
# JIMMA UNIVERSITY

## COLLEGE OF NATURAL SCIENCES, DEPARTMENT OF BIOLOGY

# A Study on Medicinal Plants Utilization and Conservation in Gera District, Jimma Zone, South West Ethiopia

**BY**

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## College of Natural Sciences, Department of Biology

**A STUDY ON MEDICINAL PLANTS UTILIZATION AND CONSERVATION IN GERA DISTRICT, JIMMA ZONE, SOUTH WEST ETHIOPIA**.

**M.Sc. Thesis**

**By**

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| SNNPR | Southern nation, nationalities and people regional state |
| SPSS | Stastical package for Social Science |
| GPS | Geographic position system |
| ICF | Informants consensus factor |

## ABSTRACT

The traditional medicinal plants of Gera District were studied ethnobotanically. The study aimed to document indigenous knowledge on utilization and conservation status of medicinal plants as well as to investigate the threats to medicinal plants. The data were collected from traditional healers and knowledgeable Gera people using group discussion, semi- structured interviews, guided field walks and observations with informants. A total of 63 medicinal plants, belonging to 36 families were observed. Fabaceae and Asteraceae represented by five species (7.9%) each followed by Rutaceae, Solanaceae and Cucurbitaceae Fabaceae and Asteraceae represented by five species (7.9%) each followed by Rutaceae, Solanaceae and Cucurbitaceae. Leaves were the most dominant part used, crushing were the dominant preparation method and oral were the dominant routes of administration followed by dermal. Agricultural expansion was ranked as the principal threat (41.6%) to medicinal plants followed by firewood (28.3%). Out of the total medicinal plants, 51 species (80.9%) were collected from wild, 6 species (9.5%) were collected from home garden and 6 (9.5%) medicinal plant from cultivated lands. In terms of the growth form distribution of the medicinal plant species herbs were represented by 20 species (35.7%), shrubs were represented by 16 species (28.6%). Identifying, establishing conservation strategies, encouraging people to grow and protecting indigenous knowledge of medicinal plant were suggested.

**Key words:** Conservation, Ethnobotany, Indigenous Knowledge, Medicinal plants, Gera Wereda.

# 1. INTRODUCTION

## 1.1 Background of the study

Plants have played crucial role as a source of traditional medicine in Ethiopia from the time immemorial to combat different ailments and human sufferings. The traditional health care practice is mainly dependent on medicinal plants collected from the wild. In spite of this, the medicinal plant biodiversity is being depleted due to manmade and natural calamities (Hamilton, 2003).

Ethnobotany is defined as the study of local people's interaction with the natural environment: how they classify, manage and use plants available around them (Martin, 1995). Over centuries, Indigenous people have developed their own locality specific knowledge on plant use, management and conservation (Cotton, 1996). The complex knowledge, beliefs and practices generally known as indigenous knowledge or traditional knowledge develops and changes with time and space, with change of resources and culture. To view this ethno botanical studies are useful in documenting, analyzing and disseminating knowledge and interaction between biodiversity and human society, how diversity in nature is used and influenced by human activities (Martin, 1995).

Ethiopia is endowed with a huge potential of medicinal plants and their uses that provide a wide contribution to the treatment of human and livestock aliments (Asfaw *et al*., 2001). In Ethiopia, about 80% of the human population and 90% of livestock is said to be dependent on traditional medicine for primary healthcare services and most of this comes from plants (Yineger, 2007).

The List of medicinal plants in Ethiopia, which is documented for National Biodiversity Strategy and Action plan by Tesema *et al*. (2002) shows that about 887 plant species were reported to be utilized in traditional medicine. Among these, 26 species are endemic and they are becoming increasingly rare and are at the verge of extinction. It is believed that the greater concentrations of these plants are found in the Southern and Southwestern parts of the country following the concentration of biological and cultural diversity (Yineger, 2005).

In Ethiopia, most of the medicinal plants used by herbalists are collected from the natural vegetation. Medicinal plants obtained from wild habitats are found in different natural ecosystems of the forests, grasslands, woodlands, wetlands, in field margins and home garden, as weeds and in many other microhabitats where they are harvested when the need arises (Asfaw, 2001).

