicinal plants used for several health problems. Such information underlines the pharmacological significance of the medicinal plants in the area. Medicinal plants with higher informant consensus need to be seriously considered for further ethnopharmacological studies, since they are species widely applied by many people and they have been utilized for a long time (Megeressa et al., 2013).

Table 11: Informant consensus factors by categories of human disease in the study area

No	Disease category	nur	Nt	ICF	% ICF
1	Diabetic	78	8	0.909	90.9
2	Nose bleed	81	11	0.875	87.5
3	Cobxo	65	9	0.875	87.5
4	Liver disease	98	15	0.856	85.6
5	Headache	82	14	0.839	83.9
6	Cancer (external)	45	9	0.818	81.8
7	Cancer (Internal)	45	9	0.818	81.8
8	Kintarot/Hemorrhage	90	18	0.809	80.9
9	Conjure	92	20	0.79	79
10	Cold sore (throat infection)	67	15	0.788	78.8
11	For Breast disease	87	20	0.779	77.9
12	Ear infection/ Pus	81	19	0.775	77.5
13	Epilepsy	76	21	0.733	73.3
14	Dingetegna/bokoksa	87	24	0.732	73.2
15	Inactive male in sexual intercourse	56	16	0.727	72.7
16	Allergic	60	18	0.71	71
17	Snake bite	51	19	0.64	64
18	Uterus disease (released out uterus)	34	21	0.393	39.3

4.17.3 Direct Matrix ranking

Direct matrix ranking was conducted by 6 key informants and they were asked to assign values based on the medicinal plant used criteria to treat 6 human diseases (3= best, 2 = very good, 1 = good, 0 = not used) for each plant species.

Cancer is the most treated disease (1st Rank) by 7 different medicinal plants. Hemorrhage was the most second (2nd Rank) treated human diseases by seven mentioned medicinal plants next to cancer. The least treated disease (6th Rank) was nose bleed. From the medicinal plant selected *Cucumispro phetarum* (Hiddi Hola A/O) was the best medicinal plant (1st Rank) in treating the seven mentioned human ailments. The second best (2nd Rank) medicinal plant selected in treating the seven types of diseases was *Allium sativum. Citrus arbutifolia* and *Olea europea* were selected at least level (6th Rank) to treat the seven types human ailments mentioned (Table 12).

Table 12: Direct matrix ranking conducted by 6 key informants on six different types of human ailments treated by 7 different medicinal plants

Ailment treated	*Aloe monticola*	*Cucum ispro phetar um*	*Vernonia amygdalin a*	*Olea europea*	*Allium sativu m*	*Croton macrosta chus*	*Citrus arbutifolia*	Total	Rank
Diabetic	3	0	0	1	1	0	0	5	5
Cancer	3	3	3	1	1	1	1	13	1
Kintarot/ Hemorrhage	1	3	0	1	3	1	3	12	2
Liver disease	0	1	0	0	2	3	0	6	4
Snake bite	1	3	1	1	1	1	1	9	3
Nose bleed	0	0	3	0	1	0	0	4	6
Total	8	10	7	4	9	6	4		
Rank	3	1	4	6	2	5	6		

4.17.4 Fidelity level (FL)

Fidelity level (FL) values were calculated for some medicinal plants commonly used against the certain some reported livestock ailments; *Croton macrostachys* (against bloat/dhiita'u A/O), Zinggeber officinale (against emesis/ol-deebisaa), *Prunus africana* (against wound), *Alium sativum* (antiseptic), *Capsicum annum* (mimmixa) (against Cow driasis), *Accacia tortilis*Inner (against Diarrhea) (Table 13).The medicinal plant species that are widely used by the local people to treat one or few ailments could be highest value of FL than the less popular. The highest values of FL indicated that a good curing potential. Ethiopia has rich floristic composition and is among few mega diverse countries in the world. Out of the estimated 6027 vascular plant species in Ethiopia, about 10% are estimated to be edible (Asfaw Debela *et al.*, 2001). And over 10% (about 600 to 1,000 species) have medicinal values.

