

**ETHNOBOTANICAL STUDY OF MEDICINAL PLANTS USED BY
PEOPLE OF GECHI DISTRICT, BUNO BEDELE ZONE OF OROMIA
REGION, ETHIOPIA**

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**Ethnobotanical Study of Medicinal Plants Used by People of Gechi District,
Buno Bedele Zone of Oromia Region, Ethiopia**

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DEDICATION

I dedicated this manuscript to my beloved mother, Habtamnesh Sisay and my brother Zinabu Desalegn, who have been continual source of encouragement in all aspects of my life.

STATEMENT OF THE AUTHOR

By my signature below, I declare that this thesis is my own work and all sources of materials consulted for this work have been duly acknowledged. I have followed all ethical principles of the research in data collection, analysis, the preparation and completion of this thesis. This thesis has been submitted in partial fulfillment of the requirement for degree of master science in Botany from the Postgraduate Program Directorate at Haramaya University. The thesis is deposited in the university library to be made available to borrowers under rules of the library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

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BIOGRAPHICAL SKETCH

The author, Amare Desalegn, was born from his father Desalegn Damte and his mother Habtammesh Sisay on May 6, 1994 G.C. in 01 kebele, Gechi District, Buno Bedele zone, Oromia Region, Ethiopia. He attended his elementary and secondary school education at Abadagne Primary School and Gechi Secondary School, respectively. He attended grade eleven and twelve at Bedele preparatory School. After completion of his preparatory education in 2013, he joined Addis Ababa university Department of Biology in 2014 and graduated on July 11, 2016 with a B.Sc. Degree in Biology. In 2017 he directly joined Haramaya University to pursue his Master of Science degree in the department of biology in the program of Botany.

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ACRONYMS/ABBREVIATIONS

CSA	Central Statistical Agency
FL	Fidelity Level
ICF	Informant Consensus Factor
IK	Indigenous Knowledge
SPSS	Statistical Package for Social Sciences
TK	Traditional Knowledge
TMPs	Traditional Medicinal Plants
WHO	World Health Organization

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ETHNOBOTANICAL STUDY OF MEDICINAL PLANTS USED BY PEOPLE OF GECHI DISTRICT, BUNO BEDELE ZONE OF OROMIA REGION, ETHIOPIA

ABSTRACT

The study of indigenous knowledge on utilization of plants as source of medicine is important to conserve useful plants and preserve indigenous knowledge for next generation. Around 80 % of Ethiopian people are estimated to be relying on medicinal plants for the treatment of human and cattle diseases. In Ethiopia many researches have done on ethnobotany based on indigenous knowledge, but there is a place where no ethnobotanical study has been done. This study was conducted in Gechi woreda that has relatively better plant resources and hence, potentially associated knowledge on plant use for medicinal purposes. The purpose of this study was to collect, identify and document ethnomedicinal plants and associated indigenous knowledge of communities in Gechi woreda. The study was conducted in Gechi district, Buno Bedele zone of Oromia region, Ethiopia. A total of 100 informants (age ≥ 20) were selected from three sampled kebeles, of these 16 key informants (Female 2 and Male 14) were selected purposively while 84 of non practitioners (Female 42 and Male 42) were selected randomly. Ethnobotanical data were obtained using semi structured interviews, field observation and focus group discussion with local people and traditional medicine practitioners. Ethnomedicinal uses of 70 plant species from 61 genera and 36 families were documented. Majority of the plants (83.7%) were used to treat human ailments. From the total medicinal plant species, 32.9 % were shrub species followed by herbs (31.4 %) and tree species (25.7%). The most frequently used plant parts were leaves (42.3%) followed by roots, and the most widely used method of preparations were crushing (smashing or grinding) of the different plant parts and squeezing. The ways of administration showed that remedies were applied through different routes, of which oral administration (56%) was reported as the most dominant route of administration followed by dermal route administration (29.6%). Disease categories such as problems of the genitourinary system (0.75), sensory organ (0.66) and respiratory system (0.63) had the highest informant consensus factor values suggesting high agreement of people on their remedies. Indigenous knowledge about medicinal plants was found to be affected by gender, age and educational level. In order to conserve substantial amount of medicinal plants and knowledge, local people must be taught about the importance of growing medicinal plants in home gardens mixing with crops and encouraging people to protect and enclose ritual and spiritual areas with higher distribution of medicinal plants in the locality.

Key words: Ethnomedicine, Indigenous knowledge, Medicinal plants, Gechi

1. INTRODUCTION

From time immemorial, humans have been interacting with plants of their surroundings in different ways, and thus, have developed their own local specific knowledge on plant use, management and conservation (Cotton, 1996). According to Posey (1999) indigenous knowledge on plants appeared when humans started and learned how to use plants. Many indigenous local communities have developed various traditional systems using locally available resources for the alleviation of health problems (Tesfaye and Sebsebe, 2009).

Human civilization is always accompanied with the plants and plants are the integral parts of human culture. Until today, almost all the ethnic communities have developed their tradition, livelihood and cultural functions that rely mainly on the plants through generations to generation associated with indigenous knowledge systems (Jain, 1995). Such interaction of human with plant is studied under ethnobotany, which accounts for the study of relationship between people and plants for their use as medicines, food, shelter, clothing, fuel, fodder and other household purposes (Samar *et al.*, 2015). It is all about the local people's interaction with the natural environment: how they classify, manage and use plants available around them (Martin, 1995). Indigenous peoples have developed their own locality specific knowledge on plant use, management and conservation (Cotton, 1996). The ethnobotanical study is important as it involves local communities in the conservation of biodiversity. This is based on the idea that the healthiest ecosystems of the world are under the control of local communities, and local communities manage many species for which science has little information (Mersha, 2011). Therefore, the study of ethnobotany leads to documentation of traditional medicinal plants (Pankhurst, 2001).

In Africa up to 80% of the population uses traditional medicine to help meet their health care needs (Yayesh *et al.*, 2015). From the developing countries, Ethiopia can be one in which Traditional Medical Practices (TMPs) are widely used. For a long time, plants have provided a source of emerging modern medicines and drug compounds. Medicines that derived from plants have made large contributions to human health and in the development of new drugs (Zewdu *et al.*, 2015).

The Ethiopian flora is estimated to contain between 6500 and 7000 species of higher plants of which about 12% are endemic. Therefore, some of these plants have chemical compounds of therapeutic value that may be used in treatment of diseases. However, the traditional knowledge as well as medicinal plants used by these people is under threat mainly due to deforestation, degradation and cultural shift (Birhanu, 2011). The Ethiopian indigenous medicinal plant knowledge is perpetuated by word of mouth within families and the communities, consists of fragile traditional skills that are likely to be lost when communities emigrate from rural areas to towns or to other regions. It can also be lost by life style changes due to industrialization, rapid loss of natural habitats and drastic alteration of the local ecology (Getu *et al.*, 2015). The current loss of medicinal plants in the country due to natural and anthropogenic factors links with the missing of valuable indigenous knowledge associated with the plants. This strong link suggests a need to conduct ethnobotanical research and to document the medicinal plants and the associated indigenous knowledge.

In Ethiopia many researches have done on ethnobotany based on indigenous knowledge, but there is a place where no ethnobotanical study has been done. There is a wide gap in knowledge about ethnobotanical data and information from various parts of Ethiopia although there is rich and diverse ethnolinguistic groups throughout the country (Engdasew *et al.*, 2015). This study was conducted in Gechi woreda that has relatively better plant resources and hence, potentially associated traditional knowledge on plant use for medicinal purposes. The current plant use trend of the area shows that the environment is facing problems of resource depletion, which would be accompanied with loss of indigenous knowledge.

General objective

- To conduct ethnobotanical study on medicinal plants used by people of Gechi woreda.

Specific objectives

- To collect medicinal plant specimens used by the people of Gechi woreda.
- To identify medicinal plant specimens used for treatment of human and livestock health problems.

- To document the plant diversity used for treatment of human and livestock health problems.
- To document indigenous knowledge of the people on medicinal plants.

2. LITERATURE REVIEW

2.1. Ethnobotany

Ethnobotany encompasses studies that are concerned with the mutual relationships between plants and indigenous people (Cotton, 1996). It deals with the documentation, analysis and dissemination of knowledge on the interaction between biodiversity and human society, and how biodiversity is valued in different societies as well as how it is influenced by human activities. It is difficult to tell exactly when ethnobotany became part of modern science. However, it can be traced back to the time when humans started making conscious interaction with plants and animals. Ethnobotanical work seems to have started with Christopher Columbus in 1492, at a time when he brought tobacco, maize, spices and other useful plants to Europe from Cuba (Cotton, 1996), and when other immigrants from the new world documented food, medicine and other useful plants of the Aztec, Maya and Inca peoples (Martin, 1995). Plants' use as a medicine is one of the relationships of humans with plants. Historical accounts of traditionally used medicinal plants depict that different medicinal plants were in use as early as 5000 to 4000 BC in China and 1600 BC by Syrians, Babylonians, Hebrews and Egyptians (Dery *et al.*, 1999). Since then, the major system of traditional medicine, which originated from ancient China, has continued to develop not only in China, but also in neighboring countries such as Japan, the Republic of Korea and Vietnam (WHO, 2007).

2.2. Indigenous Knowledge

Indigenous knowledge also called Traditional knowledge (TK) is the totality of all knowledge and practices established on past experiences and observations that is held and used by a people (Mugabe, 1998). Such knowledge includes time-tested practice that developed in the process of interaction of humans with their environment (Alcorn, 1984). Therefore, it is the result of many generations long year's experiences, careful observations and trial and error experiments (Martin, 1995). One of the widely used indigenous knowledge system in many countries is the knowledge and application of traditional medicine. Such knowledge, known as ethnomedicinal knowledge, which involves traditional diagnosis, collection of raw materials,

preparation of remedies and its prescription to the patients (Farnsworth, 1994). Indigenous knowledge on remedies in many countries including Ethiopia passes from one generation to generation verbally with great secrecy (Jansen, 1981). Such secretive and crude transfer makes indigenous knowledge or ethnomedicinal knowledge vulnerable to distortion and in most cases, some of the lore is lost at each point of transfer (Amare, 1976). Hence there is a need for systematic documentation of such useful knowledge through ethnobotanical research.

