

HAWASSA UNIVERSITY
COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES
SCHOOL OF GRADUATE STUDIES
DEPARTMENT OF BIOLOGY



**ETHNOBOTANICAL STUDY OF MEDICINAL PLANTS USED TO TREAT HUMAN
AND LIVESTOCK AILMENTS IN DAWRO ZONE, SOUTH WEST ETHIOPIA
PEOPLE REGIONAL STATE**

MSC.THESIS

BY

TEMESGEN SHIFERAW

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HAWASSA, ETHIOPI

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AND LIVESTOCK AILMENTS IN DAWRO ZONE, SOUTH WEST ETHIOPIA PEOPLE
REGIONAL STATE**

**A Thesis Submitted to School Graduate Studies Department of Biology of Hawassa
University in Partial Fulfillment the Requirement for the Degree Master of Science in
Biology (Botanical Science)**

TEMESGEN SHIFERAW

ADVISOR: FIREW KEBEDE (PhD)

June, 2024

Hawassa, Ethiopia

HAWASSA UNIVERSITY
COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES
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I hereby certify that I have supervised, read, and evaluated this thesis titled “Ethnobotanical Study of Medicinal Plants Used to Treat Human and Livestock Ailments in Dawro Zone of South West Ethiopia People Regional State” by Temesgen Shiferaw prepared under my guidance. I recommend the thesis be submitted for oral defense.

Advisor’s name

Signature

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_____	_____	_____
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Name of Internal examiner I	Signature	Date
_____	_____	_____
Name of Internal examiner II	Signature	Date
_____	_____	_____
Name of External examiner	Signature	Date
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DECLARATION

This is to certify that the thesis entitled “Ethnobotanical Study of Medicinal Plants Used to Treat Human and Livestock Ailments in Dawro Zone of South West Ethiopia People Regional State”, submitted in partial fulfillment of the requirements for the Degree of Master of Science Department of Biology, Hawassa University, is a record of original work carried out by me and has never been submitted to this or any other institution to get any other degree or certificates. The assistance and help I received during the course of this investigation have been duly acknowledged.

Temesgen Shiferaw

June, 2024

Hawassa, Ethiopia

Name of the candidate

Date

Place

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ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
CSA	Central Statistics Agency
FLI	Fidelity level index
IBC	Institute of Biodiversity Conservation
ICF	Informant Consensus Factor
IK	Indigenous Knowledge
JCS	Jaccard's Coefficient of Similarity
KWARDO	Kechi Woreda Agriculture and Resource Development Office
M a s l	Meter above sea level
M. Sc.	Master of Science
MPs	Medicinal Plants
PHC	Primary Health Care
Sq km	Square kilometer
SWEPRS	South West Ethiopia People Regional State
UK	United Kingdom
W H O	World Health Organization

ABSTRACT

This ethnobotanical study was carried out to investigate and document the use of medicinal plants in Kechi woreda. In this study, 18 purposively selected key informants and 84 randomly selected general informants from three sampled kebeles were involved. Data were collected using semi-structured interview, group discussion and field observation. The collected data were analyzed using preference ranking, paired comparison, direct matrix ranking, informant consensus factor, jaccard's coefficient of similarity and fidelity level index. A total of 91 medicinal plant species were identified. These species distributed under 81 genera and 42 families. Out of the identified medicinal plants species 75 species (56.81%) were used against human ailments, 40 species (30.30%) were used against livestock ailments and 17 species (12.87%) were used to treat both human and livestock ailments. Herbs constituted the largest growth habit (49 species) followed by trees (41 species). The most frequently used plant parts were leaves (46.07%) followed by roots (26.47%) and most widely used method of preparation was pounding (46.07%) followed by concoction (26.47%). The most common route of administration was oral (85.29%) followed by dermal (7.84%). Croton macrostachyus was predominant medicinal plant cited by most of the informants (53%) while the disease categories with the highest ICF value (21.33%) for abdominal pain. There was high preference for Ruta chalepensis for treating abdominal pain while paired comparison showed Phytolacca dodecandra the most preferred species for treatment of hepatitis illness. Anthropogenic factors such as agricultural expansion, firewood gathering, charcoal production, overgrazing etc. are the major threats to medicinal plants. In general, medicinal plants are still playing a significant role in the management of various human and livestock diseases in the study area.

Keywords: Ailments, Dawro Zone, Ethnobotany, Indigenous knowledge, Medicinal plants

1. INTRODUCTION

1.1. Background of the Study

Different biologists define ethnobotany in different ways. Martin (1995) defined ethnobotany as the interaction between local people and their natural environment, including how they classify, manage, and use the plants available to them. Balick and Cox (1996) defined ethnobotany as the study of the relationship between plants and people, with a particular emphasis on traditional culture. Other individuals described ethnobotany as the study of direct interrelations between humans and plants, including plants used for food, medicine, and other economic applications (Farnsworth, 1994).

Traditional medicine is defined by the World Health Organization (WHO) as health practices, knowledge, and beliefs that involve plant, animal, and mineral-based medicines, spiritual therapies, manual techniques, and exercises used to treat, diagnose and prevent illness or maintain well-being (WHO, 2000).

When ethnobotanists gave the above definition, they had their own aims. One of the goals of ethnobotanists was to explore the importance of plants that were used for food, clothing, shelter, fodder, fuel, furniture, and medicinal purposes (Ram *et al.*, 2004). Therefore, ethnobotanical studies were used to document, analyze and disseminate knowledge about the interaction between plant diversity and human society (Martin, 1995).

In developing countries, traditional medicine has been the primary source of treatment for both human and livestock diseases (Endalew Amenu, 2007). The use of medicinal plants, in particular, continues to play a vital role in meeting basic health needs due to its lower cost compared to modern public health services, as well as its cultural acceptability. In addition, the use of herbal remedies has increased in developed countries over the last few decades (Tesfaye Awas and Sebsebe Demissew, 2009).

The traditional methods, especially the use of medicinal plants, still play a vital role to cover the basic health needs in the developing countries. This was because use of medicinal plants has much lower cost than modern public health services and the presence of acceptable culturally linked tradition (Endashaw Bekele, 2007).

The use of plants for health purposes started a long time ago, probably at the first moment when a human being got sick (Tigist Wondimu *et al.*, 2007). According to Asmera Amde (2017), a large amount of archaeological evidence exists that indicates humans were using medicinal plants during the Paleolithic, approximately 60,000 years ago.

Trends in the use of traditional and complementary medicine were on the increase in many developed and developing countries. According to Hamilton (2003), traditional remedies are the most important and sometimes the only source of therapeutics for nearly 80% of the worldwide population. For instance, about 85% of the world's population uses herbal medicines for the prevention and treatment of diseases, and the demand is increasing in developed and developing countries (Balcha Abera, 2014).

Plant medicines make up as much as all medications in the United States, but as much as 80% of drugs in rapidly emerging nations like China and India (Abadi Birhanu and Feto Haji, 2017). It has been estimated that 500 million people in South Asian nations alone turn to plants for health security (Abebe Demssie, 2001). The most common supplementary medical practices in Germany in 1992 were homeopathy, acupuncture, chiropractic, and herbal treatment, which together treated 20 million patients (WHO, 2000).

Ethiopians mostly rely on traditional medicine; 80% of the country's population and 90% of its livestock get their medical care from plants (Fisseha Mesfin *et al.*, 2009; Gidey Yirga, 2010). Ethiopia was a diversified country with a wide range of flora and ethnic groupings, each with their own methods for using and modifying medicinal herbs. Furthermore, the great range of traditional knowledge and practices of plant resource uses, management, and conservation can be attributed to the multitude of languages, cultures, and beliefs held by the people of Ethiopia (Pankhurst, 1990). Then, the Ethiopian people classify native plant species based on their

thoughts and experiences, and the locals have long used traditional medicine (Kalayu Mesfin *et al.*, 2013).

The indigenous people of different localities in the country have developed their own specific knowledge of plant resource uses, management and conservation. In the same way, Ethiopia has a glorious tradition of health care system based on plants, which dates back to several millennia. Ethiopian farmers and pastoralists rely on traditional knowledge, practices and plants to control livestock diseases, and have used traditional medicines for many centuries due to cultural acceptability, efficacy against certain diseases and economic affordability. The reports of Dilbato *et al* revealed that cattle owners in Ethiopia have long been aware of serious diseases such as desta (rinderpest), aftegir (FMD), abasenga (anthrax), abagorba (blackleg), gendi (trypanosomosis) and diseases caused by internal and external parasites, and the zoonotic nature of diseases such as anthrax and rabies. Before the introduction of modern veterinary practice, traditional healers were usually the only people approached to attend to these livestock diseases. The various traditional practices included prevention of diseases, recognition of toxic plants, surgical intervention and crude vaccination methods (Dilbato *et al.*).

The research conducted on ethnobotanical study of medicinal plants in Ethiopia, Ermias Lulkal *et al.*, (2008) collected the highest number. Ethnomedicinal uses of 230 plants species were documented from Mana Angetu District, which is found in Bale Zone of Oromia Region. Of these, 181 (78.70%) were used as human medicine, 27 (11.74%) as livestock medicine and the remaining were 22 (9.7%) uses for treating both human and livestock ailments.

Although, only small fractions of the world's plants have been investigated scientifically so far, human kind already reaped enormous benefits from it (Farnsworth *et al.*, 1985). More than ever, plant diversity remains vital for human well beings and still provides a significant number of remedies required in health care. There for the crucial role played by plant derived products in human and livestock health, the need for systematic scientific investigation is unquestionable.

In developing nations like Ethiopia, the traditional knowledge of medicinal plants was passed down orally from generation to generation in secrecy (Jansen, 1981). Because of this, there were many false beliefs about the effectiveness of medicinal herbs due to the lack of interest in modern culture and the elders' methods of imparting knowledge (Wilson and Woldo, 1979).

In addition, Ethiopia, like other African country, struggled with the continuity and sustainability of traditional medicine mostly as a result of habitat degradation, taxonomic extinction, and loss of indigenous knowledge (Ensermu Kelbessa *et al.*, 1992). Due to high population pressure and its effects, such as house building, agricultural growth, settlement, and firewood gathering, medicinal plant species are on the decline (Bekalo Tesfaye *et al.*, 2009; Belayneh Anteneh *et al.*, 2012).

In order to preserve and maximize the use of medicinal plants in primary healthcare systems for people and livestock these factors urgently need to be addressed. Furthermore, the loss of traditional knowledge about medicinal plants was brought about by changes in lifestyle, industrialization, the migration of people from rural to urban areas, and the quick destruction of natural habitats (Behailu Etana, 2010). As a result, the documentation of the traditional use of medicinal plants was important to preserve the knowledge (Tilahun Teklehymanot and Mirutse Giday, 2007). Therefore, this study was initiated to identify major traditional medicinal plants and the documentation of indigenous knowledge, major threats to medicinal plants, and the use and conservation of traditional medicinal plants used by the people in Kechi Woreda, Dawro Zone of South West Ethiopia People Regional State.

1.2. Statement of the problem

In developing countries like Ethiopia, indigenous knowledge about traditional medicinal plants is transferred secretly from generation to generation orally. In addition, indigenous knowledge on the usage of medicinal plants as remedies is getting lost due to migration from rural to urban areas, industrialization, the expansion of modern education, and the fact that specialized healers do not convey their knowledge to the next generation. And also, in most parts of the country, the wild plants and forests are on dangerous risk by human impacts like deforestation, agricultural expansion, overexploitation, and population growth, and hence there is an evident loss of biodiversity (Eskedar Abebe, 2011).

There was also similar problem in most parts of the country in general and in Kechi woreda in particular. This area is rich in some traditional medicinal plants and is currently suffering from

habitat and species loss due to continued deforestation and mis-use of natural biodiversity of medicinal plants, as well as loss of associated knowledge of management. The findings of this study would be helped people in the study area be aware of problems associated with medicinal plants and give attention to their species. And also, the documentation of the indigenous knowledge of medicinal plants can be part of the information source for those who want to conduct research in further ethnobotanical study and development of modern drugs; hence, this study was initiated to fill gaps in the documentation of ethnobotanical knowledge in the study area.

1.3. Objectives of the Study

1.3.1. General objective

The general objectives of this study were to assess and document the medicinal plant species used by the local people to treat Human and Livestock ailments in Dawro Zone of South West Ethiopia People Regional State, particularly, in Kechi woreda.

1.3.2. Specific objectives

- To identify and document widely available medicinal plants species were used by the local people for the treatment of human and livestock ailments in the study area.
- To document plant parts used for medicinal purposes, methods of preparation, and ways of administration.
- To evaluate threats and conservation status of medicinal plants in the study area.
- To assess the current status of medicinal plants and the indigenous knowledge of the people in the study area.

1.4. Research Questions

The main focus of this study was to investigate the medicinal uses and remedies of various plants that were used by the people of Dawro zone in Kechi woreda. The findings of the study were answered the following research questions:

- Which medically important plant species are used by the local people to treat human and livestock ailments in the study area?
- Which part of the medicinal plants would be used to treat human and livestock ailments?
- How would the local people prepare and administer ethnobotanical medicines?
- What were the major threats and conservation status of medicinal plants in the study area?

1.5. Significance of the study

The study could be provided information on the botanical resources in the woreda; and brought traditional medicinal techniques derived from medicinal plants used by traditional healers and indigenous people of the study area. Since there haven't been any prior ethnobotanical studies on traditional medicinal plants in the study area, it is crucial to conduct ethnobotanical research on them. It was expected that the research would help increased the knowledge gap between indigenous cultures, traditional ways of life, and modern science. The purpose of this study was to gather actual information from informants regarding the local names, distribution, habits, habitats, usage, current status, conservation, and threats to medicinal plants. Additionally, gathering important data and documenting it was essential.

1.6. Scope of the study

This study was conducted to study medicinal plant species used to treat human and livestock ailments in Dawro zone, Kechi woreda of South West Ethiopia People Regional State. Dawro zone is one of the six zones in (SWEPRS), which include ten woredas and two town administrations. Kechi woreda is among the ten woredas, which includes only eight kebeles, from these eight kebeles, the assessment was conducted in three kebeles, namely Bera doba, Oda gofa, and Maliga maracha kebeles.

1.7. Limitations of the study

Throughout the process of conducting the study, the researcher faced some difficulties when conducting this research. Some of them were as follows:

- The informants were not voluntary, on interview and questionnaire.
- Some responses of informants were difficult to be translated in to English.
- Difficulties faced by topography of land and climatic conditions.
- No network access to exchange information with kebele administrative bodys and with some informants' in the study sites.

2. REVIEW OF RELATED LITERATURE

2.1. Ethnobotany

The terms ethno and botany combine to make ethnobotany. The terms "botany" and "ethno" refer to the study of plants and humans, respectively.

Documenting and examining the application of indigenous knowledge, beliefs, and behaviors about plant resources is the main goal of the interdisciplinary and multidisciplinary discipline of ethnobotany (Martin, 1995). Ethnobotany includes all research on the interactions between native plants and people. One of the ways that humans and plants interact is through indigenous knowledge used in traditional medicine. As a result, humans rely on plants for both survival and the synthesis of medicines (Cotton, 1996).

Ethnobotany is the scientific study of plants as they are utilized in indigenous societies for food, medicine, rituals, construction, household items and equipment, musical instruments, firewood collecting, insecticide, clothing, shelter, and other uses, according to Balick and Cox (1996). Ethnobotany, which covers plants used for food, medicine, rituals, social life, and other purposes, is the study of how plants have been utilized, controlled, and perceived in human civilizations (Khan *et al.*, 2007). Additionally, the primary purposes of ethnobotanical studies are to record, examine, and share information about the relationship between human society and biodiversity, how biodiversity is valued in various societies, and how human activity affects biodiversity (Martin, 1995).

More analytical, quantitative, cross-disciplinary, and multi-institutional approaches are becoming common in ethnobotany these days (Hamilton, 2003). It is still mostly used to assess the potential value of different plants because it is connected to economic botany. Therefore, the promise of discovering plants as possible sources of life-saving medications that could play a significant role in the treatment of major illnesses like cancer and AIDS (Mac Donald, 2009). Cotton (1996) pointed out that one possible use of ethnobotanical research in the last ten years has been the identification of novel medications based on traditional medicinal plants. Information for these kinds of inquiries can be obtained from ethnobotanical studies.

2.2. Indigenous knowledge (IK)

In many developing nations, ethnomedical knowledge is a commonly utilized indigenous knowledge system that includes traditional diagnosis, raw material gathering, and remedies formulation. Because modern medications are costly, people in many poor nations mostly rely on ethnomedical knowledge to treat illnesses (Nuria Abdurhman, 2010).

The indigenous knowledge of medicinal plants used by human beings is decreasing in alarming rate. Since the knowledge about traditional medicinal plants is transferred secretly from generation to generation orally in developing countries (Jansen, 1981). This secretes and oral transfer makes indigenous knowledge exposed to distortion (Amare Getahun, 1976). Therefore, there is a need for systematic documentation of such useful knowledge through ethnobotanical research.

Traditional people all throughout the world have a unique understanding of the plant resources that they rely on for food, medicine, and other necessities. They also have a great deal of botanical knowledge (Martin, 1995). Therefore, an ethnobotanical study of less-studied sociocultural groups is essential to preserve indigenous knowledge of the usage of plants in general and traditional medicine in particular. Yet, Ethiopian medicinal plant study and documentation are very new (Yayesh Limenih *et al.*, 2015). Ethiopian communities have differing levels of indigenous knowledge about therapeutic plants (Abdurhman, 2010).