Table 13: Fidelity Level (FL) and Lists of Ethno medicinal plants used to treat Livestock in Munessa District

No	**Local name**	**Botanical name**	**Family name**	**Parts used**	**Routes**	**Preparation**	**Indication**	**No of respondent**	**Fedility**
1	Bakkanisa	*Croton macrostachys*	Euphorbiaceae	Leaf/Twig	Oral	Infusion	Bloat/dhiita'uu	95	95
2	Ginger	*Zinggeber* officinale	Zingiberaceae	Rhizome	Topical	Paste	Emesis/ ol-deebisaa	93	93
3	Homi	*Prunus africana*	Rosaceae	Bark	Topical	Paste	Wound	91	91

4	Qullubbi	*Alium sativum*	Amaryllidaceae	Bulb	Oral	Paste or as is	Antiseptic,	90	90
5	Mimmixa	*Capsicum annum*	Solanaceae	Pods	Oral	Infusion	Cow driasis	89	89
6	Dhadacha	*Accacia tortilis*Inner	Fabaceae	Bark	Oral	Infusion	Diarrhea	87	87
7	Hiddi	*Solanum incanum*	Solanaceae	Fruit	Oral/nasal	Infusion	Cow driasis	84	84
8	Qumbi	*Comiphora holdai*	Burseraceae	Gum/Resin	Topical	Paste	Anthrax, navel illness/dhukkuba handhuuraa	83	83
9	Daysa	*Sesbania sesban*	Fabaceae	Root, bark	Topical	Infusion	Mastitis/Dhukkubbii harmaa/mucha horii	77	77
10	Gora	*Rosa abyssinica*	Rosaceae	Root	Topical	Paste	Skin problems	76	76
11	Dhaddacha	*Acacia tortilis*	Fabaceae	Inner bark	Oral	Infusion	Diarrhea	75	75
12	Burii,	*Cissus*	Vitaceae	Roots	Oral	Infusion	Cow driasis	74	74

		rotundifolia			or anal				
13	Qobbo	*Ricinus communis*	Euphorbiaceae	Leaf/Root	Oral	Infusion	Retained fetal membrane	71	71
14	Neem	*Azardrachta indica*	Meliaceae	Roots	Oral	Infusion	Ecto and endoparasites	70	70
15	Hagamsa	*Carissa spinarum*	Apocynaceae	Roots	Oral	Decoction	Helminthiasis	69	69
16	Harbu	*Ficus sycomoros*	Moraceae	Leaf	Topical	Paste	Contagious skin necrosis	68	68
17	Hudha	*Salvadora persica*	Salvadoraceae	Bark, root	Oral	Decoction	Trypanosomiasis, anthrax	65	65
18	Adami	*Euphorbia abyssinica*	Euphorbiaceae	Stem	Topical	Sap	Mange mites /Injiraan ykn Cinii horii	64	64
19	Xaxessa	*Rhus abyssinica*	Anacardiaceae	Leaf	Topical	Paste	Skin	62	62
20	Haroressa	*Grewia bicolar*	Malvaceae	Bark	Oral	Infusion	Retained	58	58

4.17.5 Paired comparison

A paired comparison was made to determine the most preferred medicinal plants among seven species that were reported to be effective in treating diabetic in the study area. Accordingly, the

ranking exercise that has been performed by 6 key informants showed that *Aloe monticola* Reynolds ranked first followed by *Cucumispro phetarum* (Hiddi Hola A/O) (Table 14).

Therefore, this result indicated that *Aloe monticola* Reynolds is the most preferred while *Citrus arbutifolia* is the least favored over the other plant species cited in treating diabetics.