2.3. Traditional Medicinal Plants

Traditional medicine has been defined as health practices, approaches, knowledge and beliefs incorporating plants, animals and mineral-based medicines, spiritual therapies, manual techniques and exercises to treat, diagnose and prevent illness or maintain well being (WHO, 2001). Medicinal plants were regularly used by people in prehistoric times for biomedically curative and psychotherapeutic purposes (Barboza *et al.*, 2009). According to Fassil (2001), about 75-90 % of the rural population in the world (excluding Western countries) relies on traditional medicines as their only health care system. This is because of traditional systems are more culturally acceptable and meet the psychological needs in a way modern medicine does not.

Traditional knowledge on medicinal plants is important for modern medicine development (WHO, 2001). Medicinal plants have source for the invention of novel drugs (Wright, 2005) and 25% of modern drugs contain one or more active principles of plant origin (Medhin *et al.*, 2001) and top 25 best selling medicines in the world originated from plant materials (Ohigashi, 2008). Nearly 50,000 species of higher plants have been used for medicinal purposes, and are also used in food, cleaning, personal care and perfumery (Barboza *et al.*, 2009). Besides their use in fighting various ailments among local populations, certain medicinal plants are also export commodities, valuable as sources of considerable income for harvesters and for use as raw materials for modern bio-pharmaceutical industries (Endashaw, 2007). In developing countries of Asia, Latin America, and Africa (including Ethiopia), it serves to meet the primary health care needs of the people.

In Ethiopia, traditional medicine plays an important role in the health care system. It is estimated that more than 80% of the population relies upon traditional medicine due to cultural acceptance, relatively low cost and lack of access to modern health facilities (WHO, 2001). Traditional medicinal practices were carried out essentially based on private practice, i.e. private agreement between consenting parties, and the knowledge of traditional practice in most cases has descended through oral folk lore (Asfaw *et al.*, 1999). Secrets of information retained by traditional healers is relatively less susceptible to distortion, but less accessible to the public (Dawit, 1986). However, the knowledge is dynamic as the practitioners make every effort to widen their scope by reciprocal exchange of limited information with each other (Dawit 1986 and Abbink, 1993).

2.4. Medicinal Plants and Ethnomedicine in Ethiopia

In Ethiopia, the practice of traditional medicine is diverse and varies greatly among different ethnic groups. Traditional medical practitioners mostly use herbs for spiritual healing, bone-setting and minor surgical procedures in treating diseases. Most traditional medical practices in Ethiopia rely on an explanation of disease that draws on both the “mystical” and “natural” causes of an illness and employ a holistic approach to treatment (Bishaw, 1991). Under the rule of Menelik (1865-1913), western medicine became more incorporated into the Ethiopian medical system. Despite western medicine becoming more wide spread in Ethiopia, Ethiopians tend to rely more on traditional medicine. Conventional medical services remain concentrated in urban areas and have failed to keep pace with the growing population, keeping health care access out of reach for most Ethiopians living in rural. Because traditional medicine is culturally entrenched, accessible, and affordable, up to 80% of the Ethiopian population rely on traditional remedies as a primary source of health care (Pankhurst 1990 and Kebede *et al.*, 2006).

Due to its long period of practice and existence, traditional medicine has become an integral part of the culture of Ethiopian people (Pankhurst, 1995). About 80% of human population and 90% of livestock of Ethiopia are dependent on traditional medicines for their health care practice; and more than 95% of traditional medicine preparations are of plant origin (NBSAP,

2005). Due to cultural and biological diversity, medicinal plants are more known in the south and south-western parts of Ethiopia (Edwards, 2001).

2.5. Medicinal Plants in Public and Livestock Health Care System

The available modern health care services of the country are not only insufficient, but also inaccessible and unaffordable to the majority (Haile *et al.*, 2008). This problem along with the rapidly increasing human population and cultural resistance towards the use of modern medicines made the majority of the people in Ethiopia to depend on traditional medicines mainly of plant origin (Dawit, 2001). About 1000 identified medicinal plant species are reported in the Ethiopian Flora, however, many others are not yet identified. Of these, about 300 species are frequently mentioned in many sources (Endashaw, 2007). However, little investigation has been done in recent decades to enhance and develop the beneficial aspects of traditional medicine including related research and its gradual integration into modern health care system (Lambert, 2001). In Ethiopia, conventional veterinary services have been playing a paramount role in the control and prophylaxis of livestock diseases in the last three decades (Teshale Sori *et al.*, 2004). However, they cannot yet deliver complete coverage in preventive and curative health care practices, because of inadequate supply of drugs and the high cost.

Ethiopia with its diverse physiogeographic features has diverse flora, which is estimated to be between 6,500 and 7,000 species of vascular plants (Ermias *et al.*, 2008). Even though, there are some common medicinal plants in traditional health care practice, only few species of medicinal plants have been identified and documented so far.

2.6. Threat and Conservation of Traditional Medicinal Plants in Ethiopia

2.6.1. Threats to medicinal plants

Some medicinal plant species of Ethiopia are reported to have been threatened because of over harvesting for marketing as medicine. Among many medicinal plants in Ethiopia, about 26 species are endemic and they are becoming increasingly rare and at the verge of extinction (Tesfaye and Sebsebe, 2009). Equally threatened is the knowledge base on which the traditional medical system is based, as the ethnomedicinal information is not documented and

remains in the memory of elderly practitioner members of society since only a few young people are willing to acquire the knowledge. According to (Fisseha *et al.*, 2009), less than 2% of them were ready to transfer their knowledge on incentive bases. Therefore, detailed information on the medicinal plants of Ethiopia could only be obtained when studies are undertaken in the various parts of the country where little or no botanical and ethnobotanical explorations have been made.

A good example of threatened species is *Taverniera abyssinica* whose slender roots are swathed and small coiled bundles presented for market. *T. abyssinica* is a popular traditional medicine for what is known as stomach ache and fever diseases (Endashaw, 2007). There are 40 species of Aloe where the sap of some species is used for medicinal, food and cosmetic application and is widely used internationally, of these 20 species are endemic and 18 are threatened. Debela *et al.* (2004) and Mirutse (2001) also stressed modern education as having an impact on the knowledge. They pointed out that those students who attended modern schools are showing unwillingness to learn from their parents, which is an evidence for the gradually disappearing traditional knowledge.

2.6.2. Conservation of traditional medicinal plants

Ethiopia has policies and strategies that support the development and utilization of plant resources in a sustainable manner. The policies are reflected under various sectors including environmental protection, development of the natural resources and diversification of the domestic and export commodities (Endashaw, 2007).

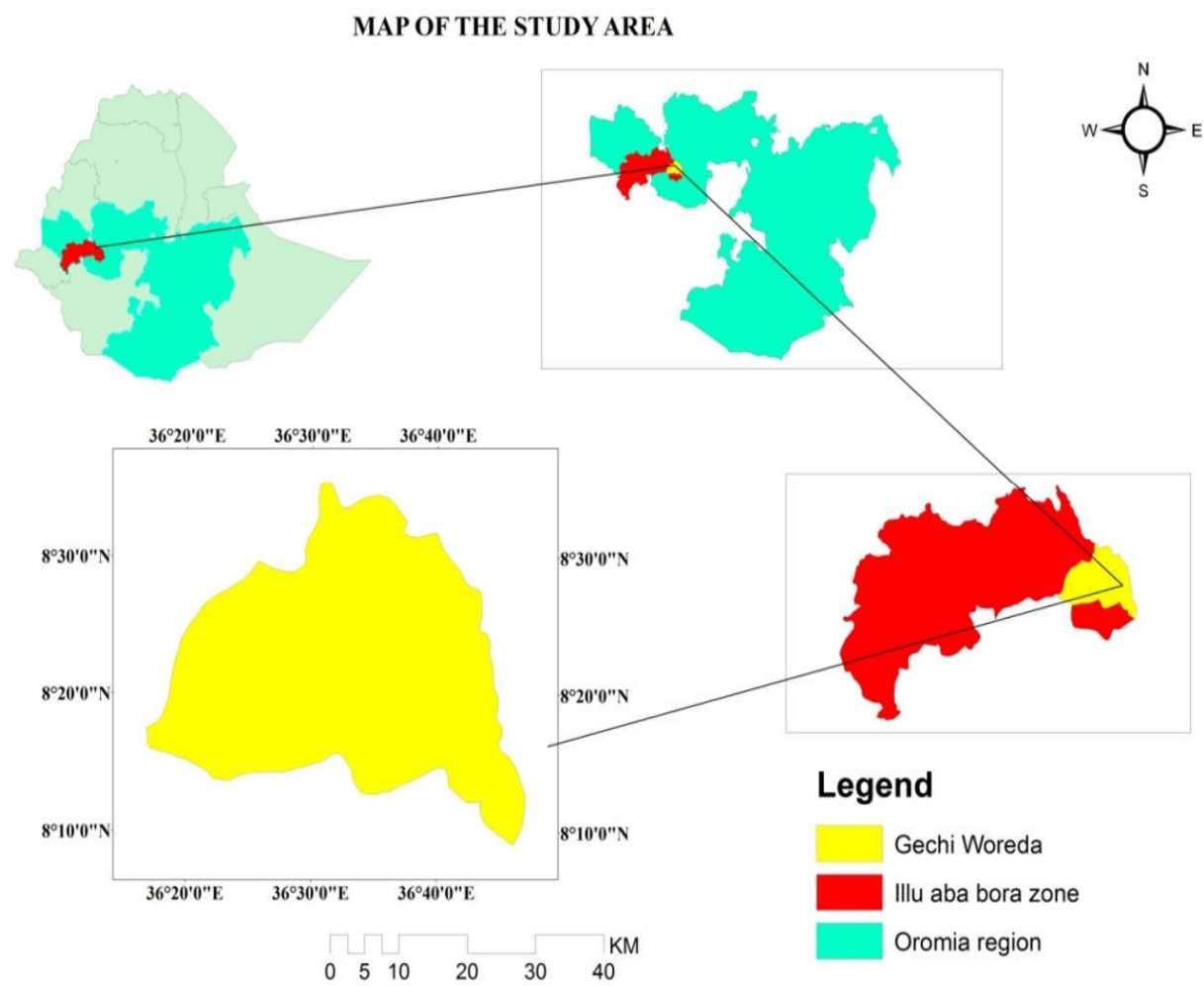
Conservation is achieved through *in-situ* and *ex-situ* conservation method. *In-situ* conservation is conservation of species in their natural habitat. Some traditional medicinal plants have to be conserved *in-situ* due to difficulty for domestication and management (Zemedu, 2001). Moreover, some plants fail to produce the desired amount and quantity of the active principles under cultivation out of their natural habitats. Medicinal plants can also be conserved by ensuring and encouraging their growth in special places, as they have been traditionally (Zemedu, 2001), this can be possible in places of worship (churches, mosques, grave yards, etc), sacred grooves, farm margins, river banks, road sides, live fences of gardens and fields.