2.3. Traditional medicine

Depending on the climatic, physiographic, floral, and faunal features of their environment, humans have utilized medicinal plants to treat and prevent a variety of illnesses (Nuria Abdurhaman, 2010). The definition of traditional medicine is the total of knowledge, abilities, and practices used to prevent, diagnose, and treat physical and mental illnesses based on theories, beliefs, and experiences unique to various cultures. Indigenous people have long used medicinal plants to treat diseases in both humans and livestock because traditional medicine is far less expensive to use than contemporary public health services and is rooted in cultural traditions (Endashaw Bekele, 2007).

According to Tigist Wondimu *et al.* (2007), educated and modern societies have historically disregarded traditional medicine. But recently, a number of ethnobotanical and ethnomedicinal research have been conducted to increase health care services by recognizing the value of traditional medicine. In many industrialized and developing countries, the use of complementary and alternative medicine is on the increase. For around 80% of the world's population, traditional medicines remain the most significant and occasionally the only source of treatments, according to Hamilton (2003). In China, India, Japan, Pakistan, Sri Lanka, and Thailand, traditional medicine is widely practiced (Singh, 2015). Furthermore, a variety of traditional medication kinds are commonly utilized to treat fundamental medical needs throughout Asia, Africa, and Latin America; These practices, which are sometimes referred to as complementary or alternative medicine, are fast expanding in industrialized nations (Jamshidi-Kia *et al.*, 2018).

According to Mesfin Tadesse and Sebsebe Demissew (1992), Ethiopians have created cures that improve and restore health. This is because of its immense geographical diversity, which results in a wide range of climatic conditions as well as a significant diversity of flora and fauna. This diversification promotes the evolution of several diseases. According to Kalayu Mesfin *et al.* (2013), the people of Ethiopia have been using traditional medicine for a while, and they classify native plant species based on their perceptions and experiences. As a result, about (80%) of Ethiopia's population obtains treatment for different diseases from traditional medicine (Endashaw Bekele, 2007). In a similar manner, traditional medicine is still widely used in Ethiopia, and its acceptance, accessibility, and appeal are unquestionable; about 90% of the population uses it for health care needs (WHO, 2000).

2.4. The use of medicinal plants in Ethiopia

According to Tibebe Tefera and Mesele Yihune (2019), plant diversity continues to be crucial for human welfare and offers a large number of treatments that are needed in the healthcare system. Ethiopia is a diversified country with a wide range of flora and ethnic groupings, each with its own methods for using and modifying medicinal herbs: IBC (2005) states that there are an estimated number of 6000 species of higher plants with 10-12% endemism in Ethiopia's flora. Ethiopians speak a wide variety of languages, cultures, and religious beliefs, which has resulted

to a significant diversity of traditional knowledge and methods for managing and conserving plant resources (Pankhurst, 1990).

Ethiopia has a long history of using medicinal herbs, as evidenced by the numerous medico-religious texts created on parchments said to date back several centuries (Fassil Kibebew, 2001). Similarly, 80% of Ethiopians employ medical plants and plant treatments that have been hand-picked over periods (Abebe Demissie, 2001). Furthermore, medicinal plants continue to be the primary and perhaps the only source of treatments. Nevertheless, obtaining the healers' traditional medical knowledge is difficult since they maintain that it is their own and only wish to pass it on to a select few, usually their eldest son (Jansen, 1981).

2.5. Plants in ethnoveterinary medicine

Ethnoveterinary medicine is defined as the study of traditional knowledge and methods used in animal health care, such as traditional surgical and manipulative techniques, traditional immunization methods, traditional management techniques, magic religious beliefs and practices, and the use of herbal remedies to prevent and treat various livestock diseases problems (Endalew Amenu, 2007).

In most developing nations, especially in Sub-Saharan Africa, animal sickness continues to be a major contributor to subpar livestock performance, which widens the gap between supply and demand for livestock and related products (Teshale Sori *et al.*, 2004).

The indigenous people of different localities in the country have developed their own specific knowledge of plant resource uses, management and conservation. When it comes to the number of livestock, Ethiopia is among the top nations in Africa. For a large number of people, livestock farming is vital to their livelihood and economy. Because modern drugs are expensive and in short supply the majority of Ethiopian farmers and pastoralists rely on their traditional knowledge methods and locally available materials, primarily plants, to control livestock ailments. Among the medical practices that lend themselves the most to scientific study is herbal medicine. Breeders of livestock can address animal health issues more affordably by using their knowledge of medicinal plants (Behailu Etana, 2010).

In developing nations like Ethiopia, livestock is essential to food security and sustainable development. Ethiopia has one of the weakest veterinary medical systems, despite the fact that raising livestock directly benefits the Convention on Animal Health (Endalew Amenu, 2007).

However, Ethiopia has a glorious tradition of health care system based on plants, which dates back to several millennia. Ethiopian farmers and pastoralists rely on traditional knowledge, practices and plants to control livestock diseases, and have used traditional medicines for many centuries due to cultural acceptability, efficacy against certain diseases and economic affordability. The reports of Dilbato *et al* revealed that cattle owners in Ethiopia have long been aware of serious diseases such as desta (rinderpest), afgangir (FMD), abasenga (anthrax), abagorba (blackleg), gendi (trypanosomosis) and diseases caused by internal and external parasites, and the zoonotic nature of diseases such as anthrax and rabies. Before the introduction of modern veterinary practice, traditional healers were usually the only people approached to attend to these livestock diseases. The various traditional practices included prevention of diseases, recognition of toxic plants, surgical intervention and crude vaccination methods (Dilbato *et al.*).

In Ethiopia and Africa, a number of traditional veterinary procedures are still unrecorded (Dawit Abebe and Ahadu Ayehu, 1993). Therefore, planning and executing successful livestock production requires accurate documentation and understanding of farmers' knowledge, attitudes, and practices about the occurrence, causes, treatments, prevention, and control of various diseases (Tafesse Mesfine and Mekonen Lemma, 2001).

2.6. Threats of traditional medicinal plants

Due to the availability of plants in general and medicinal plants in particular being impacted by both natural and anthropogenic reasons, herbal practitioners are now need to trek longer distances to gather herb collections that grew around their residences (Cunningham, 1996). According to Tesfaye Awas and Sebsebe Demissew (2009), medicinal plants are collected from their natural habitat and used by both traditional and professional healers. Accordingly, the loss of indigenous knowledge, the loss of medicinal plant habitats, and the loss of plant taxa are the main causes of this issue (Endalew Amenu, 2007).

Medicinal plants face danger from two different sources. These have both natural and man-made causes. Man-made factors include the fast population growth, the need for fuel, urbanization, the

production of lumber, overharvesting and destructive harvesting, the commercialization of alien species, and the degradation of honey collections, the expansion of agriculture, and the destruction of habitats. On the other hand, frequent droughts, bush fires, illnesses, and pest outbreaks are the main natural causes. As a result, this exacerbates the pace of extinction of taxa that are associated with indigenous knowledge, as well as the loss of commonly occurring medicinal plant species and the customs that are linked to them (Behailu Etana, 2010).

Thus, identifying medicinal plants, recording their applications, and evaluating the risks establish a foundation for local decision-making, implementing suitable management, and carrying out in-depth pharmacological analysis (Mekuanent *et al.*, 2015). Additionally, a study plan and program must be created for the conservation, use, and documenting of medicinal plants, taking into account the plants' location, current population, and recognized traditional usage (Tibebu Tefera and Mesele Yihune, 2018).

2.7. Conservation of traditional medicinal plants

Conservation is the sustainable use of biological resources. (Abdurhaman Nuria, 2010). Because of the reliance on traditional medicine for health, it is crucial to manage traditional medicinal plant resources sustainably. This is in addition to their potential importance as a source of new medications (Cunningham, 1993). Therefore, it is crucial to preserve medicinal plants by making sure and promoting their growth in designated areas, such as places of worship (churches, mosques, cemeteries, etc.), terraced grooves, farm margins, riverbanks, roadsides, and living fences of fields and gardens. In gene banks and botanical gardens, medicinal plants can also be preserved with the use of suitable conservation techniques (Zemedu Asfaw, 2001).

In Ethiopia, most medicinal plants used by the herbalists are collected from the natural vegetation. Home based medicinal plant use relies on plants of the homegarden crops, weeds and that grow wild around human habitation. The cultivated medicinal plants are mostly produced in homegardens either for medicinal or other primary purposes. Medicinal plants of homegarden are known to the public as the knowledge on them is open or public. 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. However, some local names as

Shamba and Chagga in East Africa are also very popular names worldwide as they represent well their systems. In Ethiopia, a very common Amharic vernacular name equivalent for the term homegarden is “Yeguario-ersha” or a closer alternative might be “Yeguario Meret” meaning a land at the backyard of a house (Zemedede Asfaw, 2001).

In-situ and ex-situ conservation techniques are two of the conservation measures set to prevent additional global devastation of vulnerable medicinal plants (Cunningham, 1996). As opposed to ex-situ conservation, which protects endangered species by removing a portion of them from a threatened habitat and relocating them to a new location that may be a wild area or under human care, such as seed gene banks, field gene banks, arboreta, and botanic gardens, in-situ conservation involves keeping species in their natural habitats, such as reservoirs and national parks. Certain traditional medicinal plants must be conserved in-situ due to the difficulty of domestication and management outside of their natural habitat. (Zemedede Asfaw, 2001). In-situ and ex-situ should be complementarily implanted in Ethiopia to conserve valuable plant species, which are threatened due to natural or manmade factors (Abebe Demissie, 2001).

In Ethiopia today, the issue of medicinal plant conservation calls for aggressive studies and documentation before the habitats of these plants and traditionally held knowledge bases distorted by accelerated ecological and cultural transformation (Endashaw Bekele, 2007). Therefore, Ethiopia has policies and strategies that support the development and utilization of plant resources in a sustainable manner (Nuria Abdurhaman, 2010).

3. MATERIALS AND METHODS

3.1. Description of the study area

Dawuro Zone is one among the six zones in South West Ethiopia People Regional State. The total surface area of the zone is estimated to be 4,436 sqkm. Dawuro lies in between 6° 36' to 7° 21' north latitudes and 36° 68' to 37° 52' east longitudes (DZA, 2021, unpublished). The population of Dawuro Zone was estimated to be 600,121 and density of 135.28/km² (BSP, 2004).

It is bordered with the Oromia region in the northwest, Hadiya in the north, Kambata Tambaro zone in the northeast, Wolaita zone in the east, Gamo Gofa zone in the south, and Konta zone in the west. Tarcha is the capital of the zone that is about 486 km southwest of Addis Ababa across Shashemene and 413 km across Hosana, but 491 km across Jimma. Also it is 298 km from Bonga, the Melty-city capital regional state of (SWEPRS), and 144 km from Jimma (ASA, 2017).

The present study was conducted in Kechi Woreda of Dawro Zone of South West Ethiopia Regional State. Currently Dawro Zone includes ten Woredas and two town Administrations. Of these, Kechi Woreda was purposely selected as the study area. The Woreda was located at the mid-east part of the zone about 50km away from Tarcha.

Kechi Woreda is bordered on the south by Isara, on the north by Tarcha zuriya, on the northeast by Tocha and Mari mansa and on the west by Tarcha zuriya woreda.

Based on (CSA, 2007) Kechi Woreda has a total population of 102,848, of whom 52,481 are men and 50,367 women and also 6,614 (6.43%) of its population are urban dwellers. The majority of the inhabitants practiced Ethiopian Orthodox Christianity, with 51.31% of the population reporting that belief, 44.35% were Protestants, and 3.71% practiced traditional beliefs.

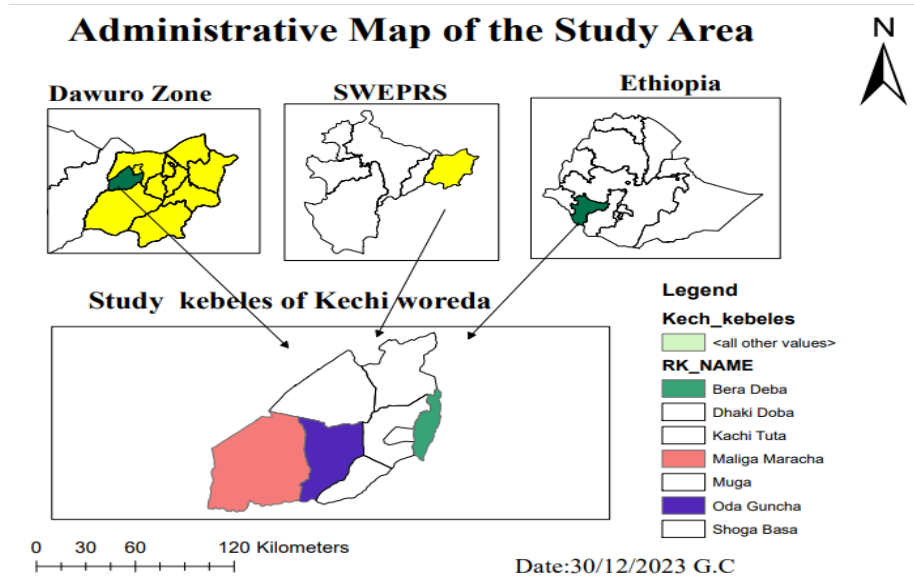


Fig 1: Location of the study area in Dawuro Zone and the sampling sites.

3.2. Topography and Altitude

The land features of the woreda are characterized by plateaus, mountains, and plains. About 60% of the land area is mountainous, while about 20% is plain, and the remaining 20% is classified as plateau. Most of Kechi Woreda is part of the South West Highlands of Ethiopia, where a large part of its topography is influenced by undulating rolling hills and plateaus. The average altitude of the Woreda ranges from 500m around the confluence of the Zigina and Omo Rivers to 3000 *m.a.s.l.*, the area named “Tuta Mountain” at Kechi tuta Kebele (KWARDO 2019).

3.3. Agroecology and climate

The agroclimatic situation of the study area is subdivided into three zones: ‘*Dega*’ covers about 50% of the total area and found above 2500 *m.a.s.l.* and receives more than 2500mm; ‘*Woinadega*’ covers about 30% of the total area and is found within 1501-2500 *m.a.s.l.* and receives 1501-2500mm; and ‘*Kolla*’ region covers 20% of the total land area and is found within 500-1500 *m.a.s.l.* and receives 500mm-1500mm of rainfall (KWARDO, 2019). Based on the altitudinal difference indicated above, the three agroclimatic zones are observed in Kechi Woreda. Though there is little seasonal variation in the amount of temperature and rainfall in the

agro-ecological zones, due to the altitude effect, the spatial variation of rainfall and temperature is clearly observed among the agroecological zones.

Generally, in the area, the months between June and September are the wettest (maximum rainy) season, whereas the dry season takes place mainly from December to February, and in the remaining season, little rainfall is observed with some variation from place to place. The woreda receives its mean annual rainfall, which ranges from 1401 to 1800 mm, and its mean annual temperature, which ranges from 15.1 to 25 degrees centigrade (KWARDRO, 2019).

3. 4. Soils and land use/cover

The major soils in Kechi Woreda are nittosols, vertisols, luvisols, and cambisols (KWARDRO, 2019). Generally, these types of soils are vulnerable to erosion if not properly managed. The major land uses and covers were annual crop cover, settlement area, pastoral land, forest and bush land, and unproductive land, of which the highest share, about 40.46%, is annual crops, followed by forest and bush land at 20%, and pastoral land at about 0.79%. Thus, the land use system of the area indicates that a large proportion of land is devoted to crop production to feed the increasing population and a small amount is used to keep livestock. Its total land area is about 746.71 sq km, covering 17.6% of the total area of Dawro Zone (KWADRO, 2019).

3. 5. Vegetation cover

Based on altitudinal variation, various types of natural vegetation are growing in Kechi Woreda. The highly dominated tree species of the woreda consist of *Cordia africana*, *Syzygium guineense*, *Croton macrostachyus*, *Ficus vasta*, *Juniperus procera*, *Acacia sp.*, and *Millettia ferruginea*. Kechi Woreda is one of the leading Woreda in Dawro Zone in terms of dense forest with medicinal plant coverage. However, in Woreda, the population number is increasing from time to time, which in turn leads to the loss of natural forests in general and medicinal plant species in particular. The forests, including traditional medicinal plants, were depleted intentionally or unintentionally in the study area from time to time in terms of coverage and quality due to the main threat of clearance of forest land for agricultural expansion, population resettlement, charcoal making, fuel wood gathering, logging timbers, land scarcity, and

construction of houses. The direct consequence of this problem for the residents includes the loss of medicinal plants from wild habitat (KWARDO, 2019).

3. 6. Population size, growth and density

Based on (CSA, 2007) Kechi Woreda has a total population of 102,848, of whom 52,481 are men and 50,367 women and also 6,614 (6.43%) of its population are urban dwellers. The area's annual population growth rate from 1994 to 2007 was 2.7%, which is higher than the nation's average annual growth rate of 2.6% for the same period (CSA, 2007). Rural residents make up a large portion of the area's total population. The results of the 2007 population census also reveal that 97,477 (94.25%) of the population lives in rural areas, with only 5942 (5.75%) living in urban areas. In terms of population density, the woreda's agroecological zones determine the population density.