Many medicinal plants are also harvested for non-medicinal purposes such as for timber, implements, firewood and other purposes. Hence, sustainable utilization measures and conservation of plants should target the habitats of such vulnerable species. Except in a few medicinal plant species where a few food crops are cultivated with medicinal value, there is no organized cultivation of plants for medicinal purposes in Ethiopia. The reason for this is that the quantities of medicinal plants traded are very small, and there is no organized large scale value addition and processing. However, there is potential in the future for increased demand for some species, and therefore it is important to identify them and start the necessary research on the conservation and sustainable utilization techniques (Bekele, 2007).

Abera (2003) assessed the locally available medicinal plants in Jimma zone and found that 39 medicinal plants were used for treatment of various diseases. Haile and Delenasaw (2007) carried out also an assessment on traditional medicinal plant knowledge and their use by local healers in Jimma zone on 27 medicinal plants. They found that the majority of the reported species grow in wild and they are rare (Fayysa *et al*., 2015).

Local communities have indigenous experience in categorizations, where they use their perceptions and experiences to categorize plants. From their experience, a number of categorization and classification criteria were developed which is important in plant diversity conservation and management. The common criteria here include plant use, habitat, life form, colour, abundance, morphological characteristics and combinations (Martin, 1995; Cotton, 1996).

Sustainable use of medicinal plants has now grown to be a timely issue in Ethiopia because of resource degradation in the lowlands and highlands. Ecosystem conservation will ensure *in situ* conservation of medicinal plants so as to apply sustainable harvesting methods for collecting

medicinal plants from wild habitats. Experience from South Africa would be essential to develop innovative methods for harvesting individual plants (Geldenhuys and Mitchell, 2006).

There is some conservation action that has been undertaken around the world designed to protect threatened medicinal plants from further damage (Cunninghum, 1996). This includes *in-situ* and *ex-situ* conservation measures. Both *in-situ* and *ex-situ* conservation efforts are implemented to capture medicinal plant genetic resources. *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 (Zemede, 2001).

Medicinal plants can also be conserved by ensuring and encouraging their growth in special places, as they have been traditionally, this can be possible in places of worship (Zemede, 2001) They are usually located close to the homestead; home gardens can accommodate women's food production and household responsibilities (FAO, 2005).

The home garden agro ecosystem in Ethiopia maintains a wide range of taxa of perennial and annual crop plants. 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. For poor rural people, medicinal plants represent affordable and locally available resources to address many diseases and health problems (Zemede, 2001).

The traditional knowledge in Ethiopia is passed verbally from generation to generation and valuable information can be lost whenever a traditional medical practitioner passes without conveying his traditional medicinal plants knowledge (Pankhurst *et al*., 2001). In addition, the loss of valuable medicinal plants due to population pressure, agricultural expansion and deforestation is widely reported by different researchers (Abebe, 2001; Berhan and Dessie, 2002). As a result, the need to conduct ethnobotanical researches and to document the medicinal plants and the associated indigenous knowledge is an urgent task (Pankhurst, 2001; Hamilton, 2003). Like some parts of the country, in Gera district there is no study was done on medicinal Plants utilization and conservation. Even if the diversity of medicinal plants in Gera district is

high nobody done study in this area. Therefore, identify the medicinal plants; access the rate of utilization and the conservation mechanisms in study area was important.

## Research questions

1. What are the main human and livestock health problem treated by medicinal plants in study area?
2. What kind of medicinal plants are used and which part of the plants are used to treat a particular or various ailments in the study area?
3. What are the major threats of medicinal plants in the study area?
4. How the medicinal plants are conserved in the study area?
5. From where are the medicinal plants harvested?

### 1.2. Objectives

#### 1.2.1. General objective

- To assess the utilization and conservation of traditional medicinal plants in Gera District Jimma zone, Southwest Ethiopia.

#### 1.2.2. Specific objectives

- To identify plant species used for medicinal purposes in treating human and livestock health problems (ailments) in Gera District.
- To identify plant parts used, way of preparation and route of administration as practiced by the local people in Gera District.
- To find out the threats of medicinal plants and identify the methods used by local peoples to conserve medicinal plants for sustainable use in Gera District.

# 2. LITERATURE REVIEW

## 2.1. The Role of Medicinal plants

According to Fassil (2001) about 75-90 % of the rural population in the world (excluding western countries) relies on traditional medicines as their only healthcare system. The majority of the population in developing countries (for instance, 80% of the population in Africa) primarily relies on traditional medicinal plants for their healthcare (WHO, 2002).