According to Zemedu (2001), medicinal plants can be conserved using appropriate conservational methods in gene banks and botanical gardens. This type of conservation of medicinal plants can also be possible in home gardens, as the home garden is strategic and ideal farming system for the conservation, production and enhancement of medicinal plants.

3. MATERIALS AND METHODS

3.1. Description of the Study Area

The study was conducted in Gechi, Buno Bedele Zone of Oromia Region, Ethiopia (Fig.1). It is about 481 km away from Addis Abeba. It located between $8^{\circ}10'$ - $8^{\circ}30'N$ and $36^{\circ}20'$ - $36^{\circ}40'E$ latitude and longitude, respectively. It bordered on the south by Didessa, on the east by the Jimma Zone, on the north by Bedele, and on the west by the Didessa river which separates it from the Jimma Zone (CSA, 2007). Elevation of the study area is about 1,787 meters above sea level. Its total land mass coverage is 1,400.47 square kilometers with estimated population density of 83.4 people per square kilometer, which is greater than the Zone average of 72.3. The district is sub-divided into 19 kebeles of which three are urban and the rest are rural (CSA, 2007). Gechi is a home for a total of 17,395 heads of households and 2048 total family members.



Source: GIS map by Geography Department student

Figure 1. Map of the study area

3.2. Vegetation and Major Cultivated Crops

The vegetation of the study area consists of various trees, shrubs and herbaceous species. Some of the common plant species include: *Croton macrostachyus*, *Maesa lanceolata*, *Ocimum gratissimum*, *Vernonia amygdalina*, *Bersama abyssinica*, *Cynodon dactylon*, *Ficus sur*, *Clausena anisata*, *Syzygium guineense*, *Justicia schimperana*, *Phytolacca dodecandra*, *Clerodendrum myricoides*, *Capparis cartilaginea*, *Solanum marginatum* etc (Coffee Production, 2006). Coffee is an important cash crop of the district; around 48 to 50 square kilometers are planted with this crop (Coffee Production, 2006). The common crops cultivated in the study area include *Guizotia abyssinica*, *Hordeum vulgare*, *Triticum aestivum*, *Linum usitatissimum* etc.

3.3. Population and Medical Services

According to CSA (2007), the total population of the study area was 70478 of which 35,307 were men and 35,171 were women; 5,442 or 7.72% of the population were urban dwellers. The majority (87.7%) of the inhabitants were Muslims, while 10.58% was Ethiopian Orthodox Christians and 1.66% Protestants. Oromo was the dominant (96.59%) ethnic group while all other ethnic groups constituted (3.41%) of the population of the site respectively. Oromiffa is spoken as a first language by 97.16% of the people while Amharic was spoken by 2.09% of the population. According to the District Health Office, the 19 kebele had only 4 health centers and 17 health posts serving the entire population. In addition, the district had 3 veterinary health clinics that were serving many livestock population of the district.

3.4. Ethnobotanical Data Collection

Reconnaissance survey was made to purposively select three kebeles of the district based on vegetation cover, traditional medicine use history, availability of medicinal plants and traditional healers. Accordingly, of the 19 kebeles of the Woreda, 3 kebeles namely Imboro, Koba and Dike were selected. For ethnobotanical data collection, 100 respondents (age ≥ 20) were selected. From these, 84 respondents were non-traditional healers, which are community members, selected randomly in 1:1 sex ratio (see Table 1). Traditional healers (16) were selected purposively from the selected kebeles based on the information gathered from the local people (Abebe, 2013).

Table 1: Total number of informants in the study area in each kebele

Name of Kebele	Agro-ecology	Traditional Healers			Non traditional Healers			Total Informants		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
Imboro	Dega	7	1	8	20	20	40	27	21	48
Koba	Dega	4		4	13	13	26	17	13	30
Dike	Dega	3	1	4	9	9	18	12	10	22
Total		14	2	16	42	42	84	56	44	100

Ethnobotanical data were collected from September 18, 2017 to December 12, 2017 by two field trips made to the site for 16 and 21 days respectively. The data collection methods were

semi-structured interviews, group discussion, and guided field walk with selected traditional healers (selection based on their willingness to go with the researcher for field observation). Traditional healers were first interviewed individually to mention about the local names of the plants they use to treat diseases, diseases treated, part(s) of plants used, methods of preparation of remedies, route of application of the remedies and dosage. Similar procedures were also applied with randomly selected non-healers for traditional medicine. Further group discussions were made with selected traditional healers (3 from the 16 traditional healers) depending on experience and having more knowledge while conducting data collection on the entire mentioned medicinal plants. Field visit was made with them for onsite observation of the plants. Voucher specimens were collected, pressed, and dried for identification. For some species, preliminary identification was done in the field using illustrations. In addition, further identification of all specimens was done by comparison with authentic specimens and with the assistance of experts at Addis Ababa University, National Herbarium. The identified specimens were deposited in Haramaya University Herbarium.

3.5. Data Analysis

Ethnobotanical data were summarized using descriptive statistical method.

Jaccard's similarity index

Jaccard's similarity index is a statistical measure used for comparing the similarity and diversity of sample sets; measures similarity between sample sets, defined as the size of the intersection divided by the size of the union of the sample sets.

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

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

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

Independent Sample t-Test

Since Independent Sample t-Test used for analysing two variable, differences in traditional medicinal knowledge due to sex was analyzed using independent t-test using number of medicinal plants reported as a dependent variable.

Informant consensus factor

Informant consensus factor (ICF) was calculated for categories of ailments to identify the agreements of the informants on the reported cures using the formula used by (Rodrigo *et al.*, 2005) and Tilahun and Mirutse (2007). ICF was calculated as follows: number of use citations for each ailment (n_{ur}) minus the number of species used (n_t) for that ailment, divided by the number of use citations for each ailment minus one.

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

Fidelity level

The fidelity level (FL), the percentage of informants claiming the use of a certain plant for the same major purpose, was calculated for the most frequently reported diseases or ailments using the following equation (Tilahun and Mirutse, 2007).

$$FL(\%) = \frac{NP}{N} \times 100$$

Where N_p is the number of informants that claim the use of a plant species to treat a particular disease, and N is the number of informants that use the plants as a medicine to treat any given disease.

Preference ranking

To compare the most effective medicinal plants used by the community to treat the particular disease, preference ranking was conducted following Martin (1995) and Cotton (1996) for most important medicinal plants used in treating the Stomach ache. For this, ten key informants were selected to identify the best preferred medicinal plant species for treatment of the illness. Each informant was provided with the mentioned medicinal plants reported to cure the illness with leaves of medicinal plant used being paper tagged, then asked to assign (10) for the most preferred species against the illness and the lowest value (1) for the least preferred plant and in accordance of their order for the remaining one. The value of each species was summed up and the rank for each species was determined based on the total score.

Direct matrix ranking

Direct matrix ranking exercise was done following Martin (1995) and Cotton (1996) in order to compare multipurpose use of a given species and to relate this to the extent of its utilization versus its dominance. Based on information gathered from informants, multipurpose tree species were selected out of the total medicinal plants and use diversities of these plants were listed for selected key informants to assign use value to each species. Then each key informant was asked to assign use values (5=best, 4=very good, 3=good, 2=less used, 1= least used, and 0=not used). Accordingly, each key informant use values for the selected multipurpose medicinal plant species, average value of use diversity for a species was taken and the values of each species were summed up and ranked.

Difference in traditional medicinal knowledge

Difference in traditional medicinal knowledge due to age group (grouped into three groups; 25-40,41-60 and >60) and education level (grouped as illiterate, elementary and secondary school completed) were analyzed using one way-ANOVA and number of medicinal plants reported as dependent variable (Table 10). SPSS version 20 software was used for the statistical analysis.

4. RESULTS AND DISCUSSION

4.1. Medicinal Plants of the Study Area

From the three Kebelles surveyed, totally, 70 plant species belonging to 61 genera and 36 families were collected and identified. About 84% and 12 % were reported to treat only human and livestock ailments, respectively. Four percent of the plants were being used to treat both human and livestock ailments (Appendix Table 1).

Number of documented species per family showed that Asteraceae was number one with 7 species, followed by Fabaceae with 6 species, Solonaceae and Polygonaceae each with 4 species, Cucurbitaceae, Lamiaceae, Euporbiaceae and Moraceae each with 3 species, Myrtaceae, Myrsinaceae, Capparidaceae and Cupressaceae each with 2 species and all the rest families accounted for 1 species each (See appendix table 1). Majority of the medicinal plant species were found in wild environment (Table 2). Richness of medicinal plants in the wild was suggesting protection efforts made by farmers around their coffee cultivation site and at edge of farm land for various purposes. Since number of medicinal plant species obtained from home gardens was also high, a well-designed home gardening may be a promising activity of maintaining diverse species in the study area.