3. 7. Economic Activities

The primary agricultural products of the "Kolla" region are sweet potatoes, sorghum, maize, teff, bananas, and yams, while the primary food crops grown in the "Dega" and "Woina-dega" agroecological zones are barley, wheat, beans, and peas. In the studied area, wheat is the main crop, especially in high- and mid-altitude regions, whereas maize is the main crop in lowland areas. In rural regions, a household's level of wealth is typically determined by the quantity of cattle they own and Enset (*Ensete ventricosum*) they farm. Apart from these, there exist other categories of crops such as diverse fruits and vegetables, cash and industrial crops including coffee (*Coffea arabicca*), and sugarcane grown by the local people. There are 25,189 hectares of arable land in the Woreda. 17,235 hectares of these ten commercially significant crops were planted in 2018/19 (KWADRO, 2019).

3.2. RESEARCH METHODS

3.2.1. Reconnaissance survey and site selection

A reconnaissance survey of the study area was conducted from March 14 to 26, 2023 and the data were collected from April 1, 2023 to June 30, 2023.

Dawro Zone has a total of ten Woredas and two city administrations. Out of these, Kechi Woreda was purposely selected found with different Agro-ecological conditions like ‘Dega’, ‘Woina dega’ and ‘Kolla’; a total of eight Kebeles in Kechi Woreda. Out of these, three Kebeles were selected, from Dega, one kebele (37.5% out of three kebele), woinadega, one kebele (37.5% out of three kebele) and kola one kebele (25% out of two kebele) were selected based on altitudinal relative variation of the three kebeles. Accordingly, Bera doba, Oda gofa and Maliga maracha were considered from eight kebeles.

3.2.2. Sources of data

In order to achieve the objectives of the study, the data for the study were obtained from primary sources. The Primary data or first-hand information were collected from farm household respondents, traditional community elders, Kebele Development Agents and community through household survey, informal discussions, and key informant interview including direct observation.

3.2.3. Informant Selection

According to Martin (1995), for this study, a total of 102 informants (86 males and 16 females) were selected from the selected study sites. The age of the informants was between 26 and 96, including knowledgeable elders, mothers, and adults. From the total number of informants, 18 key informants, six key informants per each study sites were purposely selected based on the recommendations or assistance of farmer training associations, local administrators, knowledgeable elders, health extension workers, and developmental agents. The remaining 84 informants, 28 individuals from each of the study sites were selected using simple random sampling method. Accordingly, from the total residents of the kebele were listed with their names could be summoned and identified by tossing the coin, whenever the head of the coin was

up if he/she volunteered to participate as the information source of the study site, he/she was recorded as the general informants of the study area to see the general knowledge or knowledge transfer of medicinal plants among the people, unless he/she was rejected.

3.3. Ethnobotanical data collection methods

3.3.1. Semi-structured interview

Interviews were based on a semi-structured checklist of topics consisting of 19 questions (Appendix 3), prepared before hand in English and translated into the local language (Dawrootsuwa). The questions were prepared with the following main components: (i) personal data of the respondents, which includes the name, address, age, and gender; (ii) information on medicinal plants, such as vernacular name, parts of the plant used, habit and habitat of the plant, preparation method, dosage administered, methods of administration, disease treated, side-effects of the remedy, taboo's associated with traditional medicinal plants, and antidotes used when side effects were seen in the medications.

3.3.2. Field observations

A guided field observations and interview were conducted with informants, and all relevant data, including the vernacular names of plants, the habit and habitat of the plant, the parts used, the preparation methods and modes of administration, the disease conditions treated, and the threats of medicinal plants, as well as the strategies they use for the conservation of medicinal plants and the preservation of indigenous knowledge on medicinal plants, were recorded. Field observations were performed with the help of local guides as well as interviewees in the study area (Fig. 2).



Fig. 2: Field observations were made in the study areas

3.3.3. Group discussions

Martin (1995) reports that in order to comprehend the traditional medicinal system of the people and its management, as well as the ways in which knowledge is preserved and passed down from one generation to the next, informal and group discussions were made with some general and key informants at three study sites. Additionally, talks were based on the pre-prepared, English-to-local translation checklist of questions (Appendix 3 and Fig.3).



Fig.3: Group discussions was made in the study area

3.3.4. Market survey

A market study was conducted on Tuesday market in Komma Guncha Kebele on June, 4 and 11, 2023, for two consecutive weeks. In order to document the names of the medicinal plants and other details of the herbal medications sold in the local markets in the study area, a market survey was conducted during the study. Drug merchants and customers participated in semi-structured interviews to evaluate the additional properties of plant materials (Fig. 4).



Fig. 4: Market survey was made on Boka Tuesday market

3.4. Plant sample collection and identification

Based on the informants' reports, medicinal plant species were collected from home gardens, the wild, or both. All relevant data, including local names, habits, habitats, and related plant materials, were gathered at the time of collection regarding medicinal plants. The investigator gathered medicinal plants from the study region using questionnaires that were written in English and translated into the Dawrootsuwa, the local language of the study region. Different volumes of Ethiopian and Eritrean flora (Hedberg and Edwards, 1989 and 1995; Hedberg *et al.*, 2006) were used for plant identification, along with professional advice.

3.5. Ethical consideration

Throughout the whole research procedure, including the data gathering phase, the researcher placed a strong emphasis on ethics. The participants were given an explanation of the study's purpose for their academic benefit. After obtaining approval from the research subjects and the Kechi Woreda Administrative offices, data collection was carried out.

3.6. Methods of data analysis

In accordance with Martin (1995), Alexiades (1996), and Cotton (1996), preference ranking, paired comparison, and direct matrix ranking were used to calculate the collected data. Calculations were made for the informant consensus factor, fidelity level index, jaccard's coefficient of similarity, and informant consensus ranking.

3.6.1. Descriptive statistics

Data on medicinal plants, related knowledge, management techniques, use, and conservation were analyzed and summarized using descriptive statistical approaches like percentage and frequency. According to Martin (1995), Alexiades (1996), and Cotton (1996), the most helpful information gathered on medicinal plants reported by local people includes medicinal value, local names for plant species, ways of application, methods of preparation, route of administration, disease treated, antidots used, habit and habitat, and parts used. These data were analyzed through descriptive statistical analysis.

3.6.2. The informant consensus factor (ICF)

Informants were approached at least twice for the same ideas in order to assess the dependability of the information obtained during the interview, and the accuracy of the information was established and documented. As a result, the informant's notion was disregarded if it differed from the original data since it was deemed untrustworthy. Only those that were pertinent were examined statistically. The technique used here was taken from Alexiades (1996). To determine the extent to which the informants agreed on the reported treatments for the group of illnesses, the Informant Consensus Factor was computed for each category. The ICF was determined in this way: divided by the total number of use citations in each category minus one, or the number of use citations in each category minus the number of species used (NT) divided by the sum of the use citations less one for each category (Heinerich *et al.*, 1998). The factor has a range from 0 to 1, with a high value serving as a reliable predictor of a high informant consensus rate.

$$ICF = \frac{(nur-nt)}{(nur-1)} \text{-----} (1)$$

Where, ICF= Informants Consensus Factor

(Nur) = number of use citation in each category

(NT) = number of species used

3.6.3. Preference ranking

Following Martin (1995), a preference ranking was carried out for the eight most significant medicinal herbs that were utilized to alleviate abdominal pain, as traditional healers typically do. To determine which kind of medicinal plant is best for treating abdominal pain, six informants were chosen. Each informant received eight medicinal plants that were said to be able to treat the ailment; the leaves of the plants were paper-tagged with their names. The informants were then asked to rank the plants in order of least preference (number 1), highest value (8) for the most preferred species against the illness, and lowest value (1) for the least preferred plant. Each

species' value was added up, and the final score was used to establish each species' rank. This made it easier to see how the community ranked the most potent medicinal plants for treating the ailment.

3.6.4. Paired comparison

The degree of preferences or levels of significance of particular chosen plants or plant components can be assessed using this analytical approach (Nemarundwe and Richards, 2002). The efficacy and popularity of six species of medicinal plants used to cure hepatitis ailments were evaluated by paired comparisons, as per Martin's (1995) description. From the total informants of the study, 10-key informants were chosen at random and given the opportunity to express their opinions on six traditional medicinal herbs that are known to treat hepatitis separately. Before presenting each pair to chosen informants, a list of all possible pairings of the chosen objects was created. The order within each pair was then randomly determined. The informants' replies were then recorded, the total value was summarized, and the pairs were ranked.

3.6.5. Direct matrix ranking

Direct matrix ranking was carried out in accordance with Martin (1995) and Cotton (1996). This study took into account a number of uses for medicinal plants, including food, medicine, building materials, charcoal production, and fence construction. These were common use of therapeutic herbs that important informants shared. Out of all the medicinal plants, six multifunctional tree species were chosen based on information obtained from informants, and eight use diversities of these plants were listed for six key informants who were chosen at random to assign use values to each species (Table 13). Medication, fodder, food, firewood, building, charcoal, fencing, and furniture manufacture are among the eight use values. It was possible to compare the usefulness of therapeutic plants and determine the primary reason for overuse by summing the scores. The average value use diversity for a species was calculated using data collected from informants, and the values of each species were then totaled and graded.

3.6.6. Fidelity level index (FLI)

Using the following formula, the relative healing capacity of each medicinal plant used to treat human and livestock ailments was estimated by calculating its Fidelity Level value.

$$FL = (N_p / N) \times 100 \text{ ----- (2)}$$

Where, N_p is the total number of informants who assert that a certain plant species can be used to treat a specific illness, and According to Alexiades (1996), N is the number of informants who utilize the plants as a medicine to treat any illness. Confirmation or agreement should not be used as the only indicator of a medicinal plant's potential effectiveness. Therefore, the prevalence of a certain plant and disease in the area can have an impact on informants' selections in addition to efficacy. The fidelity level index for the combined overall use and specific use reports was computed and summarized.

3.6.7. Jaccard's coefficient of similarity (JCS)

To determine how similar the species compositions of the study area with other studies conducted in different parts of Ethiopia, it was calculated the plant species between the research areas and other locations that other authors in different parts of the nation had studied. JCS was determined using the formula below (Kent and Coker, 1992).

$$JCS = c/a+b+c \text{ ----- (3)}$$

Where, JCS= Jaccard's Coefficient of Similarity,

a= Number of species which is found only in habitat woreda A

b= Number of species found only in habitat woreda B and

c= Number of common species found in habitat woredas A and B,

4. RESULTS AND DISCUSSION

4.1. Ethnomedicinal plant species used by people of the study area

4.1.1. Distribution and diversity of medicinal plants of the study area

A total of 91 species of medicinal plants were identified for this investigation. 42 families and 81 genera of 91 species of medicinal plants were identified and documented from the study area. The family Asteraceae has the greatest number of medicinal plant species 12 (13.33%) out of all the species that were documented, followed by the Fabaceae 10 (11.11%) species and other families (Table 1 as follows). The families had demonstrated that the study area's health care system made extensive use of a variety of medicinal plants. This outcome is consistent with research by Mengistu Gebrehiwot (2010), Asmera Amde (2017), and Abeba Kassa (2020), who found that the Asteraceae family is the dominating one.

Table 1: Number of species, genera and families of medicinal plants

<i>Families</i>	<i>Number of genera</i>	<i>% Of genera</i>	<i>Number of plant species</i>	<i>% Of plant species</i>
Asteraceae	9	11.11	12	13.33
Fabaceae	9	11.11	10	11.11
Lamiaceae	7	8.64	8	8.88
Poaceae	7	8.64	7	7.77
Solanaceae	3	3.70	4	4.44
Euphorbiaceae	2	2.46	3	3.33
Myrtaceae	3	3.70	3	3.33
Rubiaceae	3	3.70	3	3.33
Acanthaceae	2	2.46	2	2.22
Amaranthaceae	2	2.46	2	2.22
Anacardiaceae	2	2.46	2	2.22
Brassicaceae	2	2.46	2	2.22
Moraceae	1	1.23	2	2.22

Polygonaceae	1	1.23	2	2.22
Rutaceae	2	2.46	2	2.22
Agavaceae	1	1.23	1	1.11
Alliaceae	1	1.23	1	1.11
Annonaceae	1	1.23	1	1.11
Apiaceae	1	1.23	1	1.11
Araliaceae	1	1.23	1	1.11
Asparagaceae	1	1.23	1	1.11
Boraginaceae	1	1.23	1	1.11
Capparidaceae	1	1.23	1	1.11
Convolvulaceae	1	1.23	1	1.11
Cucurbitaceae	1	1.23	1	1.11
Cupressaceae	1	1.23	1	1.11
Cyperaceae	1	1.23	1	1.11
Ericaceae	1	1.23	1	1.11
Lauraceae	1	1.23	1	1.11
Malvaceae	1	1.23	1	1.11
Melanthaceae	1	1.23	1	1.11
Moringaceae	1	1.23	1	1.11
Musaceae	1	1.23	1	1.11
Myrsinaceae	1	1.23	1	1.11
Phytolaccaceae	1	1.23	1	1.11
Piperaceae	1	1.23	1	1.11
Pittosporaceae	1	1.23	1	1.11
Rosaceae	1	1.23	1	1.11
Thymelaceae	1	1.23	1	1.11
Tiliaceae	1	1.23	1	1.11
Urticaceae	1	1.23	1	1.11
Verbenaceae	1	1.23	1	1.11
Total	81	100	91	100

4.1.2. Habitat of medicinal plants in the study area

Majority of the people in the study area harvest medicinal plants 82 (80.39%) were found in the wild, 29(25%) in homegardens, and 3(2.94%), were found in both (Fig. 5). This data suggests that the majority of the locals in the research area make their medicine from wild medicinal plants. Furthermore, the majority of the local population has very little potential and capacity to produce around their home garden. The bulk of therapeutic plants are found in the wild environment of the residents, as explained by Balcha Abera (2014), Tamru Temam and Asalfew Dillo (2016), Kebede Tirfessa *et al.* (2017), and Abeba Kassa (2020).

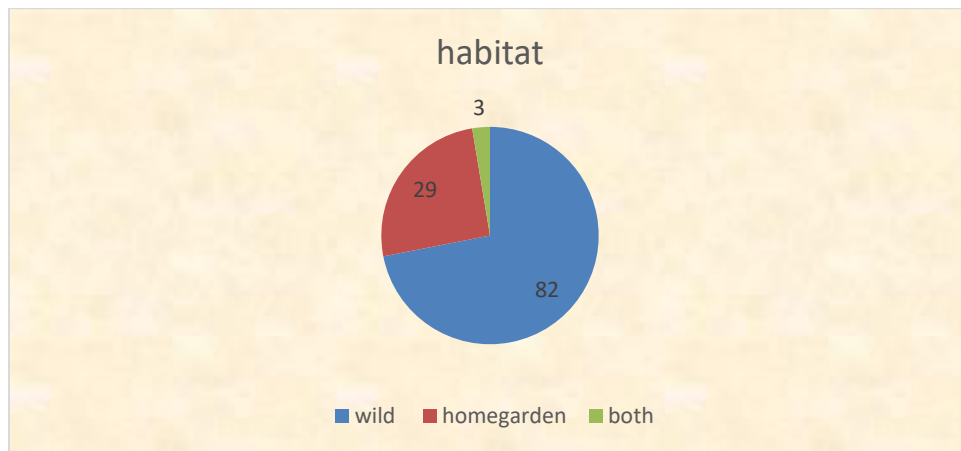


Fig. 5: Source of medicinal plants in the study area

4.1.3. Habit (growth form) of medicinal plants in the study area

The district's medicinal plants were gathered in a variety of growth forms or habits. Herbs accounted for 49 (48.03%) of the plant species documented for the study, with trees accounting for 41 (40.19%) and shrubs for 16 (15.68%) as the major growth habits in the studied region. Only a small percentage of medicinal plants (8.82%) have a growth form of climbing (Fig. 6). This result demonstrated that, in the study region, herbs were the most commonly used therapeutic plants, followed by trees. This is due to the fact that the research area has a high concentration of plant species, many of which are easily obtained by the local inhabitants. The

observations of Mirutse Giday *et al.*, (2009); Takele Bassa (2017); and others validated the above theory.

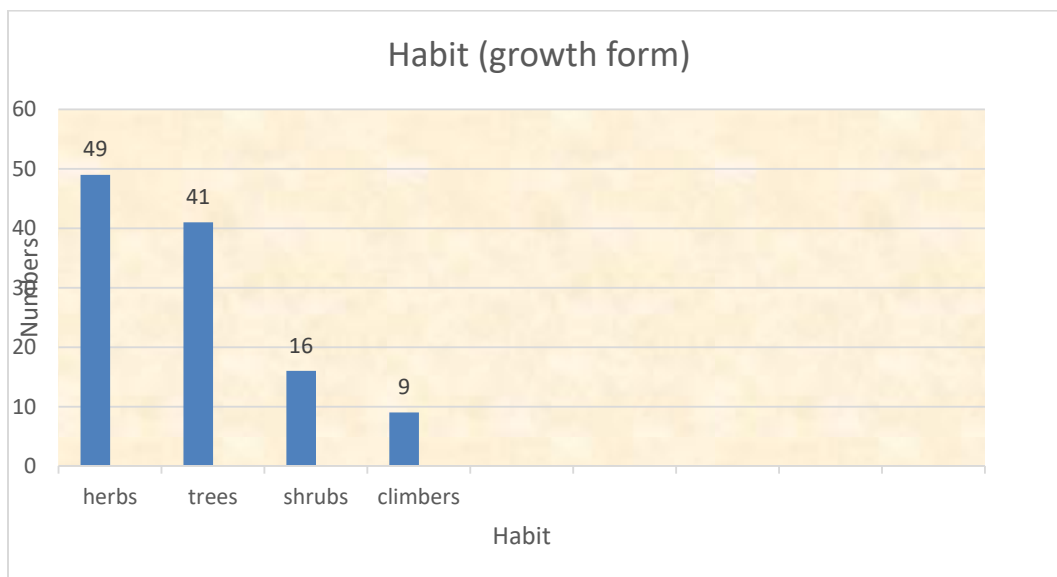


Fig. 6: Growth form (habit) of medicinal plants in the study area

4.2. Plant parts used

Different plant parts are used medicinally by the community. The majority of plant parts utilized by the local communities were leaves 47 (46.07%), followed by roots 27 (26.47%) were used. Traditional medicine was also prepared from various plant parts, such as seeds 11 (10.78%), barks 10 (9.80%), leaves and stems 6 (5.88%), stems 3 (2.94%), and other components (Table 2).