Table 14: Paired comparison of medicinal plants used to treat Diabetic in the study area

No	**Medicinal Plant Spp**	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**Total**	**Rank**
1	*Aloe monticola* Reynolds	7	7	7	7	6	7	41	1
2	*Cucumispro phetarum* (Hiddi Hola A/O)	6	6	5	6	7	6	36	2
3	Vernonia amygdalina Del.(Eicha A/O)	5	5	6	5	5	5	31	3
4	*Olea europea ssp.* Cuspid ata	4	4	5	4	4	3	24	4
5	*Allium sativum*	3	2	3	2	3	4	17	5
6	*Croton macrostachus*	2	3	1	3	1	2	12	6

5. Conclusion and Recommendations

5.1. Conclusion

Majority of the respondents/study participants were farmers and from both genders male participants were more than half percent of the study population. Majority of the medicinal healers transfer their knowledge to their elder son. More than half percent (89%) of the respondents prefer traditional medicine than modern one to treat human and livestock ailments. The result of this study clearly indicates that many medicinal plants are used to treat human and livestock ailments. Medicinal healers of the study area gave treatment for the following different human and livestock diseases like: conjure, breast disease, snake bite, liver diseases, diabetic, cold sore, throat infections, sexually inactive male, allergy, epilepsy, antiseptics, diarrhea, bloat, endo and ecto parasite, Helminthiasis, Anthrax etc. They prepare the medicine by using different mechanisms like: crushing/grinding, squeezing, boiling, roasting etc. They used different route of administration such as: oral, tying, fitted to the target infected site by traditionally standardized dose. The result of calculating Fidelity level (FL) indicated that some medicinal plants commonly used against the certain some reported livestock ailments; *Croton macrostachys* (against bloat/dhiita'u A/O), Zinggeber officinale (against emesis/ol-deebisaa), *Prunus africana* (against wound), *Alium sativum* (antiseptic), *Capsicum annum* (mimmixa) (against Cow driasis), *Accacia tortilis* inner (against Diarrhea).). The result of informant consensus factor indicated that diabetic is the disease that is most frequent in the study area and *Aloe monticola* Reynolds is the most effective and the most widely known medicinal plant in treating this disease. Based on this, the result of preference ranking revealed that, *Cucumispro phetarum* (Hiddi Hola A/O) to be the most preferred medicinal plant followed by *Aloe monticola* Reynolds and Vernonia amygdalina Del.(Ebicha). While, *Citrus arbutifolia* obtained the lowest mark and ranked 7^{th} indicating that it is less effective and hence, least preferred plant in treating the disease Cancer.

5.2. Recommendations

Based on the result of this study the following recommendations were mentioned:

- The doses of traditional medicines were not clearly known by the traditional medicinal healers; hence any concerned body including chemists and Pharmacists can make further investigation.
- Accordingly indicated in the result of this study, many of effective medicinal plants in the study area are under risk of threatening or they are endangered. Therefore any responsible bodies or organizations can do on the conservation of these threatened medicinal plant species as well as a researcher should aware the society on conservations of the endangered plant species during data collection.
- The traditional medicinal healers hidden their knowledge and are not volunteer to transfer their knowledge to community. This makes the traditional knowledge to be decreased from time to time. Hence to keep the sustainability of the knowledge it is better if the traditional healers share their knowledge among their local community.

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Appendix 1 Different medicinal plants used to treat different human and livestock ailments.

Key: H=Herb, Sh=Shrub, T=Tree, Cm=Climber Hu; Human Bo; both Li; Livestock)