Table 2: Distribution of medicinal plants in different habitats

Habitat	No. of medicinal plants	Percentage
Forest	26	37.1
Home garden	18	25.7
Road side	12	17.1
Around river	6	8.6
Agricultural field	4	5.7
Grazing Land	3	4.3
On Tree	1	1.4
Total	70	100

Some medicinal plants appear to have more medicinal values than others and cited more frequently. To mention some of them, *Allium sativum* was cited by 47 informants as a source of remedy for treating Plasmodium, Common cold and Tooth disease followed by *Datura*

stramonium cited by 38 informants for Dandruff, Wart and Toothache and *Coccinia abyssinica* cited by 36 informants to treat Broken Bone (Table.3).

Table 3: Some of the medicinal plants cited most by informants

Botanical name of medicinal plants	No. of informants	Percentage
<i>Allium sativum</i>	47	47
<i>Datura stramonium.</i>	38	38
<i>Coccinia abyssinica</i>	36	36
<i>Indigofera hochstetteri</i>	32	32
<i>Ruta chalepensis</i>	29	29
<i>Embelia schimperi</i>	18	18
<i>Rosmarinus officinalis</i>	17	17
<i>Ocimum gratissimum</i>	15	15

From the 70 medicinal plants collected, majority of them were shrubs. Herbs were the next largest life forms followed by trees, climbers and epiphytes (Fig. 2). In some other similar studies, herbs constituted the largest proportion as opposed to this result. This may be due to the dominance of shrub species in this study area's environment. Relatively high number of herbs and shrubs for medicinal purpose has also been reported previously by Debela *et al.* (2004) and Mekonnen (2013).

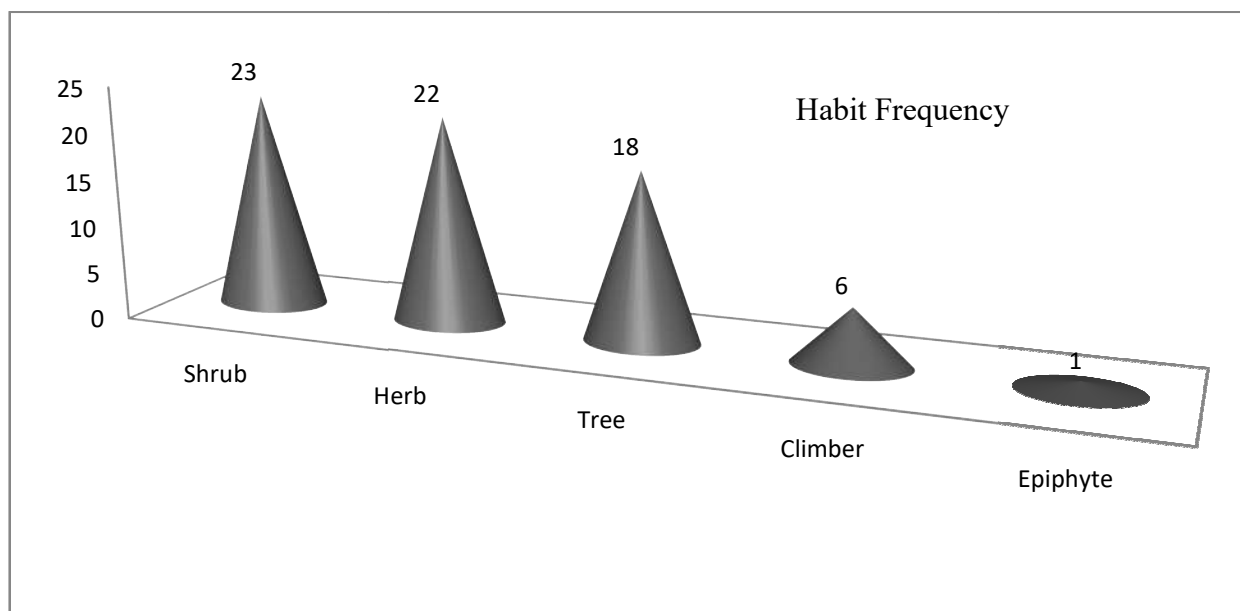


Figure 2: Habit distribution of medicinal plants from Gechi District

4.2. Plant Part(s) Used for Medicine and Preparation Methods

Most previous ethnobotanical studies on medicinal plants conducted by different researchers (Bayafers, 2000; Endalew, 2007; Mekonnen 2013; Jarso, 2016) reported that leaf was the most frequently used part of plant for remedy preparation. In this study the same was noticed with other parts such as roots, seeds and fruits also reported as main plant parts for medicine preparation (Table 4). Although use of leaf may not bring harm to plants, use of root that may require uprooting of the entire plant or injurious cutting can threaten the life of plant. Therefore, maximum care should be taken for such plants.

Table 4: Plant parts used for traditional medicine preparations in Gechi district

Plant parts	Total responses	% of total
Leaf	52	42.3
Root	22	17.9
Seed	9	7.3
Fruit	7	5.7
Stem	6	4.9
Sap	5	4.1
Whole plant	3	2.4
Bulb	3	2.4
Bark	3	2.4
Leaf and root	3	2.4
Shoot	2	1.6
Latex	2	1.6
Fruit and leaf	1	0.8
Stem and leaf	1	0.8
Above ground part	1	0.8
Stem or leaf	1	0.8
Leaf or latex	1	0.8
Leaf and seed	1	0.8
Total	123	100

As for the preparation methods, local people reported that plant parts will be crushed/pounded or squeezed out the sap for direct administration or cooked/boiled. Preparations may involve using a single plant part or mixtures of different organs of the same plant. In most cases (73%) remedy preparations involved the use of fresh parts and use of dried form accounted for 22%. In some other instances, (5%) fresh or dried forms of plant parts were used for remedy preparations. Depending mainly on the location of the ailment (whether internal or external) preparations would have been administered through different routes. These routes of

administration include oral (by drinking or eating), dermal (by creaming, rubbing against the skin, tying to external body parts), through nose (by smoking/fumigation) and eye (Fig. 3). Water, oil, sugar, salt, milk, honeys are some of the additives that the local people reported to be used to improve the flavor and reduce adverse effects such as vomiting and diarrhea so that the efficacy of the traditional medicine would be maintained or increased. Although there is limit of measurement in the amount of remedy to be administered, especially for those that are taken inside through mouth, ear or eye, there is no as such standardized dosage. Patients are simply advised to take medicines after being inspected by traditional healers about their age, physical condition and severity of the diseases. This as has been reported in different other such studies is a drawback in this study area (Mulugeta, 2014).

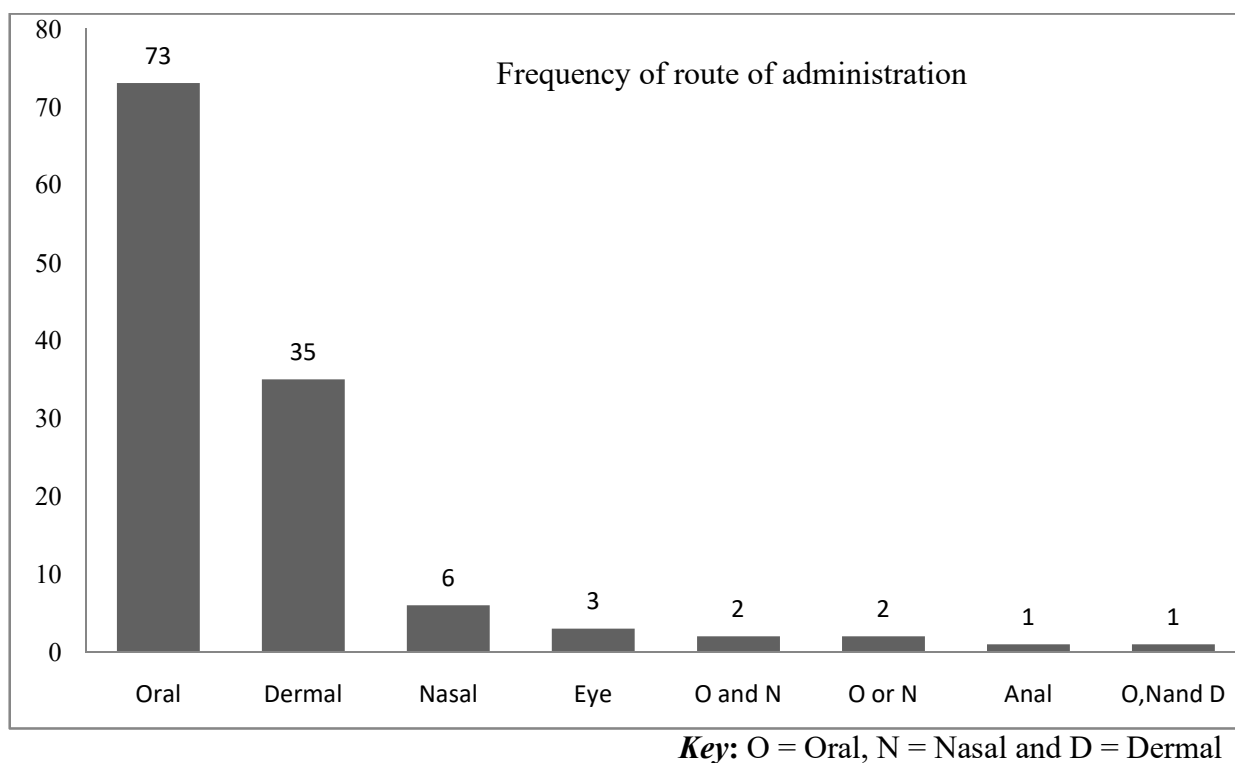


Figure 3. Route of administration of plant remedies used for human and livestock ailment

4.3. Ethnomedicinal Plant Importance and Use Knowledge

4.3.1. Jaccard's Similarity Index

In order to assess similarity in traditional medicinal knowledge between inhabitants of the three Kebelles, Jaccard's similarity index was calculated. The value of this index ranges from

zero to one, where zero shows no similarity and one shows 100% similarity. Overall, result of the assessment showed that JI was >0.75 (Table 5), suggesting that people of the three Kebeles use at least 75% of the plants in common as medicinal value. The similarity may be due to similar nature of environments between kebeles to support similar vegetation. It is also possible that information on these medicinal plants can easily flow between Kebeles so that used by people.