This finding indicated that the most often utilized plant part in the formulation of treatments is the leaf and the fact that leaves don't harm the original plant and are simple to prepare and gather accounts for their widespread use in medicine. The plant as a whole is lost when the roots are harvested since the physiological processes cease. This conclusion is consistent with the findings of other ethnomedical studies conducted by Asmera Amde (2017), Tibebu Tefera and Mesele Yihun (2018), Abeba Kassa (2020), Fisseha Mesfin *et al.* (2014), and Asmera Mesfin *et al.* (2014), which found that leaves were the most often, cited plant portion utilized in remedy compositions. However, studies by Yayesh Limenih *et al.* (2015), Tebkew Mekuanent *et al.* (2015), and Mirutse Giday (2007) demonstrated that the root was a commonly used portion.

Table 2: Plant parts used in preparation of remedies

<i>Plant part</i>	<i>Frequency</i>	<i>Percentage (%)</i>
Leaves	47	46.07
Root	27	26.47
Seeds	11	10.78
Bark	10	9.80
Leaf and stem	6	5.88
Fruit	3	2.94
Stems	3	2.94
Flowers	2	1.96
Whole plant	2	1.96
Leaf and bark	1	0.98
Leaf and bulb	1	0.98
Leaf and root	1	0.98
Rhizome	1	0.98
Root and stem	1	0.98
Sap	1	0.98

4.3. Methods of preparation

In terms of preparing traditional medicine, the residents use a variety of techniques to prepare traditional medicines for a range of illnesses. The preparations differ according to the disease type being treated as well as the location of the illness. This study's findings showed that pounding 47 (46.07%), concoction 27 (26.47%), pounding and squeezing 12 (11.76), and others in Table 3, are the methods most frequently used to prepare ethnomedicinal plants.

In order to provide immediate medical care for illnesses and aid in recovery, the majority of the population uses the pounding method to extract the plant part's bioactive components. Pounding was the most frequently used method of traditional medicine preparation in the study area as ranked by healers (Table 2). According to the local healers, pounding as a strategy permit to preserve the plant materials that are not available both in dry and rainy seasons. It was also cited

that it was effective for the complete extraction of the potential content of the plant and increase the curative power of the medicine or its efficacy, it increases the healing power of the remedy through faster physiological reaction. After preparation the remedies are either used soon or preserved for latter use.

A single plant part of various organs of the same plant or a combination of organs from different plants in the research region is used in the preparation of some treatments, while the majority of the remedies were made utilizing different plant parts of the same or different plants. This outcome is consistent with the findings of Yimam *et al.* (2022), who found that the most common method of medicine preparation was pounding.

Table 3: Types of preparation for remedy

<i>Type of preparation</i>	<i>Number of plant parts</i>	<i>Percentage (%)</i>
Pounding	47	46.07
Concocting	27	26.47
Pounding and squeezing	12	11.76
Cutting and tying	3	2.94
Chewing and sucking	3	2.94
Poundings and crashing	3	2.94
Boiling	2	1.96
Roasting and powdering	1	0.98
Powdering and drying	1	0.98
Direct feeding	1	0.98

4.4. Solvents and additives

Local people add several other things to their traditional medicinal preparations. These include water (57.88%), butter (26.49%), coffee (30.41%), and a local drink or “Bordde” (21.58%) (Table.4), the results suggest that water has the highest proportion of additives or solvents used in the formulation of medicines. According to the locals, certain chemicals are utilized to enhance flavor and lessen side effects like vomiting and diarrhea, which increases the effectiveness of traditional medicine. Such additions were also reported by a few earlier investigations (Bayafers Tamene, 2000; Eskedar Abebe, 2011; and Abeba Kassa, 2020).

Table 4: Solvents and Additives used in medicinal preparation

<i>Additives</i>	<i>Frequency of informants</i>	<i>Percentage (%)</i>
Water	57	55.88
Coffee	30	29.41
Butter	26	25.49
'Bordde' (local drink)	21	20.58
Total	134	131.36

4.5. Route of administration

In terms of administration method, oral administration account 87 (85.29%), dermal administration account 8 (7.84%) and others were shown to be the most popular routes of administration (Fig. 7). This may be because oral pathways allow for the preparation of medicines, a quick response to the physiology of disease-causing microbes, and a chance for the sick to recover from their ailment. The existence of widely dispersed internal disorders in the research area is the other factor. This result is consistent with some earlier studies, which found that the most popular mode of administration was oral. These studies included Mirtuse Giday (2007), Kalayu Mesifn *et al.* (2013), Tamru Temam and Asalfew Dillo (2016), and Tibebe Tefera and Mesele Yihun (2018).

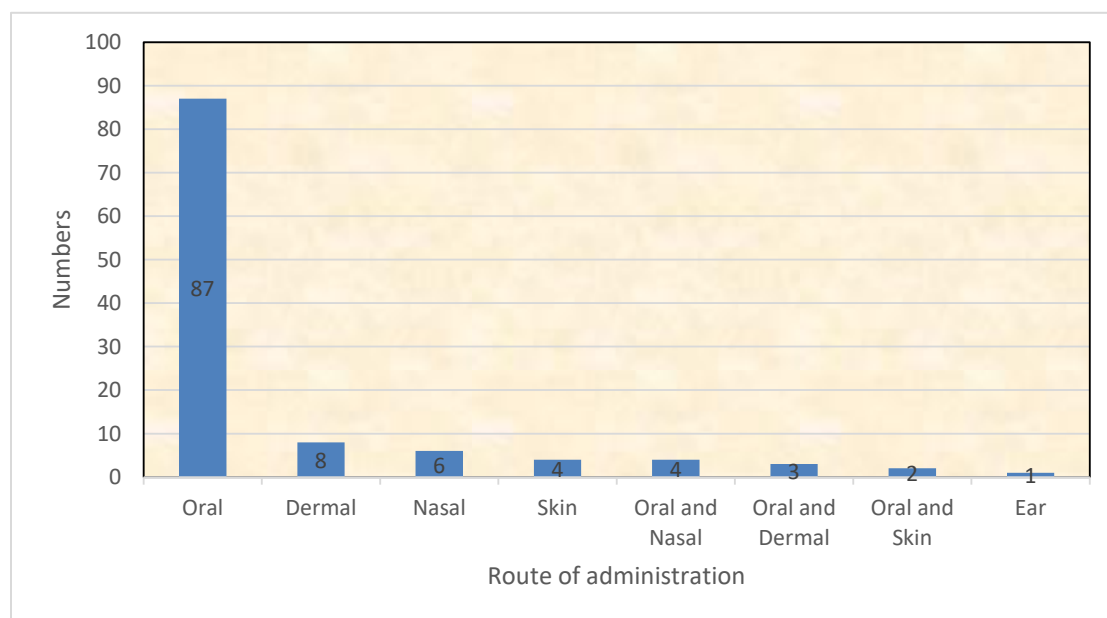


Fig. 7: Route of administration of medicinal plants in the study area

4.6. Dosage administered and unit of measurement

The dose of prepared medicinal plants determines how well they heal specific human or livestock ailments. The responses of the informants indicated that traditional healers used different dosages of plant remedies to address the same medical conditions. The usual dosage measuring units of teaspoon (Mook'iyaa), one hand, coffee cup (Siniyaa), and water cup (S'aasaa) and jug (Jookkiyaa) were frequently utilized while prescribing the plant medicines in the study area. Nonetheless, several prepared medicinal plants were estimated rather than quantified using the proper measuring tools. Approximately 58 (56.86%) of the informants stated that children and weak people receive lower dosages than adults do. On the other hand, the dosages are not established using standardized measurements. Healers give different amounts of medication depending on the location or the individual healer; there is no set dosage like in modern medicine. Most of the time, the patient's dosage is provided without tight guidelines, and the measurements are imprecise and rough (Debela Hunde *et al.*, 2006).

The majority of interviewees (50.98%) stated that there are no obvious negative effects on patients from the medications they prepare and provide to address various health issues. However, some of the informants 28 (27.45%) did report experiencing noticeable side effects, which are common when using medicinal plants to treat hepatitis, tapeworm, evil eye, and abdominal pain, gonorrhoea, and snake bites. These side effects include vomiting, nausea, severe headaches, diarrhea, gastric burning, wounded skin, loss of weight, and temporary unconsciousness. Additionally, therapeutic plants that are toxic to humans and have apparent negative side effects, including vomiting and diarrhea, are not offered to pregnant women. This result was in line with findings from prior research conducted by Abeba Kassa (2020), Giday *et al.* (2010), and Haile Yineger and Delenesew Yewlehaw (2007).

4.7. Medicinal plants used to treat both human and livestock diseases

Ninety-one species of medicinal plants were gathered in the research area. Of these, it was observed that 75 plant species (56.81%) exclusively treated human diseases, 40 species (30.30%)

only treated livestock ailments, and 17 species (12.87%) treated both human and livestock diseases (Appendix 1). This finding confirmed that, in the study area, the local people treat human illnesses with greater attention and traditional knowledge than they do livestock ailments, from other ethnobotanical studies carried out in Ethiopia (Assegid Assefa and Tesfaye Abebe, 2014; Mekuanent *et al.*, 2015; Asmera Amde, 2017 and Abeba Kassa, 2020) reported similar outcomes.

4.7.1. Medicinal plant species used to treat human diseases

Seventy-five species of medicinal plants were gathered in the study area and used to treat human diseases (Appendix 1); they are grouped in to 68 genera and 37 families. Out of these 75 species of medicinal plants nine species were found in the family Asteraceae, followed by eight in the Lamiaceae, seven in the Fabaceae, five in the Poaceae, and so on (Table 5). In the study, the Asteraceae family is the most commonly used to cure human ailments. This outcome is consistent with study by Zewude Kassa (2009), which demonstrated the importance of the Asteraceae family in the treatment of human illnesses. However, studies by Eskedar Abebe (2011), Gonfa *et al.* (2020), and Abebe Ayele (2022) reported on the supremacy of the family Asteraceae for the treatment of human ailments.

Table 5: Families of medicinal plant species used to treat human diseases

No	Families	Number of genera	% Of genera	Number of plant species	% Of plant species
1	Asteraceae	7	10.29	9	12
2	Lamiaceae	7	10.29	8	10.66
3	Fabaceae	7	10.29	7	9.33
4	Poaceae	5	7.35	5	6.66
5	Solanaceae	2	2.94	3	4
6	Euphorbiaceae	2	2.94	3	4
7	Rubiaceae	3	4.41	3	4
8	Amaranthaceae	2	2.94	2	2.66
9	Brassicaceae	2	2.94	2	2.66
10	Rutaceae	2	2.94	2	2.66

11	Acanthaceae	2	2.94	2	2.66
12	Moraceae	1	1.47	2	2.66
13	Anacardiaceae	2	2.94	2	2.66
14	Polygonaceae	1	1.47	2	2.66
15	Ericaceae	1	1.47	1	1.33
16	Alliaceae	1	1.47	1	1.33
17	Asparagaceae	1	1.47	1	1.33
18	Melianthaceae	1	1.47	1	1.33
19	Boraginaceae	1	1.47	1	1.33
20	Apiaceae	1	1.47	1	1.33
21	Convolvulaceae	1	1.47	1	1.33
22	Cyperaceae	1	1.47	1	1.33
23	Agavaceae	1	1.47	1	1.33
24	Myrtaceae	1	1.47	1	1.33
25	Urticaceae	1	1.47	1	1.33
26	Thymelaceae	1	1.47	1	1.33
27	Rosaceae	1	1.47	1	1.33
28	Capparidaceae	1	1.47	1	1.33
29	Myrsinaceae	1	1.47	1	1.33
30	Moringaceae	1	1.47	1	1.33
31	Lauraceae	1	1.47	1	1.33
32	Phytolaccaceae	1	1.47	1	1.33
33	Piperaceae	1	1.47	1	1.33
34	Pittosporaceae	1	1.47	1	1.33
35	Araliaceae	1	1.47	1	1.33
36	Malraceae	1	1.47	1	1.33
37	Verbenaceae	1	1.47	1	1.33
	Total	68	100	75	100

4.7.2. Medicinal plant species used to treat livestock ailments

Forty species of medicinal plants are utilized to treat livestock ailments in the study area (Appendix 1); they are grouped into 25 families and 37 genera. Six species made up the family Asteraceae; four species each made up Poaceae and Fabaceae; two species each made up Euphorbiaceae, Moraceae, and Rubiaceae; and one species each made up the remaining families (Table 6). This finding indicated that, in comparison to human disorders, fewer species of medicinal plants are utilized locally by the people to make cures for livestock ailments. In addition, compared to human diseases in the study area, animal diseases are less commonly known and treated by the locals. The vast majority of these therapeutic plants are harvested from natural vegetation. This outcome was consistent with Behailu Etana (2010) research, which collected most medicinal plants from their natural habitat.

Table 6: Families of medicinal plant species used to treat livestock ailments.

Families	Number of genera	% of genera	Number of species	% of species
Asteraceae	5	13.51	6	15
Poaceae	4	10.81	4	10
Fabaceae	4	10.81	4	10
Euphorbiaceae	1	2.70	2	5
Myrtaceae	2	5.40	2	5
Moraceae	1	2.70	2	5
Rubiaceae	2	5.40	2	5
Anonaceae	1	2.70	1	2.5
Asparagaceae	1	2.70	1	2.5
Brassicaceae	1	2.70	1	2.5
Boraginaceae	1	2.70	1	2.5
Cyperaceae	1	2.70	1	2.5
Agavaceae	1	2.70	1	2.5
Musaceae	1	2.70	1	2.5
Urticaceae	1	2.70	1	2.5
Tiliaceae	1	2.70	1	2.5

Cuperssaceae	1	2.70	1	2.5
Acanthaceae	1	2.70	1	2.5
Myrsinaceae	1	2.70	1	2.5
Cucurbitaceae	1	2.70	1	2.5
Solanaceae	1	2.70	1	2.5
Phytolacaceae	1	2.70	1	2.5
Piperaceae	1	2.70	1	2.5
Polygonaceae	1	2.70	1	2.5
Malraceae	1	2.70	1	2.5
Total	37	100	40	100

4.7.3 Medicinal plant species used to treat both human and livestock ailments

Seventeen species of medicinal plants were used to treat diseases in both humans and livestock (Appendix 1). They are grouped in to 13 families and 17 genera. Three species made up the Poaceae family; two species each made up the Asteraceae and Fabaceae families; and one species each made up the remaining families (Table 7). These therapeutic herbs are mostly found in the wild. This finding is consistent with Behailu Etana (2010) research, which found that most therapeutic plants were gathered from natural flora.

Table 7: Families of medicinal plant species used to treat human and livestock ailments.

Families	Number of genera	% of genera	Number of species	% of species
Poaceae	3	17.64	3	17.64
Asteraceae	2	11.76	2	11.76
Fabaceae	2	11.76	2	11.76
Acanthaceae	1	5.88	1	5.88
Asparagaceae	1	5.88	1	5.88
Boraginaceae	1	5.88	1	5.88
Brassicaceae	1	5.88	1	5.88
Moraceae	1	5.88	1	5.88

Myrtaceae	1	5.88	1	5.88
Phytolacaceae	1	5.88	1	5.88
Piperaceae	1	5.88	1	5.88
Polygonaceae	1	5.88	1	5.88
Rubiaceae	1	5.88	1	5.88
Total	17	100	17	100

4.8. Major human diseases and the corresponding plant species used to treat them

A total of 19 human diseases were recorded in the study region that were reportedly treated by 75 plant species (58 plant species that exclusively treated human diseases, and 17 plant species that cured both human and livestock ailments) (Appendix 2). Informants have reported that sixteen plant species are known to be effective in treating abdominal pain; ten species have been shown to be effective in treating snake bites; nine species have been shown to be effective in treating hepatitis; six species have been found to be effective in treating stomachaches; five species in treating wounds and chills; four species in treating evil eyes and headaches; three species in treating epilepsy and ascariasis; and two species in treating insect bites, tapeworms, and lymph adenitis. One-to-one medicinal herbs are used to cure the remaining illnesses.

Indigenous knowledge of medical plants that treat multiple ailments may be more broadly accepted than that of medicinal plants that treat a single illness. This is a result of the possibility that various people would acquire indigenous knowledge and learn how to employ a specific medicinal plant to treat at least one common human condition. Locals can easily treat human ailments that are handled by multiple plant species. Mengistu Gebrehiwot (2010), Nuria Abdurhman (2010), and Asmera Amde (2017), for instance, claimed that 62 plant species had the ability to heal 53 human diseases, 55 plant species had the ability to treat 82 human diseases, and 44 plant species had the ability to treat 50 human diseases in prior ethnobotanical studies respectively.