S.No.	Species Name	Family	Local name	Habit	Used Part	Preparation	Route of ad administration	Ailment Treated	Source	Used for	Coll. no.
1	*Ziziphus mauritiana* L.	Rhamnaceae	Qurqura	T	Leaf	All are crushed together and mixed with butter	Painting the male sexual body part	Conjure/ Falfala	Wild	Hu	GH001
	Citrus aurantifolia (Christm.)Swingle	Rutaceae	Lomi	Sh	fruit				Home Garden	Hu	GH002
	Vernonia amygdalina Del.	Asteraceae	Ebicha	T	Leaf				Home Garden	Hu	GH003
	Carissa spinarum (Forssk.) Vahl	Apocynaceae	Hagamsa	Sh	Leaf				Wild	Bo	GH004
2	*Ricinus communis* L.	Euphorbiaceae	Qobbo	T	Young Leaf	Squeezing Leaves from both plants and clearing by cotton	Adding to ear	Ear infection/ Pus	Home Garden	Bo	GH005
	Datura stramonium L.	Solanaceae	Asangira	Sh					Home garden	Hu	GH006
3	*Maytenus arbutifolia* A.Rich	Celastraceae	Kombolcha	Sh	Leaf	Crushed and dried	Adding made Coffee and simply drinking	Cold sore (throat infection)	Wild	Hu	GH007
	Carissa spinarum (Forssk.) Vahl	Apocynaceae	Hagamsa	Sh	Leaf				Wild	Bo	GH004’
4	*Calpurnia auria* (Lam.)Benth.	Fabaceae	Cheka	T /Sh	Seeds	Roasting and grinding the seeds	Putting on the central head/skull of the patient	Epilepsy	Home Garden	Hu	GH008
5	*Vernonia amygdalina* Del.	Asteraceae	Ebicha	T	Leaf	Crushing the leaf and drying	Taking the dried powder through nose	Nose bleed	Home Garden	Hu	GH003’
6	Vernonia amygdalina Del.	Asteraceae	Ebicha	T	Leaf	Crushing the leaf and drying	Taking the dried powder through nose	Headache	Home Garden	Hu	GH003’
7	*Olea europaea L.*	Oleaceae	Ejersa	T	Leaf	The leaves are crushed and dried.	Painting/washing with it for seven days	Allergic	Home Garden	Hu	GH009
	Croton	Euphorbiacea	Bakkanis	T	Leaf				Home	Bo	GH010

	*macrostachyu*Del.	e	a			Then boiling it with water.			Garden		
	Erianthemum aethiopicum Wiens and Polhill/AHU88	Loranthaceae	Digelu	T	Leaf				Wild	Hu	GH011
8	*Olea europaea L.*	Oleaceae	Ejersa	T	Leaf	The leaves are crushed and dried. Then boiling it with water.	Painting/washing with it for seven days	Uterus disease (released out uterus)	Home Garden	Hu	GH009’
	Croton macrostachyus Del	Euphorbiaceae	Bakkanisa	T	Leaf				Home Garden	Bo	GH010’
	Erianthemum aethiopicum Wiens and Polhill/AHU88	Loranthaceae	Digelu	Cm	Leaf				Wild	Hu	GH011’
9	*Cucumis ficifolius* A. Rich	Cucurbitaceae	Hiddi Hola	Cm	Fruit and root	Crushing the leaves together	Tying on the bite place	Snake bite	Wild	Bo	GH012
	Asparagus africanus Lam.	Asparagaceae	Hiddi Sare	Cm	Fruit and root				Wild	Hu	GH013
	Capparis cartilaginea Decne.	Rosaceae	Gora	Cm	Leaf				Wild	Bo	GH014
10	*Cucumis ficifolius* A. Rich	Cucurbitaceae	Hiddi Hola	Cm	Leaf	Drying and Crushing/grinding all of the plants leave together	Tying on the targeted/infected place	Cancer (external)	Wild	Bo	GH012’
	Vernonia amygdalina Del.	Asteraceae	Eebicha	T	Leaf				Home Garden	Hu	GH003’
	Capparis cartilaginea Decne.	Rosaceae	Goraa	Cm	Leaf				Wild	Bo	GH014’
11	*Aloe monticola* Reynolds	Aloaceae	Hargisa	Sh	Its Milk jelly like structure	Drying crushing the root of Udasalim. Then mixing it with extracted Aloe.	Oral	Cancer (Internal)	Wild	Hu	GH015
12	*Aloe monticola* Reynolds	Aloaceae	Hargisa	Sh	Root	Drying crushing the root of Udasalim. Then mixing	Oral	Diabetic	Wild	Hu	GH015’