Table 5: Jaccard's similarity index of indigenous knowledge among selected sites

Kebeles	Imboro	koba	Dike
Imboro	1	0.91	0.83
Koba	0.91	1	0.75
Dike	0.83	0.75	1

4.3.2. Informant consensus factor

Based on the bodily functional similarity and resemblance of symptoms, all cited human diseases were categorized into 8 categories (Table 6). Disease categories with relatively higher ICF values were Problems of the genitourinary system, Problems of the sensory organs and Problems of the respiratory system. The finding agrees with some previous conducted researches on the common occurrence of these diseases so that more number of people exchanging information and agree on plant species that can be used to treat these diseases than the rest. (Endalew 2007 and Mulugeta , 2014).

Table 6: Informant consensus factors of corporal diseases

Disease Categories	Nt	Nur	ICF
Problems of the genitourinary system	3	9	0.75
Problems of the sensory organs	7	16	0.66
Problems of the respiratory systems	4	16	0.63
Skeletal, muscle and connective tissues	2	9	0.5
Swelling and hemorrhoid	2	3	0.5
Headache, fever, Common cold, febrile illness and related diseases	9	3	0.47
Skin and subcutaneous tissues and related diseases	15	26	0.44
Gastrointestinal related diseases	24	38	0.38

4.3.3. Fidelity Level Index

Computation of FL using some commonly reported medicinal plants showed that values overall varies from 62-97% (Table 7). Generally, the medicinal plants that are widely used by local people to treat several ailments have less fidelity level value (Table.7). For example, *Juniperus procera* was reported by many informants to treat wound and hence had 97% FL. This in turn tells us that medicinal plants that used for specific diseases treatment have high FL value than plants used for several diseases.

Table 7: Fidelity index of some medicinal plants

Botanical name of medicinal plants	Examples of ailment treated	Np	N	FL	FL%
<i>Juniperus procera</i>	Wound	28	29	0.97	97%
<i>Afrocarpus falcatus</i>	Stomachache	28	31	0.90	90%
<i>Euphorbia lathryis</i>	heart burn	25	29	0.86	86%
<i>Premna resinosa</i>	Eye disease	23	27	0.85	85%
<i>Embelia schimperi</i>	Tape worm and Hookworm	21	26	0.81	81%
<i>Coffea arabica</i>	Diarrhea	18	24	0.25	75%
<i>Datura stramonium</i>	Tooth ache	19	26	0.73	73%
<i>Indigofera hochstetteri</i>	Tetanus	18	25	0.72	72%
<i>Croton macrostachus</i>	Wound	25	37	0.67	67%
<i>Coccinia abyssinica</i>	Broken bone	22	35	0.62	62%

4.3.4. Preference ranking

Preference ranking of ten medicinal plants that were reported for treating stomachache was conducted after selecting ten key informants. The informants were asked to compare the given medicinal plants based on their efficacy and to give the highest number (10) for the medicinal plant which they thought most effective in treating stomachache and the lowest number (1) for the least effective plant in treating stomachache. *Ruta chalepensis* scored 53 and ranked first indicating that it is the most effective in treating stomach ache followed by *Carissa spinarum* and the least effective was *Ehretia cymosa* (Table 8)

Table 8: Preference ranking of medicinal plants used for treating Stomachache

List of medicinal Plants	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	Total	Rank
<i>Ruta chalepensis</i>	10	10	10	10	9	9	9	9	8	6	90	1st
<i>Carissa spinarum</i>	10	8	9	8	5	8	7	9	9	9	82	2nd
<i>Coffeearabica</i>	10	10	9	7	7	9	8	8	6	4	78	3rd
<i>Vernonia amygdalina</i>	6	5	7	10	8	8	5	4	10	9	72	4th
<i>Rumex nepalensis</i>	3	5	5	7	10	4	7	9	10	8	68	5th
<i>Afrocarpus falcatus</i>	10	10	9	7	2	3	3	7	5	5	61	6th
<i>Solanum marginatum</i>	10	9	2	5	4	8	9	2	3	8	60	7th
<i>Eucalyptus globulus</i>	1	3	6	5	6	9	10	2	4	8	54	8th
<i>Salix subserrata</i>	1	1	2	8	9	4	4	7	5	2	43	9th
<i>Ehretia cymosa</i>	3	1	1	8	1	5	2	6	1	4	32	10th

R= key informants

4.3.5. Direct matrix ranking

Charcoal making, construction, firewood, fencing, food, forage, furniture and medicine were use values that people of the study area used. Some of the plants were known to be used for most of these purposes. Therefore, direct matrix ranking was done for some selected multipurpose plants. Ranking of the fourteen plant species was done based on the use criteria rated as 5 = best; 4 = Very good; 3 = good; 2 = less used; 1 = least used and 0 = no value. Result showed that *Syzygiumguineense* was the most utilized plant for different use values followed by *Afrocarpus falcatus*, *Carissa spinarum*, *Eucalyptus globulus*, *Prunus africana*, *Juniperus procera*, *Cupressus lusitanica*, *Croton macrostachyus* and *Acacia abyssinica* (Table. 9).

Table 9: Direct matrix ranking of selected multipurpose plant species.

Plant Species	Use Categories								Total	Rank
	Charcoal	Construction	Fencing	Fire	Food	Forage	Furniture	Medicine		
<i>Syzygium guineense</i>	5	4	2	5	4	4	4	3	31	1 st
<i>Podocarpus falcatus</i>	5	5	3	5	0	0	5	3	26	2 nd
<i>Carissaspinarum</i>	3	0	4	4	5	4	0	5	25	3 rd
<i>Eucalyptus globulus</i>	2	5	5	5	0	0	4	3	24	4 th
<i>Prunus africana</i>	4	4	1	5	0	2	4	3	23	5 th
<i>Juniperus procera</i>	3	5	3	4	0	0	4	3	22	6 th
<i>Cupressus lusitanica</i>	3	5	2	4	0	0	4	3	21	7 th
<i>Croton macrostachyus</i>	5	2	2	4	0	0	2	5	20	8 th
<i>Acacia abyssinica</i>	5	2	1	4	1	1	2	3	19	9 th
<i>Ficus sur</i>	2	3	1	3	3	3	1	3	19	9 th
<i>Maisa lanceolata</i>	4	2	2	4	1	1	1	3	18	10 th
<i>Vernonia amygdalina</i>	2	0	3	3	0	4	1	4	17	11 th
<i>Premna resinosa</i>	2	2	3	3	0	1	1	4	16	12 th
<i>Bersama abyssinica</i>	2	0	3	4	0	0	0	5	14	13 th
Total	47	39	35	57	14	20	33	50	295	
Rank	3rd	4th	5th	1st	8th	7th	6th	2nd		

4.4. Socio-Demographic Factors Influencing Indigenous Medicinal

Knowledge

Analyses of gender, age and educational status of respondents influenced knowledge of the local people on medicinal plants. Age wise, participants of the study were grouped into three categories and analysis of variance (one-way ANOVA) showed that there was significant

($P < 0.002$) difference between the three age groups in the number of medicinal plants reported (Table 10). The results revealed that knowledge on medicinal plants increases with age. This could be because of the fact that the elders have accumulated knowledge through their life-long experiences of interactions with their environments, and due to the fact that the young generations are under the influence of modernization and globalization. The same result was reported by different researchers (Sintayehu, 2011; Anteneh *et al.*, 2012; Berhane *et al.*, 2014; Abebe, 2017; Yeshanbel, 2017). This indicates that indigenous knowledge of medicinal plants differs among the same community members within different age level and educational level.

Traditional medicinal knowledge also varied significantly ($P < 0.002$, independent samples T-test) between male and female with males reporting higher number of medicinal plants than females (Table 10). Likewise, educational level had significant impact on traditional medicinal knowledge of the study area. Modern education has contributed to the loss of indigenous knowledge of ethnomedicinal plants in the study area. The same result was reported by different investigators (Gidey and Samuel, 2012).

Table 10: Traditional medicinal plant knowledge variation among sex, age and education level

Sex	Mean value	p- value of t- test
Male	7.91	0.002
Female	3.92	
Age	Mean value	one way- ANOVA
25-40	4.81	0.001
41-60	6.74	
>60	7.51	
Education level	Mean value	one way- ANOVA
Illiterate	8.10	0.003
Elementary education	6.01	
Secondary education	5.87	

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary and Conclusions

The study on ethnobotany of traditional medicinal plants used by people was conducted in Gechi district, Buno Bedele Zone of Oromia Region, Ethiopia. The study was aimed at collecting, identifying and documenting traditional medicinal plant specimens used by the people of the district for treatment of human and livestock health problems. The study involved selecting non-practitioners of traditional medicine randomly and practitioners purposively between the ages of ≥ 20 . Semi-structured interviews, observation, group discussion and guided field walk, preference ranking, direct matrix ranking and informant consensus factor and fidelity level were applied to collect and analyze the data.