4.9. Major livestock ailments and the corresponding plant species used to treat them

This study found that 40 plant species (23 of which only treated livestock ailments; the remaining 17 species treated both human and livestock problems) were used to treat 15 different livestock ailments (Appendix 2). Similar to human disorders, several medicinal plants can heal different problems in livestock, and one medicinal plant can treat multiple ailments in livestock. Seven species of medicinal plants were used to treat hepatitis; five species were used to treat bloating; five species were used to treat snake bites; four species each were used to treat diarrhea and epilepsy (Listeriosis); three species were used to treat abdominal pain; two species each were used to treat blackleg, constipation, and leech expulsion; and one species was used to treat all other diseases.

There are fewer medicinal plants used to treat disorders in animals than there are for treating illnesses in humans. This may be the result of the residents prioritizing their own illnesses over animal illnesses and relying only on therapeutic herbs to identify illnesses in livestock based simply on symptoms. Furthermore, compared to human diseases, the respondents' understanding of treating animal diseases is also lacking. In light of this, related ideas have also been reported in other parts of Ethiopia by Endalew Amenu (2007), Mengistu Gebrehiwot (2010), Nuria Abdurhman (2010), and Asmera Amde (2017), and who reported 34 livestock problems treated by 27 medicinal plants, 17 livestock problems treated by 14 medicinal plants, and 14 livestock problems treated by 16 medicinal plants, and 13 livestock problems treated by 3 medicinal plants respectively.

4.10. Transfer of medicinal plants knowledge

The study area's traditional knowledge of medicinal plants is still employed by the locals in their latter years, and this information is becoming less prevalent as older, informed community members pass away. According to the majority of respondents, contemporary medicine, the loss of traditional knowledge about medicinal plants in the research area was attributed to contemporary education, religious beliefs, and modernization; rapid changes in people's way of life. The fact that elderly traditional healers in the research area kept their information to

themselves was a significant issue. This is because they believed that knowing about medicinal plants was a method to make money, and that sharing the knowledge would lessen the plant remedy's ability to heal (Bitew *et al.*, 2022). Furthermore, it was reported locally that "Kaayaa" and "Shareechuwa" were traditional healers. They were also referred to as "leaf collectors," or "Maataa mas'uwaa."

From the study it was found that the primary sources of traditional knowledge transfer about the use of medicinal plants were family members (31.42%), elder sons (25.71%), trusted sons (14.28%), relatives (20%), and friends (8.57%), with the majority of the information being passed down orally (Table 8). Future generations will no longer be able to learn about the various traditional uses of medicinal plants in the study region due to this oral information transfer without documenting. The majority of respondents share what they know with their relatives. This indicates that the majority of traditional knowledge about medicinal plants is inherited through families. The firstborn children of a household are primarily responsible for maintaining histories. Fewer people share with lovely, trustworthy neighbors and other people who are related by blood. Intimate key informants also frequently exchange information and share their knowledge (Bitew *et al.*, 2022).

Table 8 :Transfer of medicinal plant knowledge

<i>Medicinal knowledge transfer</i>	<i>Number of key informants</i>	<i>Percent (%)</i>
Family members	11	31.42
Elder son	9	25.71
Trusted sons	5	14.28
Relatives	7	20
Friends	3	8.57
Total	35	99.98

4.11. Importance of medicinal plants in the study area

4.11.1. Informant consensus

The study's findings demonstrated that not all informants had the same level of familiarity with medicinal plants. There are more well-known therapeutic plants than others. This could be because the ailment that needs to be treated is more common, the medicinal plant is beneficial, or both. Among medicinal plants in the research region, *Ruta chalepensis* was the most commonly cited by the informants 54 (53%). It was commonly used to treat evil eye and abdominal pain, while *Echinops kebericho* 49 (48%) was used as a snake repellent and to treat headaches. Based on the number of informants cited, *Croton macrostachyus*, *Clerodendrum myricoides*, and *Indigofera arrecta* were ranked third, fourth, and fifth, respectively. As a result, the rating percentages for additional widely used medicinal plants that informants indicated are provided below (Table 9). *Ruta chalepensis* also gained popularity, according to a study done in the Debre Libanos district of Central Ethiopia in 2014 by Seyoum Getaneh and Zerihun Girma.

Table 9: Lists of medicinal plant species cited by more than 8 of informants

Medicinal plant species	Local name	Informants citing (#)	%
<i>Ruta chalepensis</i>	S'alotiyaa	54	53
<i>Echinops kebericho</i>	Burssaa	49	48
<i>Croton macrostachyus</i>	Ankkaa	46	45
<i>Clerodendrum myricoides</i>	Alggaa	41	40
<i>Indigofera arrecta</i>	Wusiwussiyaa	40	39
<i>Erythrina brucci</i>	Borttuwaa	36	35
<i>Tragia cinerea</i>	Kinkkilishuwaa	26	25
<i>Ficus vasta</i>	Esaa/Wolaa	22	22
<i>Carduus chamaecephalus</i>	Kashiyaa	22	22
<i>Maesa lanceolata</i>	Geggec'uwaa	22	22
<i>Phytolacca dodecandra</i>	Hanc'c'iic'aa	22	22
<i>Premna schimperiana</i>	C'awulaa	22	22
<i>Syzygium guineense</i>	Ochchaa	20	20
<i>Girardinia diversifolia</i>	Konaa	15	15
<i>Sida schimperiana</i>	Kinddichchuwaa	15	15
<i>Piper capense</i>	Tunjjaa	12	12
<i>Salvia nilotica</i>	Sa'a okataa	10	10
<i>Cynodon spp.</i>	Suraa maataa	8	8

4.11.2. Informant consensus factor (ICF)

The disease categories with the highest ICF values were headache, diarrhea, and evil eye (0.85), followed by abdominal pain (0.83). The ICF value for hepatitis was comparatively low (0.46) (Table 10). When it came to the usage of certain human medicinal plant species for treating specific diseases, informants' agreement was strongest when it came to the highest determined ICF values. In a similar vein, research carried out in the Goma District, Jima Zone, Oromia Region by Behailu Etana (2010) revealed that the evil eye has the highest ICF value among the other disease categories. Heinrich *et al.* (1998) state that while looking for bioactive chemicals in plants, high ICF values are crucial for identifying species of interest.

Table 10: ICF for the given diseases category

Category of diseases	Species (nt)	Use citation (nur)	ICF
Abdominal pain	14	82	0.83
Snake bite or seeing	10	38	0.75
Hepatitis	9	16	0.46
Bloating and Stomachache	8	40	0.82
Wounds and Chills	8	46	0.80
Diarrhea, Headache and Evil eye	4	22	0.85
Epilepsy/Listeriosis and Ascariasis	4	16	0.80
Blackleg, Constipation, Leech expel, Lymph adenitis, Tapeworm and Insect bite	3	10	0.77

4.11.3. Preference ranking

Based on how traditional healers often treat abdominal pain, a preference ranking of the eight most significant medicinal plants were carried out in accordance with Martin (1995).

Table 11: Preference ranking of medicinal plants used to treat abdominal pain

Medicinal plants	Respondents (R)						Total	Rank
	R1	R2	R3	R4	R5	R6		
<i>Ruta chalepensis</i>	8	8	8	8	8	8	48	1 st
<i>Lepidium sativum</i>	7	7	7	7	7	7	42	2 nd
<i>Indigofera arrecta</i>	6	6	6	6	6	6	36	3 rd
<i>Premna schimperiana</i>	5	5	5	5	5	5	30	4 th
<i>Piper capense</i>	4	4	4	4	4	4	24	5 th
<i>Verbena officinalis</i>	3	3	3	3	3	3	18	6 th
<i>Vernonia urticifolia</i>	2	2	2	2	2	2	12	7 th
<i>Brassica nigra</i>	1	1	1	1	1	1	6	8 th

According to the above analysis: *Ruta chalepensis*, *Lepidium sativum* and *Indigofera arrecta* were ranked first, second and third respectively based on its degree of treating abdominal pain. *Brassica nigra* and *Vernonia urticifolia* medicinal plants were used for abdominal pain treatment purpose however least preferred (Table 11). *Indigofera arrecta* widely available in the the study area, so residents have been using this plant for treating abdominal pain.

4.11.4. Paired comparison

The efficacy and popularity of six species of medicinal plants used to cure hepatitis were evaluated by paired comparisons (Martin, 1995). Six key informants were selected at random and given the opportunity to express their opinions on six traditional medicinal herbs that are known to treat hepatitis separately. A list of all possible pairings of chosen items was created, and before each pair was given to a chosen informant, the order within each pair was randomly chosen. The informants' responses were then recorded, the total value was summed, and a ranking was determined based on their reports.

Table 12: Paired comparison of medicinal plants used to treat hepatitis illness

Medicinal plant	Respondents (R)						Total	Rank
	R1	R2	R3	R4	R5	R6		
<i>Phytolacca dodecandra</i>	5	5	5	5	5	5	30	1 st
<i>Asparagus officinales</i>	4	3	4	4	3	4	22	2 nd
<i>Milletia ferruginea</i>	2	3	2	2	4	3	16	3 rd
<i>Cordia Africana</i>	3	3	2	1	0	0	9	4 th
<i>Rumex abyssnicus</i>	1	0	1	3	1	2	8	5 th
<i>Schifleria abyssinica</i>	0	1	1	0	2	1	5	6 th

The above analysis shows that *Phytolacca dodecandra* ranked first followed by *Asparagus officinales* while *Schifleria abyssinica* is the least preferred over the other plant species cited in treating hepatitis (Table 12).

4.11.5. Direct matrix ranking

The result showed that *Croton macrostachyus*, *Premna schimperiana*, and *Eucalyptus globules* were ranked first, second, and third, respectively. *Cordia africana*, *Persea amercana*, and *Hagenia abyssinica* were medicinal plants that were less used for those stated use categories (Table 13). *Croton macrostachyus* was available in the forest and home gardens in the study area. The plant easily burns for firewood, is good for furniture making, construction, and fencing, and is so preferred and widely used in the study area. The result agrees with the work of Mesfin *et al.* (2009) in Wonago Woreda, SNNPR, and Ethiopia, which indicates that *Croton macrostachyus* is the most widely used multipurpose medicinal plant.

Table 13: Direct matrix ranking of medicinal plants with different uses

Medicinal plant					
<i>Cordia</i>	<i>Croton</i>	<i>Eucalyptus</i>	<i>Hagenia</i>	<i>Persea</i>	<i>Premna</i>
<i>Africana</i>	<i>macrostachyus</i>	<i>globules</i>	<i>abyssinica</i>	<i>amercana</i>	<i>schimperiana</i>

Respondents	R1	R2	R3	R4	R5	R6
Uses						
Med.	5	5	5	5	5	5
Food	0	0	0	0	6	4
Fen.	2	4	3	2	2	3
Fur.	6	5	2	5	0	1
F.W.	4	5	4	3	2	5
Char.	0	2	0	0	0	0
Cons.	0	4	6	4	0	3
Fod.	1	0	0	0	4	0
Total	18	25	20	19	19	23
Rank	6 th	1 st	3 rd	4 th	4 th	2 nd

Key: R= respondent; Med. = medicinal, F.W= firewood, Fod. =fodder, Char. = charcoal,

Cons. =construction, Fen. =fencing, Fur. =furniture

4.11.6. Fidelity level index (FLI)

Fidelity level value of some selected medicinal plants is shown in Table 14 below.

Table 14: Fidelity level index for some plant species

Disease	Plant species	Percent of Informants	Np	N	FL (Np/N)	FL (%)
Evil eye	<i>Ruta chalepensis</i>	59	41	60	0.68	68
	<i>Artemisia afra</i>	46	26	47	0.55	55
Hepatitis	<i>Asparagus officinales</i>	69	16	70	0.22	23
	<i>Justicia schimperiana</i>	63	10	64	0.15	16
	<i>Phytolacca dodecandra</i>	69	28	70	0.40	40

The percentage of informants who stated that a certain plant species was used for the same main reasons cannot be used as the sole criterion to demonstrate a plant species' efficacy. Moreover, the fidelity level index might be computed to determine the species' medicinal use values.

Higher FL values are found in medicinal plants that are commonly utilized by the community to cure one or a small number of diseases than in less common ones (Tilahun Teklehaymanot and Mirutse Giday, 2007). Several informants in this investigation reported using *Phytolacca dodecandra* and *Ruta chalepensis* to treat hepatitis and evil eye, respectively (Table 14). Therefore, in FL analysis, informant consensus could not be used as a measure for the possible effectiveness of medicinal plant species. *Asparagus officinales*, for instance, is stated by 69% of informants to be the second species, after *Phytolacca dodecandra* (0.40), and is used to cure hepatitis.

4. 11.7. Jaccard`s coefficient of similarity (JCS)

To determine how similar the species compositions of the study area with other studies conducted in different parts of Ethiopia, it was calculated between the research areas and other locations that other authors in different parts of the nation had studied. JCS was determined using the formula below (Kent and Coker, 1992).

$$JCS = c/a+b+c \text{ -----} (4)$$

Where, JCS = Jaccard`s Coefficient of Similarity,

A = Number of species which is found only in habitat woreda A

B = Number of species found only in habitat woreda B and

C = Number of common species found in habitat woredas A and B,

Accordingly, A = Number of species found only in Kechi woreda

B = Number of species found only in other woreda and

C = Number of species found in Kechi woreda and other woreda

Table 15: Jaccard's coefficient of similarity of Kechi Woreda with other studies,

Sample area	A	B	C	JCS= c/a+b+c	JCS %	Sources
Kechi Woreda	91	-	-	-	-	
Sedie Muja Woreda	60	57	31	0.20	20	Abeba kassa, 2020
Seru Woreda	55	88	36	0.20	20	Mengistu Gebrehiwot, 2010
Jeldu Woreda	40	152	51	0.20	20	Zewdie kassa, 2009
Debark Woreda	66	73	24	0.14	14	Eskedar Abebe, 2011
Berber District	76	54	15	0.10	10	Tilahun Tolossa & Moa Megersa, 2018
Hawassa Zuria District	66	80	25	0.14	14	Banchiamlak Nigussie & Young Dong, 2019

The study area has the highest level of similarity (20%) with 51 common species with the study conducted around Jeldu Woreda, followed by 36 common species (20%) with Seru Woreda, 31 common species (20%) with Sedie Muja Woreda, 25 common species (14%) with Hawassa Zuria District, and 24 common species (14%) with Debark Woreda, according to Jaccard's Coefficient of Similarity (JCS). The study done on the Berbere District was the one with the least amount of similarities (Table 15).

4.12. Market survey of medicinal plants of the study area

In order to gather information on the marketability of medicinal plant species and other pertinent details, a market survey was conducted in the Boka Tuesday market for two consecutive weeks of the study area. Although some sellers sell some medicinal plants in the market, the study found that there is no publicly recognized commerce in medicinal plants in the study area. Plant species such as *Echinops kebericho*, *Lannea fruticose*, *Maerua oblongifolia*, *Piper capense*, and *Premna schimperiana* can be found growing in home gardens and sold. Many community members contact traditional healers at their homes, because the cost of these remedies is lower than that of modern medications. Some are sold for their cooking, medicinal, spice, and fragrant qualities (Table 16).

Table 16: Lists of medicinal plants sold in Boka Tuesday market for different purposes

Medicinal plant species	Local name (Dawregna)	Used for
<i>Allium sativum</i>	Tuummuwaa	Medicinal and Spice
<i>Amaranthus caudatus</i>	Gaggabba ayfiya	Medicinal and Spice
<i>Artemisia afra</i>	Aguppiya	Spice or Aromatic
<i>Brassica nigra</i>	Sannafic'c'iyaa	Medicinal and Food
<i>Brassica oleracea</i>	Santsayfiyaa	Food
<i>Citrus aurantifolia</i>	Loomiyaa	Medicinal and Aromatic
<i>Coffea Arabica</i>	Bunaa	Stimulant
<i>Echinops kebericho</i>	Burssaa	Medicinal
<i>Elettaria cardamomum</i>	Okashiyaa	Spice
<i>Lannea fruticose</i>	Dechimarac'c'iyaa	Medicinal
<i>Lepidium sativum</i>	Shippaa/Sibikkaa	Medicina and spice
<i>Maerua oblongifolia</i>	Sangganna	Medicinal
<i>Piper capense</i>	Tunjja	Medicinal
<i>Premna schimperiana</i>	C'awulaa	Medicinal
<i>Zingiber officinale</i>	Yenjeeluwaa	Spice

4.13. Taboo's associated with medicinal plant uses

The respondents of the study area informed that, medicinal plant practitioners of the study area were followed taboos related to the use of medicinal plants, such as only harvesting medicinal plants on Wednesdays, Fridays, and Sundays and giving these plants to patients on those days. On the other hand, patients are unable to use or consume the medication during the remaining days when the therapeutic plants cannot be harvested, because diseases cannot be cured by plant medication. When gathering plant materials from the wild or home garden, herbalists are unable to interact with humans. The collector is not allowed to wash their hands or face before gathering the medicinal herb. Males are more often able to gather the therapeutic plants. They may also take money in order to collect.

In the preparation of a single remedy, plant parts are mostly taken from individuals of the same species growing in three or seven different places. One healer said that this increases its remedial

effectiveness. This could be a way of balancing the amount of phytochemical and pharmacological constituents based on habitat variation. It was mentioned that sexual intercourse is forbidden for healers and patients alike during any medicinal plant collection, preparation and application. These are all related, and healers can accept that none of these conditions can be cured by plant medicine (Chekole *et al.*, 2015).