						it with extracted Aloe.					
13	*Cucumis ficifolius* A. Rich	Cucurbitaceae	Hiddi Hola	Cm	Root	Peeling and washing in gentle the crushed. Finally squeezing	Oral	Cobxo	Wild	Bo	GH012’
14	*Cucumis ficifolius* A. Rich	Cucurbitaceae	Hiddi Hola	Cm	Root	Peeling and washing in gentle the crushed. Finally squeezing	Oral	For Breast disease	Wild	Bo	GH012’
15	*Cucumis ficifolius* A. Rich	Cucurbitaceae	Hiddi Hola	Cm	Root	Peeling and washing in gentle the crushed. Finally squeezing	Oral	Digetegna /bokoksa	Wild	Bo	GH012’
16	*Cucumis ficifolius* A. Rich	Cucurbitaceae	Hiddi Hola	Sh	Leaf and fruit	All are mixed ad crushed together. Then squeezed.	Fitted to the infected area.	Kintarot/ Hemorrhage	Wild	Bo	GH012’
	Allium sativum L.	Amaryllidaceae	Qullubi Adi	H	Bulb				Home Garden	Bo	GH016
	Citrus aurantifolia; (Christm.)swingle.	Rutaceae	Lomi	Sh	Fruit						
									Home Garden	Hu	GH002’
17	*Croton macrostachyus* Del	Euphorbiaceae	Bakkanisa	T	Its bark	Both Crushed and powdered together mixed with Honey	Oral	Liver disease	Home Garden	Bo	GH010’
18	*Croton macrostachyus* Del	Euphorbiaceae	Bakkanisa	T	Root	Crushed and powdered then mixed with Honey	Oral	Inactive male in sexual intercourse	Home Garden	Bo	GH010’

19	*Accacia tortilis* Forssk	Fabaceae	Dhadacha	T	Bark	Infusion	Oral	Diarrhea	Wild	Li	GH017
20	*Alium sativum*L.	Amaryllidaceae	Qullubbi	H	Bulb	Paste or as it is	Oral	Antiseptic	Home garden	Bo	GH016’
21	*Azardrachta indica* A.Juss	Meliaceae	Neem	T	Root	Infusion	Oral	Ecto and endoparasites	Home garden	Li	GH018
22	*Acacia tortilis* Forssk	Fabaceae	Dhaddacha	T	Inner bark	Infusion	Oral	Diarrhea	Wild	Li	GH017’
23	*Capsicum annum*L.	Solanaceae	Mimmixa	T	pods	Infusion	Oral	Cow driasis	Home garden	Li	GH019
24	*Carissa spinarum*L.	Apocynaceae	Hagamsa	T	Root	Decoction	Oral	Helminthiasis	Wild	Bo	GH004’
25	*Cissus rotundifolia*Vahl.	Vitaceae	Burii,	T	Root	Infusion	Oral/anal	Cow driasis	Wild	Li	GH020
26	*Comiphora holdai* sprague	Burseraceae	Qumbii	T	Gum /Resin	Paste	Topical	Anthrax, navel illness/dhukkuba handhuura a	Wild	Li	GH021
27	*Croton macrostachyus* Del	Euphorbiaceae	Bakkanisa	T	Leaf /Twig	Infusion	Oral	Bloat/dhiita’uu	Home garden	Bo	GH010’
28	*Euphorbia abyssinica* Pax	Euphorbiaceae	Adami	T	Stem	Sap	Topical	Mange mites /Injiraan ykn Cinii horii	Wild	Li	GH022
29	*Ficus sycomoros*Forssk	Moraceae	Harbu	T	Leaf	Paste	Topical	Contagious skin necrosis	Wild	Li	GH023
30	*Grewia bicolar*Juss	Malvaceae	Haroressa	Sh	Bark	Infusion	Oral	Retained	Wild	Li	GH024
31	*Rhus abyssinica*	Anacardiaceae	Xaxessa	Sh	Leaf	Paste	Topical	Skin	Wild	Li	GH025
32	Ricinus communis L.	Euphorbiaceae	Qobbo	T	Leaf /Roo	Infusion	Oral	Retained fetal	Home garden	Bo	GH005’