Gechi district comprises diverse plant species. In this study, 70 medicinal plant species were recorded. Of these, 84% and 12% were reported to treat human and livestock ailments, respectively while 4% were cited to be used as treatment for both humans and livestock ailments. Majority of medicinal plant species were obtained from wild vegetation (37.1%) followed by Home garden (25.7%), Road side (17.1%), Around River (8.6%), agricultural field (5.7%), Grazing Land (4.3%) and on tree (1.4%). Analysis of growth forms of these medicinal plants revealed that shrub species 23(32.9 %) constitute the largest category followed by herb species 22(31.4 %), tree species 18 (25.7%), climbers 6(8.6%) and epiphyte 1 (1.4%). Leaves were the most frequently used plant parts followed by root for preparation of human and livestock remedies. Herbal remedies are prepared from fresh materials 93(73%), dried plant materials 28(22%) and fresh or dried 6(5%). Traditional medicine preparation mostly involved single plant. Route of administration was mainly internal in which oral administration is the common route followed by dermal (external application). Analyses of gender, age and educational status of respondents influenced knowledge of the local people on medicinal plants

5.2. Recommendations

- Encouraging people to protect and enclose ritual and spiritual areas with higher distribution of medicinal plants in the locality.

- Local people must be taught about the importance of growing medicinal plants in home gardens mixing with crops in the farm lands and live fences.
- In order to use medicinal plants sustainably, the traditional healers should harvest parts other than the roots, but if using the root is mandatory, he/she should try to plant two or more plants before rooting up the plant

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7. APPENDICES

7.1. Appendix I: List of Medicinal Plants

Appendix table 1: List of medicinal plants used for the treatment of human and livestock ailments with their scientific name, family, local name, habit, habitat, parts used, disease treated, methods of preparation with dosage used and route of application

Key: Habitat; Agricultural field (AF), Home garden (HG), Forest (F), Road side (RS), Grazing land (GL), Around river (AR) and On the tree (OT). Treatment for; Human (H), Livestock (L) and Both (B). Route; Oral (O), Nasal (N), Dermal (D) Eye (E), Anal (A), Oral or Nasal (on), Oral and Nasal (ON) and Oral, Nasal and Dermal (OND). Common Name; Oromiffaa (O) and Amharic (A).

Scientific name and Habit	Family	Comm on Name	Ha bit at	Disease treated.	Tre atm ent for	Part(s) used and mode of preparation	Ro ute
<i>Acacia abyssinica</i> Tree	Fabaceae,	1.Laaftoo(O)	F	Tonsillitis	H	Root: Fresh root bark is given for chewing.	O
				Eye disease	H	Shoot: shoot or nearly growing leaf squeezed and directly applied to infected eye.	E
<i>Afrocarpus falcatus</i> (Thunb.) Mirb. Tree	Podocarpaceae	2. Zigba (A)	F	Stomach ache	H	Leaf: Leaf combined with leaf of <i>Syzygium guineense</i> and smashed, immerse in water, drink before breakfast every morning, this induces vomiting which is thought to help treat severe Stomach trouble.	O
				Diarrhea	H	Leaf: Fresh leaf is smashed and the extract is given orally.	O
<i>Allium sativum</i> Herb	Alliaceae	3.Qullubbiadii(O)	HG	Malaria	H	Bulb: Bulb of <i>Allium sativum</i> and rhizome of <i>Ginger officinale</i> are pounded and eaten with honey.	O
				Common cold	H	Bulb: Bulb is pilled and inner part is inserted to nasal pore after sleeping when breathing is difficult through nose.	N
				Tooth disease	H	Bulb: Bulb pilled and inner part is put on affected part of teeth.	O

Cont'd

Scientific name and Habit	Family	Common Name	Habitat	Disease treated.	Treatment for	Part(s) used and mode of preparation	Route
<i>Artemisia abyssinica</i> Sch., Bip. Ex A.Rich. Shrub	Asteraceae,	4.Qoddoo(O)	HG	Malaria	H	Leaf: Fresh leaf and <i>Allium sativum</i> bulb are squeezed together and given orally or nasally.	on
<i>Asplenium monanthes</i> L. Epiphyte	Aspleniaceae	5.Digalu bakkan nisaa (O)	OT	Headache	H	Leaf: Leaf of <i>Asplenium monanthes</i> is pounded with leaf of <i>Cussonia ostinii</i> and cup of tea is taken by human.	O
<i>Bersama abyssinica</i> Fresen. Tree	Melianthaceae	6.Lolchisaa (O)	F	Plague	L	Root: Root is crushed and mixed with water, sprayed on cattle skin and consumed directly.	D
				Stomachache	H	Shoot: Shoot is smashed and mixed with water, drink by cup of tea.	O
<i>Beta vulgaris</i> L. Herb	Chenopodiaceae	7.Qosta (O)	HG	dehydration	H	Leaf: The fresh leaves will be cooked with oil & added salt, then after will be eaten.	O
<i>Bidens biternata</i> (Lour.) Merr. and Sherff Herb	Asteraceae	8.Cogogitii gurraatii	RS	Febrile	H	Leaf: Leaf will be pounded together with leaf of <i>Croton macrostachyus</i> and rubbed against the body.	O
<i>Bidens pilosa</i> L. Herb	Asteraceae	9.Maxanne(O)	GL	Nasal bleeding	H	Leaf: Freshly squeezed leaves are inhaled through nasal opening.	N
<i>Calpurnia aurea</i> (Ait.)Benth./ Shrub	Fabaceae	10.Cee kaa (O)	AR	wound	H	Leaf: Leaf is smashed and the solution is added to parasite infected wound.	D
				Scabies	L	Leaf: Leaf of <i>Calpurnia aurea</i> is pounded and mixed with water, used to wash scabies of cattle.	D
<i>Capparis cartilaginea</i> Decne. Climber	Capparidaceae	11. Gooraa (O)	RS	Toothache	H	Root: Root will chewed and held onto the teeth.	O

Cont'd

Scientific name and Habit	Family	Comm on Name	Ha bit at	Disease treated.	Tre atment for	Part(s) used and mode of preparation	Ro ute
<i>Carissa spinarum</i> L. Shrub	Apocynaceae	12.Hagamsa (O)	F	Gonorrhoea and Stomach ache	H	Root: Fresh root of <i>C. spinarum</i> is pounded and mixed with local alcohol such as “Tella”.	
				Stomach ache	H	Leaf: Pounded leaf of <i>Carissa spinarum</i> mixed with honey, taken in small amount every morning.	
				Head ache	H	Leaf: Leaf of <i>Carissa spinarum</i> is pounded and dried. Dry smoke is used as treatment for head ache.	
<i>Capparis tomentosa</i> Lam. Shrub	Capparidaceae	13.Harangamaa(O)	F	Head ache	H	Root: Dried root is powdered and one spoon of the powder is mixed with alcohol and given to human.	O
				diarrhea	H	Leaf: Dried and powdered leaf is mixed with water, and taken by spoon.	O
<i>Citrus limon</i> (KL.) Burm.f. Shrub	Rutaceae	14. Loomii (O)	HG	Common cold	H	Fruit: Juice will be drunk with tea.	
				Nasal bleeding	H	Sap: Sap is sniffed or taken orally.	
				Face dandruff	H	Sap: Sap of <i>Citrus lemon</i> is rubbed on deteriorated face directly.	
<i>Clausena anisata</i> Shrub	Rutaceae	15.Ulumaayii (O)	RS	Skin infection	H	Leaf: Leaf of <i>Clausena anisata</i> , <i>Solanecio gigas</i> and <i>Justicia schimperiana</i> are pounded together, and creamed on skin.	D
<i>Clematis simensis</i> Fresen. Climber	Ranunculaceae	16.Hidadafeetii (O)	F	Dandruff and Head ache	H	Leaf: Leaves of <i>Clematis simensis</i> is pounded and the solution is tied on the head for dandruff and replacement of hair.	D
				Tonsillitis	H	Leaf: Leaf is crushed and pressed, rolled in clean cloth and tied on neck.	D
				Elephantiasis	H	Leaf: Leaf of <i>Clematis simensis</i> and <i>Lagera aleta</i> are crushed, smashed and tied on swelling.	D

Cont'd

Scientific name and Habit	Family	Common Name	Habitat	Disease treated.	Treatment for	Part(s) used and mode of preparation	Route
<i>Clerodendrum myricoides</i> (Hochst.) Vatke. Shrub	Lamiaceae	17. Maraasisaa (O)	RS	Tooth ache	H	Leaf or latex: Either chewing its leaves by infected teeth or Dried powdered Latex root of <i>Clerodendrum myricoides</i> is mixed with butter and creamed on infected teeth.	O
				Tooth ache	H	Stem: Stem of <i>Clerodendrum myricoides</i> is pilled and used as teeth brush.	O
				Head ache	H	Latex: Dried, powdered Latex root of <i>Clerodendrum myricoides</i> is mixed with butter and creamed on head.	D
<i>Coccinia abyssinica</i> Climber	Cucurbitaceae	18. Ancootee (O)	HG	Broken Bone	H	Root: The root will be cooked and eaten with oat bread.	O
<i>Coffea arabica</i> L. Tree	Rubiaceae,	19. Buna (O)	HG	Diarrhea	H	Seed: Roused and pounded seed is mixed with honey and eaten.	O
				Stomach ache	H	Leaf: Drink tea made of coffee leaves mixed with chili and fennel.	O
<i>Croton macrostachyus</i> DelT. Tree	Euphorbiaceae	20. Bakannisa (O)	F	Wound	H	Sap: Sap will be rubbed against the affected body part.	D
				Ring Worm	H	Leaf: Leaf is crushed and smashed, the extract is creamed on infected area.	D
<i>Cucumis ficifolius</i> A. Rich. Climber	Cucurbitaceae	21. Yemidir Embua y (A)	AR	Stomach ache	H	Root: Fresh or dried root powder is mixed with water and given orally.	O
				Diarrhea	B	Whole plant: Whole fresh plant is used to prepare decoction with water and given for human and cattle.	O
				Taeniasis	L	Whole plant: Whole dried plant powdered with water is given orally for cattle.	O