4.14. Antidotes used to avoid side effects of medicinal plants

The practitioners of study area employ some local preparations as antidotes, such as Milk (Yoghurt, Buttermilk), Local drinks (Borddiya woy Geeshuwa parssuwa), honey (Degeriya eessaa); and hydromel. When a medicinal plant's potency is strong and it cannot adequately treat a patient's ailment, antidotes are applied. But if great caution is not exercised, there is a good probability that the patient would suffer from the adverse effects of the medicinal plant being used. This situation is evident even in contemporary medical care services. In addition, standard treatment guidelines for multistage treatment services have already been established by the Food, Medicine, and Health Care Administration and Control Authority (EFMHACA) of Ethiopia at various levels of health facilities (health centers, primary hospitals, and general hospitals) (EFMHACA, 2014). Nevertheless, despite playing a crucial role in primary healthcare services, traditional treatment approaches have several shortcomings.

4.15. Portion of the community uses medicinal plants

The study's findings indicate that residents of rural communities are more adept at using plant medicine than residents of towns or villages (Table 17). There are not enough modern health facilities, lack of money, and lack of transportation to get to the health facilities, and some diseases like hepatitis, epilepsy, snake bites, and evil eye have small chances would be treated with modern medicine. In other way there is a wealth of plant diversity that can be used to treat a variety of diseases, indigenous plant knowledge that is passed down from generation to generation orally, plant medicine can treat illnesses quickly and at home, were the reasons that residents of rural communities more adept at using plant medicine.

Table 17: Part of the community member use medicinal plant more largely

Community members	Respondets										Total	Rank
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10		
Rural community	5	5	5	4	5	5	4	5	5	5	48	1 st
Urban community	-	-	-	-	-	-	-	-	-	-	-	-
Both	3	2	1	1	2	3	2	1	2	1	18	2 nd

4.16. Sources and status of using medicinal plants in the study area

Medicinal plants are one of the many different kinds of beneficial plants that can be found in the wild, according to Tesfaye Awas and Sebsebe Demissew (2009). The research conducted by Etana Tolassa and Fisseha Mesfin (2007) also revealed that some medicinal plants were taken from home gardens in the study areas, but the bulk of the plants were collected from the wild, accounting for 72.94% and 61.1%, respectively. Similarly, Mirutse Giday and Gobena Ameni (2003) found that very few people in the two Woredas of Southern Tigray cultivate plants in or around their home gardens for medical purposes. This showed that, despite the fact that numerous plants are grown for various purposes, mostly food, very few plants are cultivated in home gardens across the majority of the nation for therapeutic purposes. Similar to this, people in the study region pick medicinal plants from nearby or distant locations rather than making the effort to produce them in their own backyard gardens. Certain therapeutic plants are no longer present in the same locations as they did ten or twenty years ago, according to informants. Some traditional professional healers began cultivating plants including *Hagenia abyssinica*, *Nicotiana tabacum*, *Lepidium sativum*, *Echinops kebericho*, *Ruta chalepensis*, *Piper capense*, *Allium sativum*, and *Artemisia afra* due to the lack of medicinal plants.

4.17. Threats and conservation of medicinal plants in the study area

4.17.1. Threats to medicinal plants in the study area

Medicinal plants of the study area were impacted by anthropogenic causes. The main reasons that pose a threat are overgrazing, construction, firewood harvesting, tree-cutting, charcoal production, and agricultural expansion. Seven informants were chosen to rate these factors based on the degree of damage they pose. Six points were assigned to the most dangerous factor, and one point was given to the least dangerous. Thus, with a score of 39, agricultural expansion was the most dangerous element, followed by the gathering of firewood with a score of 35 and others in table 18 as follows.

Table 18: The ranking of threatening factors of medicinal plants in the study area

Threatening factors	Respondents							Total	Rank
	R1	R2	R3	R4	R5	R6	R7		
Agricultural expansion	6	4	6	6	6	5	6	39	1 st
Fire wood collection	4	3	5	6	6	5	6	35	2 nd
Charcoal making	5	6	4	4	3	5	6	33	3 rd
As construction materials	5	4	3	6	6	3	4	31	4 th
Drought	2	3	4	5	3	2	1	20	5 th
Over-grazing	3	1	2	5	1	2	3	17	6 th

Like all other regions of the nation, Ethiopia is experiencing a decline in biodiversity due to both natural and man-made reasons. The study area's biodiversity is impacted by human-made variables in a variety of ways (Abebe Demissie, 2001). The loss of taxa, the habitat of medicinal plants, and other categories are the main causes of Ethiopia's traditional medicine's continuity and sustainability issues, as they are throughout Africa (Fisseha Mesfin, 2007).

The analysis's findings demonstrated that risks to medicinal plants, particularly those caused by human activity, have a significant effect on them. Other reports in the nation (Tesfaye Awas, 2004 and Fisseha Mesfin, 2007) revealed similar conclusions. The study also showed that within the study area, threats differ in kind and intensity among different species and locations. For instance, the medicinal plants cultivated close to the town and villages are under severe danger from firewood gatherers, lumber suppliers, and marketers of charcoal, who utilize the plants to generate additional revenue by selling them to city people. It is believed that a number of threatened medicinal plant species, including *Premna schimperiana*, *Milettia ferruginea*, *Cordia africana*, *Maesa lanceolata*, *Acacia abyssinica*, and *Croton macrostachyus*, are on their way. Expanding agriculture poses a danger to the medicinal plants found in the rather densely inhabited study kebeles of Bera Doba and Oda Gofa. Drought poses a danger to the medicinal plants that are grown in the lowland area of the Woreda, where rainfall is irregular and poor. The destruction and conversion of medicinal plant species' habitats for other uses, such as agricultural development, urbanization, cutting for construction, firewood, and charcoal, is regarded as a more dangerous factor in this study than the overharvesting of these species. Some people travel to remote locations, such as the top of a mountain, a hillside, along a river, or valleys, to gather

medicinal plants because of these factors, especially those that grow in the wild and have strong curative or preventive powers (Abebe Demissie, 2001).

4.17.2. Conservation of medicinal plants in the study area

The local farmers use their indigenous knowledge to protect important plant species on their farmlands, in home gardens, and/or in any form of their land ownership as cultivations, traditional agroforestry, or as life fences, even though there is no specific conservation efforts made available to medicinal plants in the study area. Therefore, farmers' native Knowledge is a key component of the process that values ethnobotanically significant plant species and provides protection for medicinal plants. A small number of traditional healers occasionally attempt to grow extremely rare species in their home gardens that are difficult to locate within a suitable area. The difficulty of cultivating species that cannot be propagated outside of their natural habitat and biological range is cited by the healers as the main issue with such conservation trials.

The results of the study indicated that the effort made by the community to conserve medicinal plants is not satisfactory though their importance is obvious especially to the professional traditional healers also some members of the community cultivate different plant species in homegardens and around their vicinities, serving as food, shade, ornamental, wind break, live fence and to some extent for their medicinal purpose.

The field observation and discussion with the informants showed that many of the plants in homegardens or grown near the homegardens were mainly cultivated for other purposes than for their medicinal value especially as a food crop but species like *Ruta chalepensis* and *Ocimum lamiifolium* and are cultivated for their medicinal value. This study is similar with the study of Zemedu Asfaw (1997), which indicated that the plant species, primarily cultivated for medicinal purposes are few, accounting for about 6% of the total crop species grown in home gardens. The results of the study showed that whether the plants are cultivated for their medicinal purpose or other purpose, it has a great contribution to the conservation of medicinal plants and the associated traditional medicinal knowledge.

5. CONCLUSION AND RECOMMENDATION

5.1. Conclusion

Ninety-one plant species of medicinal significance have been identified and documented from the current study area. Of these, it was found that 75 species (56.81%) were used to treat diseases in humans, 40 species (30.30%) were used to treat diseases in livestock and 17 species (12.87%) were used to treat diseases in both humans and animals. Eighty-two (80.39%) of the species of medicinal plants that were gathered and identified were wild. The daily health care system of the study area's residents depends on medicinal plant resources for both themselves and their animals.

There have been reports of traditional medicinal plants in the research region being used to cure a total of 19 human diseases and 15 livestock ailments. Several plant species that are employed as various forms of medicine. It was discovered that most plant species observed in the research area were also used elsewhere in the nation.

The identified medicinal plants were found in various environments throughout the district. Traditional treatments are primarily derived from herbs, with tree and shrub species coming in second. It was also discovered that the most commonly utilized plant parts for making cures for humans and animals were leaves, followed by roots. The preparation of traditional medicine mostly involved various plant forms. As a result, different preparation techniques are used depending on how medicinal plants are used in different forms or portions. The primary mode of administration was internal, with oral being the most prevalent method, followed by cutaneous or external.

The main anthropogenic threats to medicinal plants are agricultural expansion, firewood gathering, overgrazing, charcoal production, building materials, and over-population. Thus, it is reasonable to draw the conclusion that in order to preserve indigenous knowledge and ensure its sustainable use, awareness-raising initiatives should be required to raise awareness among healers and the local community about the value of protecting and managing medicinal plants.

5.2. Recommendations

Following an analysis of the study's outcomes, the following suggestions were made:

- ❖ Encourage the people to cultivate medicinal plants in their homegardens and farmlands.
- ❖ The local people need supports through awareness raising education on the sustainable utilization and management of plant resources.
- ❖ Encourage the local herbal medicine practitioners to enhance the use of traditional medicine through licensing and other incentives.
- ❖ Encourage participation of the local people in conservation activities.
- ❖ We need to promote awareness about the necessity for the conservation of wild habitat and, consequently, in-situ conservation of wild medicinal plants.
- ❖ The local population should receive training on how to see traditional healers with positivity and prioritize the utilization of therapeutic herbs and multipurpose tree species.

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7. APPENDIXES

Appendix 1: List of medicinal plants used to treat human, livestock and both human and livestock diseases in the study area: Scientific name, local name, habit, habitat, disease treated, parts used, and method of preparation and route of administration.

Key: Habit (Ha): (Herb (H); Shrub (S); Tree (T); climber (Cl). Habitat (Hab): (Hg=home garden, W=wild; Bo=both. Parts used (Pu): (Ba=Bark, Bb= Bulb, R=Root, L=Leaf, Sa=Sap, Ft=Fruit, Fr=Flower, Se=Seed, St=Stem; L+St=leaf and stem together, R+St= Root and Stem together; R+Leaf=Root and Leaf together,Se+L=Seed and Leaf together,Whole plant); Bu+L=Bulb and Leaf together, Ba+L=Bark and Leaf together, R+Ba=Root and Bark together. Route of administration (RA): (O-oral, D-dermal, N-nasal, E-ear), DT-disease treated.

Plant species used to treat human diseases

Botanical name	Local name	Family name	Ha	H ab	Pu	Mode of preparation	R A	DT
<i>Abrus precatorius</i>	Badalluwaa	Fabaceae	Cl	W	Se	Concocted, pounded with the leaf of <i>Clerodendrum</i> . & <i>Ruta</i> .	O/ N	Evil eye
<i>Acacia sp.</i>	Odooruwaa	Fabaceae	T	W	Ba	Pounded with the bark of <i>Ficus cycomorus</i> and squeezed	O	Hepatitis
<i>Agarista salicifolia</i>	C'ank'k'uwaa	Ericaceae	T	W	L	Pounded	D	Wound (s'iibbaa)
<i>Albiza schimperiana</i>	C'aattaa	Fabaceae	T	W	L	Pounded	O	Hepatitis
<i>Allium sativum</i>	Tuummuwaa	Alliaceae	H	H g	Bu+ L	Concocted	O	Abdominal pain, chills
<i>Amaranthus</i>	Gaggabbaa	Amaranthaceae	H	H	Se	Roasted and	O	Abdomin

<i>caudatus</i>				g		powdered		al pain
<i>Artemisia absinthium</i>	Naatiruwaa	Asteraceae	H	H g	L	Pounded or chewed	O	Stomachache
<i>Artemisia afra</i>	Aguppiyaa	Asteraceae	H	H g	L	Pounded and mixed with butter or crashed in hands with <i>Ruta chalepensis</i>	O/ N	Abdominal pain Evil eye
<i>Asparagus officinales</i>	C'engгаа	Asparagaceae	H	W	R	Concocted	O	Hepatitis/ Insect bite
<i>Aspilia massambicensis</i>	Kishshuwaa	Asteraceae	S	W	Ft	Crashing and squeezing	Ear	Earache
<i>Bersama abyssinica</i>	Walassooniyaa	Melanthaceae	T	W	L	Pounded and squeezed	N	Ascaris
<i>Brassica nigra</i>	Sannafichiya	Brassicaceae	H	H g	Fr	Concoction	O	Abdominal pain
<i>Carduus chamaecephalus</i>	Kashiyaa (gezziyawa)	Asteraceae	H	W	R	Pounded & mix with water	O	Epilepsy
<i>Citrus aurantifolia</i>	Loomiyaa	Rutaceae	T	H g	Ft	Pick & cut one side for sucking	O	Stomachache Common cold
<i>Clerodendrum myricoides</i>	Alggaa	Lamiaceae	S	B o	R	The root of bark pounded	D	Gland swelling (Gaabaa)
<i>Coffea arabica</i>	Bunaa	Rubiaceae	T	H g	L	Concocted	O	Chills
<i>Cordia africana</i>	Mok'otsaa	Boraginaceae	T	B	L	Concocted,	O	Hepatitis,

				o		Crashed and mixed with water		Repair abortion
<i>Coriandrum sativum</i>	Deebbuwaa	Apiaceae	H	H g	Se	Concocted	O	Diarrhea
<i>Croton macrostachyus</i>	Ankkaa	Euphorbiaceae	T	W	L	Crushed or squeezed with hands	D	Wounds
<i>Cuscuta reflexa</i>	Golo/Haad'apiro	Convolvulaceae	Cl	W	St	Included with the leaf of <i>Insete ventercosum</i>) & boiled in the fire	O	Ascaris (children)
<i>Cyathula cylindrical</i>	Gumppullaa	Amaranthaceae	H	W	L	Crashed and squeezed	D	Wound
<i>Cynodon spp</i>	Suraa	Poaceae	H	W	L+ St	Cut and tied on the neck	S	Snake saw/ Snake bite
<i>Cyperus articulate</i>	Bidaaraa	Cyperaceae	H	H g	R	Concocted	O	Chills/Stomachache
<i>Datura stramonium</i>	Lafilafuwaa	Solanaceae	H	W	L	Crushed or squeezed with hands	D	Wounds
<i>Dicliptera laxata</i>	Toguwaa	Acanthaceae	H	W	L	Pounded and mixed with butter	O	'Ayine tila' (Asayfiya)
<i>Dracaena studeneri</i>	Ilallaa	Agavaceae	T	W	L	Pounded & mix with water	D/ O	Body swelling or snake bite/seen
<i>Echinochloa pyramidalis</i>	Kana-duppa	Poaceae	H	W	St+ L	Pounded & mixed with water	O	Snake bite

<i>Echinops amplexcaulis</i>	Kashiyaa (Gad'awaa)	Asteraceae	H	W	R	Pounded and mixed with water	O	Epilepsy
<i>Echinops kebericho</i>	Burssaa	Asteraceae	H	H g	R	Pounded/Added to fire with <i>Eucalyptus globulus</i>	O/ N	Snake bite/seen/repellant, Headache
<i>Erythrina brucci</i>	Borttuwa	Fabaceae	T	W	Ba	Chewing and sucking	O	Stomachache
<i>Eubolia schimperi</i>	K'ank'k'uwaa	Poaceae	Cl	W	Se	Pounded & mixed with 'Bordde' (local drink)	O	Tape worm
<i>Eucalyptus globules</i>	Bootsa balzzafiyaa	Myrtaceae	T	H g	L	With <i>Echinops kebericho</i> add on to fire and fumigating	N	Headache
<i>Ficus sycamore</i>	Wolaa	Moraceae	T	W	Ba+ L	Concocted	O	Hepatitis
<i>Ficus vasta</i>	Esaa	Moraceae	T	W	Sa	Cut the plant with an axe to release the white sap	D	Wound
<i>Gardenia ternifolia</i>	Gembellaa	Rubiaceae	T	W	L	Pounded with <i>Girardinia diversifolia</i>	O/ S	Snake bite
<i>Girardinia diversifolia</i>	Konaa(k'eeraa)	Urticaceae	H	W	R	Pounded with <i>Gardenia ternifolia</i>	O/ S	Snake bite
<i>Gnidia glauca</i>	Migiraa	Thymelaceae	S	W	R	Pounded with the root of <i>Phytolacca</i> .	O	Hepatitis
<i>Hagenia abyssinica</i>	Soyd'd'uwaa	Rosaceae	T	W	L	Pounded & mix with water	O	Tapeworm
<i>Hordeum vulgare</i>	Banggaa	Poaceae	H	H g	Se	Concocted	O	Snake bite
<i>Indigofera</i>	Wusiwussiyaa	Fabaceae	S	W	R	Pounded & squeezed	O	Abdomin