					t			membrane			
33	*Capparis cartilaginea* Decne.	Rosaceae	Gora	C m	Root	Paste	Topical	Skin problems	Wild	Bo	GH014’
34	*Salvadora persica*	Salvadoracea e	Hudha	Sh	Bark , root	Decoction	Oral	Trypanoso miasis, anthrax	Wild	Li	GH026
35	*Sesbania sesban*	Fabaceae	Daysa	T	Root , bark	Infusion	Topical	Mastitis/D hukkubbii harmaa/m ucha horii	Home garden	Li	GH027
36	*Solanum incanum*	Solanaceae	Hiddii	Sh	Fruit	Infusion	Oral/ nasal	Cow driasis	Wild	Bo	GH028
37	*Zinggeber officinale* Rose.	Zingiberaceae	Ginger	H	Rhiz ome	Paste	Topical	Emesis/ ol-deebisaa	Home garden	Li	GH029
38	*Prunus africana* (Hook.f)Kalkm	Rosaceae	Homi	T	Bark	Paste	Topical	Wound	Wild	Li	GH030

Appendix 2. Semi-structured questioner used for data collections.

Demographic characteristics of the respondents

1. Address: Kebele_____ Woreda_____
2. Gender: a) Male b) Female
3. Marital status: a) Single b) Married c) Widowed
4. Age:_____
5. Educational status: a) illiterate b) 1-4 c) 5-8 d) 9-12 e) Above 12
6. Occupation:_____

I. **Please Choose the best answer for the following questions according to your knowledge, experiences and perception towards medicinal plants**

7. Willingness to transfer your knowledge: a) to elder son b) to elder daughter c) to all children d) other specify
8. Source of Knowledge of traditional healing: a) Mother b) Father c) Grandmother and Grandfather d) other specify
9. Which type of plant you used frequently for medicinal use? a) Tree b) Shrub c) Herbs d) lianas
10. Which part of medicinal plants used to treat animal/livestock ailments?
    a) Leaf b) Root c) Stem d) Bark e) other specify
11. How do you think about the various categories of human ailments treated with medicinal plants
    a) Very commonly mentioned b) fairly mentioned c) occasionally mentioned
    d) Very rarely mentioned

12. Common practices to combat animal health problems in Munessa District

    a) Traditional Medicine b) modern medicine/veterinary clinic c) both

13. Common practices to combat animal health problems in Munessa District

    a) Traditional Medicine b) modern medicine c) both

14. At which condition the medicinal plants are collected? a) Morning b) midday c) night

15. In which seasons of the year, the medicinal plants are abundantly found? a) Summer b) winter c) spring d) autumn

16. From where do you collect the medicinal plants? a) forest b) homegarden c) grassland d) farmland e) roadside f) riverine g) other specify

III. Open ended questions; give your correct answer for the following questions

14. Have you ever used the medicinal plants for human ailments?
    _____
15. Have you ever used the medicinal plants to treat livestock ailments?
    _____
16. List the most common human and livestock diseases in your locality----------
    ----
17. Which plant has the most effective therapeutic value to treat human disease? ----------
    ----
18. What antidotes you are using during medicine preparation? why?----------
    ----
19. Which plant has the most effective therapeutic value to treat livestock disease?
    _____
20. Which medicinal plants are used for multipurpose human ailments treatment?
    _____
21. Which medicinal plants are used for multipurpose livestock ailments treatment? ----------
    ---------- ---------
22. Status of medicinal plants and corrective management measures using indigenous knowledge ----
    ----
23. Lists of plant species that are used to treat different human diseases

Apendixe.3 Representative medicinal plants in the study area.

Euphorbia abyssinica (Adami A\O)

Croton macrostachyus(Bakkanisa A\O*)*

Carissa spinarum (Hagamsa A\O)

Rhus abyssinica(Xaxessa A\OJ)

Apendixe.3 Photo taken during group discussion with informants