Cont'd

Scientific name and Habit	Family	Common Name	Habitat	Disease treated.	Treatment for	Part(s) used and mode of preparation	Route
<i>Cucurbita pepo</i> L. Herb	Cucurbitaceae	22. Buq qee(O)	HG	Gonorrhoea	H	Seed: Seed powder is mixed with water and filtered.	O
<i>Cupressus lusitanica</i> Tree	Cupressaceae	23. Yeferenji Tid(A)	HG	Diarrhea (animal)	L	Leaf: Leaves crushed, juice given to animals for diarrhea.	O
<i>Cynodon dactylon</i> L. Prers. Herb	Poaceae	24. Coqorsa (O)	GL	Tissue death	H	Above ground: Above ground parts of <i>Cynodon dactylon</i> is rubbed to the affected skin for a week with butter.	D
<i>Datura stramonium</i> L. Shrub	Solanaaceae,	25. Asangira (O)	AR	Dandruff	H	Leaf: Fresh leaf is smashed and its solution is creamed on affected part of skin.	D
				Wart and Toothache	H	Stem: Leafy-stem is squeezed and its drop prepared with butter creamed on infected part.	D
<i>Dodonaea angustifolia</i> L.f. Shrub	Sapindaceae	26. Kitkita (A)	F	Wounds and Eczema	H	Leaf: Fresh leaf paste mixed with butter and applied.	D
<i>Echinops kerebicho</i> Mesfin. Herb	Asteraceae	27. Qarabicho (O)	HG	Tissue death	H	Root: Root is dried and burned, steam is fumigated or smoked	ON
<i>Echinops macrochaets</i> Fresen. Shrub	Asteraceae	28. Kushile (A)	F	Toothache	H	Root: Fresh root paste with water is given orally.	O
				Febrile illness	H	Root: Dried root decoction is given orally.	O
<i>Ehretia cymosa</i> Thonn. Tree	Boraginaceae	29. Ulaaga (O)	F	Stomachache (waransa)	H	Leaf: Leaf is smashed and the sap is taken by human.	O

Cont'd

Scientific name and Habit	Family	Common Name	Habitat	Disease treated.	Treatment for	Part(s) used and mode of preparation	Route
<i>Embelia schimperi</i> Vatke. Shrub	Lamiaceae	30.Haanquu (O)	RS	Tape worm	H	Seed: Seed is dried and powdered, mixed with water, taken by glass.	O
				hook worms	H	Seed: Seeds dried, powdered and eaten to eliminate hookworms.	O
				Hook worms	H	Leaf and seed: Leaf and seed and leaf of <i>Croton macrostchys</i> are pounded together and taken in a glass.	O
<i>Eucalyptus globulus</i> Labill. Tree	Myrtaceae	31.Bargamoodii(O)	HG	Stomach ache	H	Fruit: Chew top part of the fruit.	O
				Fever	H	Leaf: Rub leaves on skin to reduce fever.	D
				Common cold	H	Leaf: Boil Eucalyptus and Damakasse leaves in water and inhaled.	ON
				Influenza	H	Leaf: Leaves chopped and boiled. Vapor bath is taken by human.	ON
<i>Euphorbia lathyris</i> L. Tree	Euphorbiaceae	32. Ad aamii (O)	F	Heart burn	H	Stem: Stem is chopped and boiled to fumigate ulcerated breast.	D
				Rabies	L	Root: One spoon root powder mixed with a cup of fresh milk or Powder of roots or leaves mixed with water and taken by Dog.	O
<i>Ficus palmata</i> Forssk. Shrubs.	Moraceae	33.Luugoo(O)	HG	Skin infection	H	Latex: Latex will be rubbed against the skin.	D
<i>Ficus sur</i> Forssk Tree	Moraceae	34. Harbuu (O)	F	Ring worm	H	Sap: Sap of Ficus is creamed on affected skin.	D
<i>Ficus sycomorus</i> L. Tree	Moraceae	35.Odaa (O)	F	Hepatitis	H	Sap: Sap is collected from bark surface of <i>Ficus sycomorus</i> and creamed on skin.	D
<i>Foeniculum vulgare</i> L. Herb	Apiaceae	36. Ensilal (A)	RS	Incontinence	H	Whole plant: The whole part will be pounded mixed with water and drunk.	O

Cont'd

Scientific name and Habit	Family	Common Name	Habitat	Disease treated.	Treatment for	Part(s) used and mode of preparation	Route
<i>Guizotia abyssinica</i> (L.f.) Herb	Asteraceae	37. Nuugii (O)	AF	Cough and Asthma	H	Seed: Seed roasted, powdered, boiled and drunk with honey.	O
<i>Hordeum vulgare</i> L. Herb	Poaceae	38. Garbuu (O)	AF	Broken bones	H	Stem: Seed flour will be made into porridge and eaten.	O
<i>Indigofera hochstetteri</i> Bak. Herb	Fabaceae	39. Qoricha hadha' a(O)	AR	Tetanus	H	Leaf: Leaves is chopped and warmed on fire by broad leaves and fumigate on affected part, finger and nail.	D
				Tetanus	H	Root: Root of <i>Indigofera hochstetteri</i> is powdered and mixed with butter and put on affected area.	D
<i>Indigofera spicata</i> Forssk. Shrub	Fabaceae,	40. Yayit Misir (A)	F	Febrile illness	H	leaf and stem: Fresh leaf and stem is used for fire fumigation.	ON
<i>Juniperus procera</i> Hochst. ex. Endl Tree	Cupressaceae	41. Yabesha Tsid (A)	HG	Wound	H	Leaf: Fresh leaf is crushed and the solution is creamed on affected part.	D
<i>Justicia schimperiana</i> (Hochst. ex Nees) T. Anderson Shrub	Acanthaceae	42. Sen sel (A)	F	Rabies	B	Leaf: Leaf with <i>Salix mucronata</i> leaf is squeezed and juice is given for human and animals before food every morning.	O
<i>Kalanchoe densiflora</i> Rolfe. Herb	Crassulaceae	43. Endahulla (A)	RS	Gonorrhoea	H	Leaf: Leaf is squeezed, creamed on the wound.	A
				Elephantiasis	H	Leaf: Leaf is pounded and tied at the infected part.	D
<i>Lantana camara</i> L. Herb	Verbenaceae	44. Yawef qolo (A)	F	Leishmaniasis	H	Leaf: Leaf will be squeezed and sniffed.	

Cont'd

Scientific name and Habit	Family	Common Name	Habitat	Disease treated.	Treatment for	Part(s) used and mode of preparation	Route
<i>Lepidium sativum</i> L. Herb	Brassicaceae	45. Fee xoo (O)	HG	Stomach ache and Malaria,	L	Seed: Dried seed decoction is given to animals.	O
<i>Linum usitatissimum</i> L. Herb	Linaceae	46. Talbaa (O)	AF	Retained placenta digestion system	H	Seed: Seed is grinded and the powder is dissolved in water and given in glass.	O
<i>Lippia Adoensis</i> Hochst. Ex. Walp. Var. Adoensis. Shrub	Verbenaceae	47. Ku saayee (O)	RS	Fungal infection and common cold	H	Leaf: Fresh leaf juice mixed with little water and applied topically.	O
				Ring Worm	H	Leaf: Leaf is directly rubbed on affected skin.	D
<i>Maesa lanceolata</i> , Tree	Myrsinaceae,	48. Abb ayii(O)	F	Elephantiasis	H	Bark: Bark is pounded and mixed with butter, creamed on infected body.	D
				Scabies	H	Leaf: Leaves rubbed on the skin.	D
<i>Nicandra physaloides</i> Herb	Solanaceae	49. Haawwixii (O)	RS	Liver problem	H	Leaf and root: Leaf and root are pounded together and mixed with cold water and the solution is taken.	O
<i>Nicotiana tabacum</i> L. Shrub	Solanaceae	50. Tamboo (O)	HG	Blotting	L	Leaf and root: Leaf and root are dried, powdered, mixed with salt and made as bread. Slice is given to cattle for three days.	O
				Gastroenteritis	L	Leaf: Fresh leaf juice is mixed with water and given orally to cattle.	O
				Wound	H	Leaf: Dried leaf powder is mixed with <i>Coffea arabica</i> powder and applied topically.	D

Cont'd

Scientific name and Habit	Family	Common Name	Habitat	Disease treated.	Treatment for	Part(s) used and mode of preparation	Route
<i>Ocimum gratissimum</i> L. Shrub	Lamiaceae	51. Daa makase (O)	RS	Febrile illness and headache	H	Leaf: Leaf of <i>Ocimum gratissimum</i> is smashed and the solution is sniffed nasally.	N
				Headache, Cough	H	Leaf: Fresh or dried leaf is crushed with coffee and given orally before food.	O
				Allergic	H	Leaf: Leaf of <i>Ocimum gratissimum</i> is squeezed and its drop is taken.	OND
<i>Phytolacca dodecandra</i> L'Herit Shrub	Phytolaccaceae	52. Handoode (O)	RS	Anemia	H	Leaf: Leaf of <i>Phytolacca dodecandra</i> is squeezed and juice is made.	O
				Stomachache, Scabies, Itching and Rabies	B	Leaf: Fresh leaf juice is mixed with water and given orally for human and livestock.	O
				Liver problem	H	Root: Root is crushed and pounded, mixed with water. Some amount of the solution is given to human while 3-4 is used for livestock.	O
<i>Premna resinosa</i> (Hochst.) Schauer. Tree	Verbenaceae	53. Urgesaa (O)	F	Eye disease	L	Leaf: Leaves is chewed and spitted on cattle eye.	E
				Toothache	H	Root: Root is chewed and the solution is creamed on infected teeth.	O
<i>Prunus africana</i> Tree	Rosaceae	54. Hoomii (O)	F	Wound	L	Bark: Bark is powdered and added directly on wound of donkey, mule and horse.	D
<i>Rhynchosia elegans</i> A. Rich. Climber	Fabaceae	55. Tero Areg (A)	F	Rabies	B	Leaf: Dried leaf powder is mixed with little water and taken by human and livestock.	O