<i>arrecta</i>								al pain
<i>Justicia schimperiana</i>	Taadak'aa	Acanthaceae	S	W	L	Pounded	O	Epilepsy
<i>Lactuca paradoxa</i>	Maas'oliyaa	Asteraceae	Cl	W	Wp	Pounded and mix with water	O	Abdominal pain
<i>Laggera pterodonta</i>	Seesaa/Geleshs ho tambbuwa	Asteraceae	S	W	R	Crashed	O/D	Swelling/ Evil eye
<i>Lannea fruticose</i>	Dechi-marac'c'iya	Anacardiaceae	T	W	R	Pounded or crashed and then mixed with <i>Coffea arabica</i>	O	Chills
<i>Lepidium sativum</i>	Shippaa/sibikkaa	Brassicaceae	H	Hg	Se	Concocted	O	Abdominal pain
<i>Maerua oblongifolia</i>	Sanggaanaa	Capparidaceae	T	W	R	Dried & powdered	O	Stomachache
<i>Maesa lanceolata</i>	Geggec'uwaa	Myrsinaceae	T	W	R+ Ba	Pounded with the root of <i>Clerodendrum</i> .	O	Abdominal pain ('Oytsaa')
<i>Milettia ferruginea</i>	Zaagiyaa	Fabaceae	T	W	Ba	Concocted	O	Snake bite, hepatitis
<i>Moringa stenopetala</i>	Halakkuwaa	Moringaceae	T	Hg	Se	Pounded & dried in sun light	O	Hypertension, malaria
<i>Ocimum basilicum</i>	Dunkkiyaa	Lamiaceae	H	Hg	Se	Crashed within hands	O	Body Rheumatic
<i>Ocimum lamifolium</i>	Daamakasiya	Lamiaceae	H	Hg	L	Crashing & Squeezing	N	Headache
<i>Penisetum clandestinum</i>	Gors's'aa	Poaceae	H	W	L	Crushed and mixed with water	O	Snake bite

<i>Pentas schimperiana</i>	Dawuridamaa	Rubiaceae	H	W	L	Pounded & mixed with water	O	Bone broken
<i>Persea americana</i>	Abakaatuwaa	Lauraceae	T	H g	L	Pounded or crashed	O	Chills
<i>Phytolacca dodecandra</i>	Hanc'c'iic'aa	Phytolaccaceae	S	W	R	Concocted with the bark of <i>Croton</i> & <i>Momordica</i>	O	Gonorrhoea Or Hepatitis
<i>Piper capense</i>	Tunjja	Piperaceae	S	W	Se	Concocted	O	Abdominal pain/Chills
<i>Pittosporum abyssinicum</i>	Shollaa	Pittosporaceae	T	W	Ba	Pounded & mixed with water	O	Ascariasis
<i>Plectranthus ornatus</i>	Dissaa	Lamiaceae	H	H g	R	Concocted	O	Chills/Stomachache
<i>Premna schimperiana</i>	C'awulaa	Lamiaceae	T	W	Ft	Pounded	O	Abdominal pain/chills
<i>Pycnostachys abyssinica</i>	Olommuwaa	Lamiaceae	S	W	L	Pounded	O	Abdominal pain
<i>Rumex abyssinicus</i>	C'ol'iyyaa	Polygonaceae	H	W	R+S t	Chewing & sucking water	O	Stomachache
<i>Rumex nepalensis</i>	Zans's'allaa	Polygonaceae	H	W	R	Chewing & shucking watery part	O	Stomachache
<i>Ruta chalepensis</i>	S'alotiyaa	Rutaceae	H	H g	L	Crashed in hands with <i>Clerodendrum</i>	O	Evil eye Abdominal

						<i>myricoides</i>		al pain
<i>Salvia nilotica</i>	Sa'a-okataa	Lamiaceae	H	W	L	Squeezed in hands	S	Wound
<i>Satureja paradoxa</i>	Settuwaa	Lamiaceae	H	W	L	Boiled with water	N	Headache
<i>Schiffleria abyssinica</i>	Dargguwaa	Araliaceae	T	W	Ba	Pounded with the leaf of <i>Ficus sycamore</i>	O	Hepatiti s
<i>Sclerocarya birrea</i>	Woshilechchaa	Anacardiaceae	T	W	Se	Pounded & mixed with water	D	Lymph adenitis
<i>Sida schimperiana</i>	Kinddichchuwaa	Malraceae	H	W	L	Pounded & squeezed	D	Insect bite
<i>Solanum incanum</i>	Wora buluwaa	Solanaceae	H	W	R	Pounded and mixed with water	O	Abdomin al pain
<i>Solanum sp.</i>	Pugagiyaa	Solanaceae	S	W	L	Pounded	O	Abdomin al pain
<i>Tragia cinerea</i>	Kinkkilishuwa a	Euphorbiaceae	Cl	W	St	Part taken & tied on the neck	S	Lymph adenitis
<i>Tragia doryoges</i>	Kinkkilishuwa a	Euphorbiaceae	H	W	L+ R	Pounded with the leaf & root of <i>Croton</i>	O	Snake bite
<i>Verbena officinalis</i>	Higishshaa	Verbenaceae	H	W	R	Pounded & squeezed	O	Abdomin al pain
<i>Vernonia urticifolia</i>	Zammuwaa	Asteraceae	S	W	L	Pounded & squeezed	O	Abdomin al pain
<i>Vigna sp.</i>	Bak'aliya haytsaa	Fabaceae	Cl	H g	L	Pounded & mixed with water	O	Leech

Plant species used to treat livestock ailments

Botanical name	Local name	Family name	Ha	Hab	Pu	Mode of preparation	RA	DT
<i>Annona</i>	Monok'uwaa	Annonaceae	T	W	St	Pounded &	O	Abdomi

<i>senegalensis</i>						squeezed		nal pain
<i>Arundinaria alpine</i>	Wooshshaa	Poaceae	T	Hg	L	Pounded	O	Diarrhea
<i>Asparagus officinales</i>	C'enggaa	Asparagaceae	H	W	R	Concocted	O	Hepatiti s
<i>Brassica nigra</i>	Sannafichiyaa	Brassicaceae	H	Hg	Se	Concocted	O	Abdomi nal pain
<i>Carduus chamaecephalus</i>	Kashiyaa(gez ziyawaa)	Asteraceae	H	W	R	Pounded & mix with water	O	Epilepsy
<i>Cordia africana</i>	Mok'otsaa	Boraginaceae	T	Bo	R	Concocted	O	Hepatiti s
<i>Croton macrostachyus</i>	Ankkaa	Euphorbiaceae	T	W	L	Pounded	O	Bloat
<i>Cynodon spp</i>	Suraa	Poaceae	H	W	L+ St	Cut and tied on the neck	S	Snake saw
<i>Cyperus articulate</i>	Bidaaraa	Cyperaceae	H	Hg	Rm	Concocted	O	Avoid expired blood at birth
<i>Dracaena studeneri</i>	Ilallaa	Agavaceae	T	W	L	Pounded &mix with water	O	Blackleg
<i>Echinops kebericho</i>	Burssaa	Asteraceae	H	Hg	R	Pounded and mix with water	O/D	Snake bite or seen
<i>Ensete ventricosum</i>	Looc'inggiya uutsaa	Musaceae	S	Hg	L	Chopped, direct feeding	O	Retained placenta
<i>Eragrostis tef</i>	Gaashiyaa	Poaceae	H	Hg	L+ St	Smashed and preserved	O	Bloating
<i>Erythrina abyssinica</i>	Borttuwaa	Fabaceae	T	W	Ba	Pounded	O/N	Blackleg
<i>Eucalyptus</i>	Bootsa	Myrtaceae	T	W	L	Boiled with	N	Headach

<i>globules</i>	balzzafiyaa					<i>Echinops kebericho</i> added to fire& fumigate		e
<i>Ficus sycamore</i>	Wolaa	Moraceae	T	W	L	Concocted with the bark of <i>Schifleria abyssinica</i>	O	Hepatiti s
<i>Ficus vasta</i>	Esaa	Moraceae	T	W	Ba	Pounded	O	Diarrhea
<i>Gardenia ternifolia</i>	Gembbellaa	Rubiaceae	T	W	L	Pounded with <i>Girardinia diversifolia</i>	O	Snake bite
<i>Girardinia bullosa</i>	Konaa	Urticaceae	H	W	R	Pounded & mixed with water	O	Evil spirit
<i>Gnewia mollis</i>	Gomariyaa	Tiliaceae	T	W	Ba	Pounded& squeezed	O	Constipa tion
<i>Guizotia schimperi</i>	Qod'uwaa	Asteraceae	H	W	L	Concocted	O	Bile disease
<i>Juniperus procera</i>	S'iiddaa	Cuperssaceae	T	Hg	L	Pounded	O	Bloat
<i>Justicia schimperiana</i>	Taadak'aa	Acanthaceae	S	W	L	Pounded	O	Epilepsy
<i>Maesa lanceolata</i>	Geggec'uwaa	Myrsinaceae	T	W	L	Pounded and crashed	O	Bloat
<i>Millettia ferruginea</i>	Zaagiyaa	Fabaceae	T	W	R	Concocted	O	Hepatiti s
<i>Momordica foetida</i>	K'ec'aa	Cucurbitaceae	H	W	L+ St	Concocted with <i>Vernonia neophrastifolia</i> & <i>Maesa lanceolata</i>	O	Bloat
<i>Nicotiana</i>	Tambuwwaa	Solanaceae	H	Hg	L	Pounded &	N	Leech

<i>tabacum</i>						squeezed		expel
<i>Penisetum clandestinum</i>	Gors's'aa	Poaceae	H	W	L	Crashed & mixed with water	O	Snake bite
<i>Pentas shimperiana</i>	Dawuridamaa	Rubiaceae	H	W	L+ St	Pounded & mixed with water	O	Constipation, Bone broken
<i>Phytolacca dodecandra</i>	Hanc'c'iic'aa	Phytolacaceae	S	W	R	Concocted	O	Hepatitis
<i>Piper capense</i>	Tunjja	Piperaceae	S	W	L	Concocted	O	Abdominal pain
<i>Rumex abyssinicus</i>	C'ol''iyaa	Polygonaceae	H	W	R	Concocted with <i>Milletia</i> and <i>Cordia</i>	O	Hepatitis
<i>Senna occidentalis</i>	S'okka d,aliyaa	Fabaceae	Cl	W	Wp	Pounded and squeezed	O	Anthrax
<i>Sida schimperiana</i>	Kinddichchuwaa	Malraceae	H	W	L	Pounded and squeezed	O	Diarrhea (k'arddaa)
<i>Spilanthus mauritiana</i>	Aydaamiyaa	Asteraceae	H	W	Fr	Pounding	O	Ascaris
<i>Syzygium guineense</i>	Ochaa	Myrtaceae	T	W	Ba	Pounded with <i>Phytolacca dodecandra</i>	O	Hepatitis
<i>Tragia sp.</i>	Kinkkilishuwaa	Euphorbiaceae	Cl	W	R	Pounded	O	Diarrhea
<i>Vernonia amygdalina</i>	Garaa	Asteraceae	T	W	L	Concocted and pounded	O	Anti-trypanosomiasis
<i>Vernonia neophrastifolia</i>	Buuzzuwaa	Asteraceae	S	W	L	Concocted	O	Bloat

<i>Vigna sp.</i>	Bak'aliya haytsaa	Fabaceae	Cl	Hg	L	Pounded & mixed with water	O	Leech
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Plant species used to treat both human and livestock diseases

Botanical name	Local name	Family name	Ha	Hab	Pu	Mode of preparation	RA	DT
<i>Acacia sp.</i>	Odooruwaa	Fabaceae	T	W	Ba	Pounded with the bark of <i>Ficus cycomorus</i> .	O	Hepatitis
<i>Asparagus officinales</i>	C'enggaa	Asparagaceae	H	W	R	Concocted	O	Hepatitis
<i>Brassica nigra</i>	Sannafichiyaa	Brassicaceae	H	Hg	Se	Concocted	O	Abdomin al pain
<i>Carduus chamaecephalus</i>	Kashiyaa (gezziyawa)	Asteraceae	H	W	R	Pounded & mix with water	O	Epilepsy
<i>Cordia Africana</i>	Mok'otsaa	Boraginaceae	T	Bo	R	Concocted	O	Hepatitis
<i>Cynodon spp</i>	Suraa	Poaceae	H	W	L+ St	Cut and tied on the neck	S	Snake saw
<i>Echinops kebericho</i>	Burssaa	Asteraceae	H	Hg	R	Pounded and mix with water	O/ D	Snake bite or seen
<i>Eucalyptus globules</i>	Bootsa balzzafiyaa	Myrtaceae	T	Hg	L	With <i>Echinops kebericho</i> added to fire and fumigate	N	Headache
<i>Ficus sycamore</i>	Wolaa	Moraceae	T	W	L	Concocted & pounded with the bark of <i>Schifleria abyssinica</i>	O	Hepatitis
<i>Gardenia ternifolia</i>	Gembbellaa	Rubiaceae	T	W	L	Pounded with <i>Girardinia</i>	O	Snake bite

						<i>diversifolia</i>		
<i>Justicia schimperiana</i>	Taadak'aa	Acanthaceae	S	W	L	Concocted	O	Epilepsy
<i>Milletia ferruginea</i>	Zaagiyaa	Fabaceae	T	W	R	Concocted	O	Hepatitis
<i>Penisetum clandestinum</i>	Gors's'aa	Poaceae	H	W	L	Crashed and mixed with water	O	Snake bite
<i>Phytolacca dodecandra</i>	Hanc'c'iic'aa	Phytolacaceae	S	W	R	Concocted	O	Hepatitis
<i>Piper capense</i>	Tunjja	Piperaceae	S	W	L+ Se	Concocted	O	Abdominal pain
<i>Rumex abyssinicus</i>	C'ol''iyaa	Polygonaceae	H	W	R	Concocted	O	Hepatitis
<i>Vigna sp.</i>	Bak'aliya haytsaa	Fabaceae	Cl	Hg	L	Pounded & mixed with water	O	Leech

Appendix 2: Major human and livestock ailments and number of corresponding plant species used to treat them in the study area.

Major human diseases of the study area and medicinal plant species used to treat them.

No	English name	Local name	Plant species used	%
1	Hepatitis	Zuluwaa	8	10.66
2	Insect bite	Sa'abaa	2	2.66
3	Gland swelling	Gaabaa	1	1.33
4	Stomachache	Uluwa sakuwaa	6	8
5	Epilepsy	Kaariyaa	3	4
6	Headache	Huup'iyaa sakuwaa	4	5.33
7	Snake bite	Shooshsha dukaa	9	12
8	Evil eye	Manaa harggiya	4	5.33
9	Bone fracture	Mek'etsaa me'uwaa	1	1.33
10	Ascariasis	Sheniyaa	3	4

11	Tape worm	Soyd'uwaa	2	2.66
12	Gonorrhoea	Yaataa	1	1.33
13	Abdominal pain	Oytsaa sakuwaa	16	21.33
14	Wound	Maytsaa	5	6.66
15	Diarrhea	Gusuwaa	1	1.33
16	Lymph adenitis	S'ii'iyaa	2	2.66
17	Ear ache	Haytsaa sauwaa	1	1.33
18	Chills	Meeguwaa	5	6.66
19	Common cold	K'ufuwaa/Oshinchcha	1	1.33
Total			75	100

Major Animal diseases of the study area and the number of plant species used to treat them.

No	English name	Local name	Plant species used	%
1	Hepatitis	Zuluwaa	7	17.50
2	Blackleg	S'okka	2	5
3	Bloating	Mac'iraaruwaa	5	12.50
4	Abdominal pain	Uluwa sakuwaa	3	7.50
5	Epilepsy/Listeriosis	Kaariyaa	4	10
6	Pancreatic disorder	Lans's'iya dic'aa	1	2.50
7	Snake bite	Shooshsha dukaa	5	12.50
8	Tsetse fly	C'ababiyaa	1	2.50
9	Anthrax	S'ilkkiyaa	1	2.50
10	Ascariasis	Sheniyaa	1	2.50
11	Constipation	Uluwaa meluwaa	2	5
12	Retained placenta	Du'aa is'uwaa	1	2.50
13	Leech expel	Ulletsaa	2	5
14	Mastitis/evil eye	Asayfiyaa	1	2.50
15	Diarrhea	Gusuwaa	4	10
Total			40	100

Major Diseases of both human and livestock of the study area and the number of plant species used to treat them

No	English name	Local name	Plant species used	%
1	Hepatitis	Zuluwaa	7	41.17
4	Abdominal pain	Uluwa sakuwaa	2	11.76
5	Epilepsy	Kaariyaa	3	17.64
7	Snake bite	Shooshsha dukaa	4	23.52
8	Leech expel	Ulletsaa	1	5.88
Total			17	100

Appendix 3: Check-lists, questionnaires and list of informants prepared for ethnobotanical data collection.

Checklist of Semi-structured Interview Questions

Dear respondents, I am Temesgen Shiferaw and I am a post graduate degree student in Hawassa university, faculty of natural and computational science, department of Biology in partial fulfillment of the requirements of degree in botanical science.

This interview questionnaire is to get firsthand information for the study entitled as “Ethnobotanical Study of Medicinal Plants Used to Treat Human and Livestock Ailments in The People of Kechi Woreda, Dawro Zone of South West Ethiopia People Regional State (SWEPRS), Ethiopia”.

The primary objective of this study is to document medicinal plant species and the associated indigenous knowledge used to treat human and livestock ailments in Kechi woreda. The questions have been prepared in such a way that it will require the minimum time to complete and respond to varies questions will be additive for the eventual outcome of the research. The information forwarded by the respondents will keep confidential and will not affect any body in any way. So, you are kindly requested to give your response honestly.

Thank you for your genuine replay!