Cont'd

Scientific name and Habit	Family	Common Name	Habitat	Disease treated.	Treatment for	Part(s) used and mode of preparation	Route
<i>Ricinus communis</i> L. Shrub	Euphorbiaceae	56. Qoobboo (O)	HG	Amoebiasis	H	Seed: Dried seed is given for chewing during stomachache.	O
				Anthrax	H	Fruit: Dried fruit is powdered and mixed with water, given with cup of tea.	O
				Blotting	L	Root: Root is pounded with table salt, mixed with cold water, given to cattle.	O
<i>Rosmarinus officinalis</i> L. Herb	Lamiaceae	57. Yesiga Metibsha(A)	HG	Toothache	H	Leaf: Fresh leaf is given for chewing.	O
<i>Rumex abyssinicus</i> Jacq Herb	Polygonaceae	58. Meqmeqo(A)	AR	Dandruff	H	Leaf: Dry, grind, mix it with butter and rub it on the affected part or Crush and rub it on the affected part of the body/head.	D
<i>Ruta chalepensis</i> L. Herb	Rutaceae,	59. Xee naadaama(O)	HG	Stomachache	B	Leaf: Fresh leaf is crushed with <i>Allium sativum</i> bulb and water, is given orally for human and livestock.	O
				Stomachache	H	Leaf: Leaf will be crushed mixed with coffee and drunk.	O
<i>Rumex nepalensis</i> Spreng. Herb	Polygonaceae	60. Tultii (O)	AR	Stomachache	H	Root: Roots chewed and juice swallowed.	O
				Loxoscelism	H	Leaf: Leaf is directly rubbed on affected skin.	D
				Amoebiasis	H	Root: Root is pounded and given with a cup tea.	O
<i>Rumex nervosus</i> . Shrub	Polygonaceae	61. Embacho (A)	F	Scabies and Acne	H	Stem or leaf: Fresh stem or leaf is crushed and the solution is mixed with <i>Citrus lemon</i> juice and water is given for washing.	D
				Scabies	H	Leaf: Leaf is boiled and rubbed at the infected site.	D
<i>Salix subserrata</i> . Shrub	Salicaceae	62. Aleltu (O)	F	Stomachache	H	Leaf: Leaves are pounded and dried, and then mixed with milk, drunk.	O

Cont'd

Scientific name and Habit	Family	Common Name	Habitat	Disease treated.	Treatment for	Part(s) used and mode of preparation	Route
<i>Schinus molle</i> L. Tree	Anacardiaceae	63. Qundoo barbaree (O)	RS	Pharyngitis	H	Fruit: Fruit chewed for sore throat.	O
				Eye disease	L	Leaf and fruit: Leaf and fruit of <i>Schinus molle</i> are chewed and spitted on cattle, equines, goat and sheep eye.	E
<i>Solanum marginatum</i> L. f. Shrub	Solanaceae	64. Hiddii (O)	RS	Plague	L	Fruit: Fresh fruit is smashed and mixed with water and applied topically on affected body part of livestock.	D
				Skin infection	H	Fruit: Fruit is creamed on affected skin area until it is cured daily in morning.	D
				Stomach ache	H	Root: Root tip will be chewed and swallowed.	O
<i>Syzygium guineense</i> (Willd.) Dc. Tree	Myrtaceae	65. Baddessa (O)	F	hook worm	H	Bark: Bark and exudates of <i>Aloe pubescens</i> concoction is made, taken with a cup of tea.	O
<i>Triticum aestivum</i> L. Herb	Poaceae	66. Qamadii (O)	AF	Skin infection	H	Seed: Seed will be chewed and the bolus will be put on the swollen area	D
<i>Verbascum sinaiticum</i> Benth Herb	Scrophulariaceae	67. Gurra Harree (O)	GL	Incontinence	L	Root: Root will be crushed mixed with water and given to animal.	O

Cont'd

Scientific name and Habit	Family	Common Name	Habitat	Disease treated.	Treatment for	Part(s) used and mode of preparation	Route
<i>Vernonia amygdalina</i> Del. Tree	Asteraceae	68. Ebicha (O)	F	Stomach ache, Malaria	H	Leaf: Fresh leaf mixed with leaf of <i>Rumex nervosus</i> and <i>Justicia schimperiana</i> is squeezed and mixed with water is given orally.	O
				Incontinence	H	Leaf: The squeezed fresh leaf is added in water and drunk in the morning and at night.	O
				Tooth ache	H	Leaf: To treat tooth infection leaves of <i>Vernonia amygdalina</i> are chewed with bulb of <i>Allium sativum</i> .	O
				Tooth ache	H	Stem: Stem is used as teeth brush at the infected site.	O
<i>Vigna membranacea</i> (L.) A. Rich. Climber	Fabaceae	69. Hiddahantuutaa (O)	RS	Rabies	L	Root: Root is dried, powdered and baked with <i>teff</i> and given to cattle.	O
<i>Zingiber officinale</i> Roscoe: Herb	Zingiberaceae	70. Zingibaa	HG	Common cold	H	Leaf: leaves are boiled and drink the filtrate by glass.	O

7.2. Appendix II: Checklist of questioners prepared for data collection in the study area

1. Date _____ kebele _____
2. Name of respondent _____ sex _____ Age _____
 - 2.1. Occupation _____
 - 2.2. Marital status _____
 - 2.3. Religion _____
 - 2.4. Educational background _____
3. What are the most common human health problems in your kebele?
4. What are the most common livestock health problems in your kebele?
5. Do you use plants to treat disease in your locality?
 - 5.1, Name of plant _____
 - 5.2, Habitat of plant _____
 - 5.3, Habit of the plant _____
 - 5.4, part of the plant used _____
 - 5.5, Preparation methods _____
 - 5.6, Amount used (dose) _____
 - 5.7, Application methods _____
 - 5.8, Treats to the above plant _____
 - 5.9, Methods of conservation of the plant _____
and other uses of the plant _____
6. How do you prevent or control diseases?
7. How do you treat human health problems?
8. How do you treat live stock problems?
9. Which plants do you use for treating those particular diseases?
10. Local name of plants?
11. Botanical name?
12. Family name of the plant?
13. How widespread is the medicinal plants from your residence?
14. Used alone, mixed with water or other materials, concoction/decoction, etc. _____

15. Preparation forms (crushed, pounded, powder, exudation, concoction, milky latex/extract with cold water/boiled/juice etc. _____
16. Does the dosage differ among sex and age groups? _____
17. Which age groups of the local people use the medicinal plant frequently? _____
18. Any noticeable side effects? _____
19. How do you preserve traditional medicines? _____
20. Are there restrictions/taboos in collecting medicinal plants? _____
21. Are medicinal plants marketable? _____
22. Are there threats to those medicinal plants _____
23. How is the knowledge of traditional medicine passed to a family member/younger generation? _____
24. Is there any relationship between modernization and traditional medicinal plant use in the study area? _____
25. Preference ranking _____
26. Direct matrix ranking _____
27. Fidelity level index _____

Identification

Survey area/District- Gechi

Peasant Association----

Community/Village-----

Interviewer/Facilitator-----

Date/month/year-----/-----/-----

Time: From-----

-----Thank you-----

7.3. Appendix III. Human and Livestock Diseases in the Study Area

Appendix table 2: human and livestock diseases in the study area

No	English Name	Local Name (O)	No. of citation of the disease by respondent
1.	Back pain	Dhibee waransa	88
2.	Heart burn	Dhitoo harmaa	21
3.	Common cold	Dhibee Qorra	60
4.	Cough	Qakee	24
5.	Leishmaniasis	Dhibee sinbiraa	18
6.	Diarrhea/Amoebiasis	Gara kasaa	63
7.	Eye disease	Dhukuba ijaa	42
8.	Febrile illness	Michii	47
9.	Tissue death	Dhukuba mashaalee	21
10.	Fungi infection	O'ichoo	12
11.	Gonorrhea	Cophxoo	31
12.	Haemorrhoid	Kormamu Harree	26
13.	Head ache	Mata bowoo	69
14.	Heart burn	Gubaatii	43
15.	Hook worm	Sabata waqayoo	42
16.	Intestinal parasite	Ramoo gara	80
17.	Lymphatic swelling	Dhitoo	33
18.	Malaria	Busaa	29
19.	Nasal bleeding	Funuuna	51
20.	Rabies	Dhibee Saree	27
21.	Skin infection	Shifee	35
22.	Stomach ache	Garacha	91
23.	Tonsilites	Harsasee	11
24.	Tooth ache	Dhibee hilkani	67
25.	Incontinence	Rako ficanii	28
26.	Wound	Madaa	41

27.	Anthrax	Abba Sangaa	9
28.	Blotting	Bokoksaa	17
29.	Gastroenteritis	Ulandhula	11
30.	Plague	Dhukubaa ilbiisa	13
31.	Retained placenta	Diluu,Coofira	32
32.	Ascariasis	Maga, Mitimitii	72
33.	Bone fracture	Lafee cabaa	80
34.	Dandruff	Foroforii	68
35.	Eczema	Cittoo	36
36.	Ring worm	Roobbii	19
37.	Scabies	Cittoo	43
38.	Pharyngitis	Amdarra hoolaa	19
39.	Skin infection	Dhukkuba gogaa	76
40.	Influenza	Qufaa	67
41.	Liver problem	Hadhooftuu	40
42.	Tetanus	Hadhaa	70
43.	Hepatitis	Dhukkuba sinbiraa	13
44.	Anaemia	Hirrinaa dhigaa	11
45.	Allergy	Allaarjiikii	45
46.	Skin infection	Dhukuba gogaa	61
47.	Abortion	Ulfaa baasuu	24
48.	Wart	Kormoommu	7
49.	Elephantiasis	Dhukuba milaa	11
50.	Taeniasis	Hoqsisaa	8
51.	Asthma	Dhukuba Qonqoo	12
52.	Dehydration	Hirrina Bishaanii	5
53.	Loxoscelism	Dhukuba Sararitii	3