I. General information

1. Information on respondents: Date of interview_____Kebele_____Name of interviewer_____ Name of respondent_____Gender: M _____ F____ Age_____ Ethnicity_____Religion: Orthodox_____Muslim_____ Protestant_____other_____Educational level_____Marital status_____ for how long have you lived in the area? _____

2. What are the most common diseases of humans in your area?

3. What are the most common diseases of livestock in your area?

4. What are the most common diseases of both human and livestock in your area?

5. How local people prevent and control a given diseases in your area?

II. Ethnobotanical Data

6. List plant species commonly used to treat human and livestock diseases in your area.

6.1. Plants species used to treat human diseases

Botanical name	Local name	Family name	Habit	Habitat	Parts used	Mode of preparation	Route of application	Disease treated

6.2. Plants species used to treat livestock diseases

Botanical name	Local name	Family name	Habit	Habitat	Parts used	Mode of preparation	Route of application	Disease treated

6.3. Plants species used to treat both human and livestock diseases

Botanical name	Local name	Family name	Habit	Habitat	Parts used	Mode of preparation	Route of application	Disease treated

6.4. Which of the following medicinal plants are the most preferred in your area?

No	Plant species	Respondents level										Total	Rank
		R1	R2	R3	R4	R5	R6	R7	R8	R9	R10		

6.5. Which of the following of medicinal plants, the pair is most preferred in your area?

Pair	Respondents level										Total	Rank
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10		

6.6. Which of the following medicinal plants are used for multiple purposes (food, medicinal, fire wood, building, charcoal and fence)?

No	Purpose	Plant species	Total	Rank

7. What is the status of using traditional medicine in your locality?

8. Which plants species are the most preferred in their uses as medicine and why?

9. Which medicinal plants are used for multiple purposes other than medicinal value?

10. Which member of the community uses medicinal plant most and why?

11. Are there taboos associated with medicinal plant use? (Time of collection, Method of collection, Sex, Age, Storage, etc.), what does taboos imply?
12. How the local people measure the dose of preparations of traditional plant medicine? Is there variation in dose among age and sex? If yes state each.
13. Are there antidotes used to avoid plant medicinal side effects? If yes, mention them.
14. How do the knowledge of traditional medicinal plants use transferred in the community?
15. What kind of medicinal plants are sold in the market?
16. Is the medicinal plant species are easily accessible? If not, why?
17. Which medicinal plants species are most threatened in your area?
18. What are the threatening factors of medicinal plants in the area?
19. Is there any effort made to conserve medicinal plants in the community? How do you conserve medicinal plants in your locality?

Thank you!

Name of collector _____ Date _____

Name of field assistant _____

Checklist of Semi-structured Interview Question prepared in English language and translated in to local language (Dawrootsuwa) for collecting Ethnobotanical Data D’aletetsaw maaddiya mitsaa zeretsatuwaa shiishshanaw giigeedda doonaa ooshaa cheekilisttiyaa.

Bonchchetteedda ooshettiyawantto! Ta sunsay Temesggen Shifara geetettee.Hawaasa Yunbberesttiyaan 2tso digiriya tammariya.Bayoloojiya timirttiya kifiliyan doozatuwaba s’annayay. Ha doonaa ooshay giigeeddawe koyro detsaa marrajja “Asaanne Soo medoossa harggiya patsanaw maaddiya doozaa zeretsatuwa” Kac’c’i woradaan Dawuro zooniya Dugehaanne Wulaha Top’p’iya Asatuwa Killiliya Top’p’iya giyaa kaaraana.

Ha oosuwaw koyro detsaa k’oppobay; Kac’c’i woradaan asaanne medoosatu harggiya patsanaw maaddiya doozaa zeretsatuwa shaaki shiishshanaassanne hara gakettiya Beni wogaa doozaappe

d'aliya giigissi asaanne soo medoossa harggiya akkamuwa hiillatuwa bayennaada s'aafi wotsanaassa.

Ha maaraan giigeedda ooshatuunne hara gaketitiya k'ofatuu wurssetsa muruutaakko gakkanaw ooshayenne zaaruu laafa wodiya akkee guussa. Hintte immiya zaaruwanne k'ofaa s'uuray aydekka gidin hak'an naagetteddawaa. He gishshaw hintte zaaruwa woy k'ofaa k'osennaan ammanettiide immanaada k'ofissay.

Hintte Eenotawunne Tumo k'ofaassi galatay!

A. Ooshettiya asaa Kumentsa hanotaa

1. Ooshettiya asaa hanotaa

Ooshaa gallassa _____ Qabaliya suntsa _____ Oochchiya asaa suntsa _____ ooshettiyaasa(suntsa) _____

mattuma: _____ Yeletalaytsa _____ Zariya(kochcha) _____ Ammanuwa: O rrtodokisiya _____ Kaatoolikiya _____ Isilaamaa _____ Pirotisttanttiya _____ Haraa _____

T/detsaa: _____ Akaanne Geluwa hanota: _____ Woysa keena laytsa ha heeran de'aaddii? _____

2. Ne heeraan darii eretteedda asaa sakkiya sakuu ayaa ayee?
3. Ne heeraan darii eretteedda soo medossa harggi ayaa ayee?
4. Ne heeraan darii eretteedda asaanne soo medossa kotsa sakkiya harggi ayaa ayee?
5. Ha killi s'eesetteedda harggatuwa heeraa asay te'iyaa woy naagiya beni wogaa akkamuwa hiillay de'ii, _____

B. D'aletetsaw maaddiya doozaa zeretsatuwa shaakussa

6. Asaanne medossa harggiya akkamanaw maaddiya doozaa zeretsatuwa maaran oda.

6.1. Asaa harggiya patsanaw maaddiya doozaa zeretsatuwaa

Dooza heeraa suntsa	Dichchaa detsaa	De'iyaa geessuwa	Akettiya doozaa kifiliya	Giigiya ogiya	Akettiya ogiya	Patsiya harggiya

6.2.Soo medossa harggiya patsanaw maaddiya dooza zeretsatuwanne giigiya maara

Dooza heeraa suntsa	Dichchaa detsaa	De'iyaa geessuwa	Akettiya dooza kifiliya	Giigiya ogiya	Akettiya ogiya	Patsiya harggiya

6.3.Asaanne soo medossa harggiya kotsa patsanaw maaddiya dooza zeretsatuwa

Dooza heeraa suntsa	Dichchaa detsaa	De'iyaa geessuwa	Akettiya dooza kifiliya	Giigiya ogiya	Akettiya ogiya	Patsiya harggiya
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7. Ne heeraan dooza zeretsaappe giigiya wogaa d'aliya go'ettussa hanotay ayaa malatii?
8. Hak'a doozaa zeretsay d'aletetsaan aad'o go'aa immii? Ayaw?
9. Hak'a d'aletetsa dooza zeretsay d'aletetsaappe hara guja go'aa immii?
10. Hak'a heeraa asay woga d'aliyaa ha'i wodiya d'aliyappe aatsi go'ettii? Ayaw? Qassikka mattuma gidдон wogaa d'aliyaa go'ettussa dummatetsay de'ii?
11. Ne heeraan d'aletetsaw haniya dooza zeretsaa go'ettussanna gakettiya c'aak'uu de'ii? (Duutsiya wodiya, duutsiya maaraanna, mattumaanna, laytsa detsaanna, shiishshi wotsiya maaraanna gakettiyawe). De'ooppe c'aak'uu ayaa ko'nc'c'issii?
12. Heeraa asay dooza zeretsaappe giigiya d'aliya ayaan makki go'ettii? Dooza d'aliya makki go'ettussaan laytsanne mattuma gidдон dummatetsay de'ii? De'ooppe paatta oda.
13. Doozaa d'aliya hara miyye k'ohaa d'ayssiya (aliyaa) yewuu de'ii? De'ooppe paatta oda.
14. Doozaa d'aletetsa go'aa wogay heeraan yeletaappe yeletaakko ay ogiyan aad'd'ii?
15. Hak'a k'ommo d'aletetsa dooza zeretsay geyaan zal'ettii?
16. D'aletetsaa dooza zeretsay metennaan mataan beettii? Beettennawaa gidoope ayaw?
17. Ne heeraan darii laafettedda (bayanaw dendeedda) d'aletetsa dooza zeretsay hak'awee?
18. Da'letetsa dooza zeretsay laafettanaada ootsiya metatuu ayaa ayee?
19. Ne heeraan da'letetsaw maaddiya dooza zeretsa wurennaada woy d'ayennaada gam'etsiya naaguwa hiillay de'ii?
20. Neeni ne heeraan da'letetsaw maaddiya dooza zeretsatuwa ay ogiyan naaga oykkay?

Marajja shiishshiya asa suntsa: _____gallassa: _____

Kaaletsiya asa suntsa: _____

Darii Galatay!

List of Informants in the study area (Notice *: key Informants)

No.	Full name	Sex	Age	Marital status	Education	Occupation	Kebele
1	*Aymalo Ante	M	69	Married	Illiterate	Farmer	Bera-doba
2	Mesfin Mamo	M	39	Married	4 th	Farmer	Bera-doba
3	*Kebede Chekole	M	38	Married	10 th	Farmer	Bera-doba
4	*Amisalech Woju	F	68	Married	Illiterate	Farmer	Bera-doba
5	Bahiru Bekele	M	56	Married	3 rd	Farmer	Bera-doba
6	Amaru Dejene	M	25	Married	10 th	Farmer	Bera-doba
7	*Bekele Beyene	M	52	Married	2 nd	Farmer	Bera-doba
8	Ataro Adeko	M	40	Married	Basic education	Farmer	Bera-doba
9	Tadesse Adeko	M	26	Married	Basic education	Farmer	Bera-doba
10	Worabo Woju	M	34	Married	Basic education	Farmer	Bera-doba
11	Alemayehu Amba	M	63	Married	Basic education	Farmer	Bera-doba
12	Abera Wudu	M	58	Married	Basic education	Farmer	Bera-doba
13	Alamayehu Omoshe	M	26	Married	Basic education	Farmer	Bera-doba
14	Beyenech Desalegn	F	47	Married	Basic education	Farmer	Bera-doba
15	Matafe Manjo	F	60	Married	Illiterate	Farmer	Bera-doba
16	Abayneh Wodaje	M	61	Married	Basic education	Farmer	Bera-doba
17	Taye Tefera	M	78	Married	6 th	Farmer	Bera-doba
18	Abate Azazo	M	57	Married	Basic education	Farmer	Bera-doba
19	Wolancho Woju	M	43	Married	Basic education	Farmer	Bera-doba
20	Desta Gebeyehu	M	58	Married	Basic education	Farmer	Bera-doba
21	Fanaye Chekole	F	46	Married	Basic education	Farmer	Bera-doba
22	Zenebe Tefera	M	39	Married	Basic education	Farmer	Bera-doba
23	Workinesh Darcha	F	38	Married	Basic education	Farmer	Bera-doba
24	Ataro Ayele	M	40	Married	Basic education	Farmer	Bera-doba
25	Gezumu Gamu	M	48	Married	6 th	Farmer	Bera-doba
26	Mesele Mengesha	M	57	Married	4 th	Farmer	Bera-doba
27	Melese Mamo	M	38	Married	6 th	Farmer	Bera-doba
28	Batista Otoro	M	40	Married	6 th	Farmer	Bera-doba

29	Aster Tadesse	F	48	Married	6 th	Farmer	Bera-doba
30	Alemayehu Dubale	M	57	Married	3 rd	Farmer	Bera-doba
31	Masana Mangasha	M	43	Married	2 nd	Farmer	Bera-doba
32	*Gatisa Gamu	M	74	Married	Basic education	Farmer	Bera-doba
33	*Akilile Kibebu	F	40	Divorce	3 rd	Farmer	Bera-doba
34	Tilahun Getachew	M	26	Married	BA Degree	Civl-servant	Bera-doba
35	*Amarech Mekuria	F	58	Married	Basic education	Farmer	Maliga-maracha
36	*Dorana Boroda	M	95	Married	Illiterate	Farmer	Maliga-maracha
37	Melese Meshesha	M	56	Married	Basic education	Farmer	Maliga-maracha
38	*Tsfaye Tarika	M	72	Married	Illiterate	Farmer	Maliga-maracha
39	*Angamo mist	F	47	Married	Illiterate	Farmer	Maliga-maracha
40	*Betela Adeko	M	46	Married	Illiterate	Farmer	Maliga-maracha
41	Zenebe Mengesha	M	43	Married	2 nd	Farmer	Maliga-maracha
42	Terefe Duilo	M	50	Married	6 th	Farmer	Maliga-maracha
43	Mengesha Bobicho	M	65	Married	Basic education	Farmer	Maliga-maracha
44	Dokito Doramo	M	48	Married	Illiterate	Farmer	Maliga-maracha
45	Aymalo Adeto	M	57	Married	Basic education	Farmer	Maliga-maracha
46	Utino Woju	M	38	Married	4 th	Farmer	Maliga-maracha

47	Dogiso Dosha	M	40	Married	Basic education	Farmer	Maligamaracha
48	Zewude Adare	M	48	Married	3 rd	Farmer	Maligamaracha
49	Abera Dodicho	M	57	Married	Basic education	Farmer	Maligamaracha
50	Girma W/Giorgis	M	43	Married	9 th	Farmer	Maligamaracha
51	Gebeyehu Gashara	M	58	Married	Basic education	Farmer	Maligamaracha
52	Arash Amboma	F	46	Married	6 th	Farmer	Maligamaracha
53	Adamu Ayanu	M	39	Married	3 rd	Farmer	Maligamaracha
54	Hadayo Osu	M	80	Married	Illiterate	Farmer	Maligamaracha
55	Dara Aldada	M	47	Married	Basic education	Farmer	Maligamaracha
56	Tirfe Belayneh	M	46	Married	Illiterate	Farmer	Maligamaracha
57	Masana Mamo	M	43	Married	Basic education	Farmer	Maligamaracha
58	Birhanu Duba	M	50	Married	Illiterate	Farmer	Maligamaracha
59	Waju Bushuro	M	65	Married	Illiterate	Farmer	Maligamaracha
60	Goshu Godeto	M	48	Married	Illiterate	Farmer	Maligamaracha
61	Waju Minota	M	57	Married	2 nd	Farmer	Maligamaracha
62	Ayisa Agaga	M	38	Married	6 th	Farmer	Maliga-

							maracha
63	Wodaje Manu	M	40	Married	Basic education	Farmer	Maliga-maracha
64	Galasso Gafaro	M	66	Married	Illiterate	Farmer	Maliga-maracha
65	Terefech Tesema	F	45	Married	Basic education	Farmer	Maliga-maracha
66	*Arota Woju	M	60	Married	4 th	Farmer	Maliga-maracha
67	Tarekegn Tekile	M	34	Married	9 th	Farmer	Maliga-maracha
68	Ankato Abaro	M	96	Married	Basic education	Farmer	Maliga-maracha
69	Getachew Shorimo	M	58	Married	6 th	Farmer	Oda-gofa
70	Abitse Duba	M	26	Married	3 rd	Farmer	Oda-gofa
71	Chonu Chofore	M	47	Married	2 nd	Farmer	Oda-gofa
72	*Getachew Desta	M	60	Married	9 th	Farmer	Oda-gofa
73	*Dogiso Dolango	M	61	Married	Basic education	Farmer	Oda-gofa
74	*Tefera Tarada	M	78	Married	Basic education	Farmer	Oda-gofa
75	*Mengesha Tona	M	57	Married	Basic education	Farmer	Oda-gofa
76	*Gesese Otoro	M	43	Married	Basic education	Farmer	Oda-gofa
77	*Getsinesh Chebude	F	58	Married	Basic education	Farmer	Oda-gofa
78	Azalech Desalegn	F	46	Married	2 nd	Farmer	Oda-gofa
79	Duba Ante	M	39	Married	4 th	Farmer	Oda-gofa
80	Tona Kebede	M	38	Married	Basic education	Farmer	Oda-gofa
81	Fanay Betela	F	40	Married	Basic education	Farmer	Oda-gofa
82	Shewaye Sanimio	M	48	Married	Basic education	Farmer	Oda-gofa
83	Abera Gurache	M	57	Married	4 th	Farmer	Oda-gofa
84	Deneke Lasu	M	38	Married	4 th	Farmer	Oda-gofa
85	Abate Ataro	M	40	Married	3 rd	Farmer	Oda-gofa
86	Shabara Mandoeye	M	48	Married	Basic education	Farmer	Oda-gofa

87	Damene Dadiso	M	57	Married	Basic education	Farmer	Oda-gofa
88	Asegedech Mandoye	F	43	Married	Basic education	Farmer	Oda-gofa
89	Azime Amamo	F	58	Married	6 th	Farmer	Oda-gofa
90	Kebede Kasa	M	46	Married	3 rd	Farmer	Oda-gofa
91	Tefera Dolamo	M	39	Married	2 nd	Farmer	Oda-gofa
92	Zenebe Shifaraw	M	38	Married	Basic education	Farmer	Oda-gofa
93	Zelege Ambushe	M	40	Married	4 th	Farmer	Oda-gofa
94	Abraham Shanko	M	48	Married	Basic education	Farmer	Oda-gofa
95	Dawalke Leka	M	57	Married	Basic education	Farmer	Oda-gofa
96	Shawaye Sayle	F	38	Married	4 th	Farmer	Oda-gofa
97	Bekele Ashanga	M	40	Married	4 th	Farmer	Oda-gofa
98	Gesese Gaze	M	48	Married	2 nd	Farmer	Oda-gofa
99	Wodaje Woju	M	57	Married	3 rd	Farmer	Oda-gofa
100	Ute Kocho	M	43	Married	Basic education	Farmer	Oda-gofa
101	Adino Otoro	M	48	Married	6 th	Farmer	Oda-gofa
102	Wondimu Mengesha	M	46	Married	Basic education	Farmer	Oda-gofa