There is a large magnitude of use and interest in medicinal plants in Ethiopia due to acceptability, accessibility and biomedical benefits (Dawit, 2001). More than 35,000 plant species are being used around the world for medicinal purposes and in Ethiopia there are 800 or more plant species employed as medicinal agents; which according to the data base of the National Herbarium has grown to 1000 and more will be added to the list as new studies bring as new medicinal plants from various cultures (Tesema *et al.*, 2002).

In Ethiopia, there is a long history of using medicinal plants to treat a variety of diseases (Mesfin *et al*., 2014). Eighty percent (80%) of the human population and 90% of livestock in Ethiopia rely on traditional medicine, as many plants species have displayed medicinal value for some diseases of human and livestock (Abebe, 2001). According to Bekele, (2007) the major reasons why medicinal plants are demanded in Ethiopia are due to culturally linked traditions, the trust the communities have in traditional medicine and relatively low cost in using them.

However, the traditional knowledge of medicinal plant in Ethiopia is not compiled (Giday *et al.*, 2003; Sori *et al*., 2004). Traditional medicinal knowledge of medicinal plants and their use by indigenous cultures are not only useful for conservation of cultural traditions and biodiversity, but also healthcare and drug development in the present and future (Tamiru *et al.*, 2013). The studies conducted on the traditional medicinal plants in Ethiopia are very limited when compared with the multiethnic cultural diversity and the diverse flora of Ethiopia (Giday *et al*., 2009).

Apart from their use in the traditional system of medical care at the local level, medicinal plants are currently used in the production of modern drugs as a source of direct therapeutic agents, as raw materials for the manufacture of complex semi-synthetic compounds and as taxonomic markers in the search for new compounds (WHO, 1998).

Most pharmaceutical companies recently have developed mechanisms to involve indigenous people collect plant samples on the recommendation of traditional practitioners. This approach is reported to be more successful than random collection of sample of medicinal plants (Balick and Cox, 1996; Alexiades, 1996; Asfaw *et al*., 1999).

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

## 2.2. Medicinal Plants in Ethiopia

Plants have played crucial role as a source of traditional medicine in Ethiopia from the time immemorial to combat different ailments and human sufferings. The traditional health care practice is mainly dependent on medicinal plants collected from the wild. In spite of this, the medicinal plant biodiversity is being depleted due to manmade and natural calamities. Moreover, the indigenous knowledge associated with the conservation and use of medicinal plants is also disappearing at an alarming rate. The widespread use of traditional medicine among both urban and rural population in Ethiopia could be attributed to cultural acceptability, its attributed efficacy against certain types of diseases, physical accessibility, and economic affordability as compared to modern medicine (Hamilton, 2003).

Traditional medicine has become an integral part of the culture of the Ethiopian people due to its long period of practice and existence (Mirgisa, 1998). The antiquity of the traditional use of medicinal plants in Ethiopia could never be disregarded. Due to acceptability, accessibility and biomedical benefits there is a large magnitude of use and interest of medicinal plants in Ethiopia (Dawit, 2001).

The long history of use of medicinal plants in Ethiopia is reflected in various medico-religious manuscripts produced on parchments and believed to have originated several centuries ago Reviews of medical textbooks that have been written in Geez or Arabic between 17th and 18th centuries indicated that the majority of Ethiopians, with the exception of few privileged groups, starting from the time of the Italian occupation, have been depending almost entirely on the traditional medicine (Fassil, 2001).

## 2.3. Medicinal plants in human healthcare system

Plant diversity remains vital for human well-being and still provides a significant number of remedies required in healthcare. Medicinal plants played an essential role in the treatment of various afflictions in Ethiopia. For the role-played by plant-derived products in human and livestock health, systematic scientific investigation is vital (Fekadu, 2007). Pharmaceutical industries and western researchers on plant-based drugs have now rediscovered that plants have much to contribute to the discovery of new, effective, safe and advantageous therapeutic agents. Plants play a major role in providing prototype molecules for possible development into conventional drugs by the pharmaceutical industry.

The review made by Bekele (2007) indicated that about one thousands identified medicinal plant species were reported in the Ethiopia Flora, however, many others are not yet identified and the researches undertaken in the higher learning institutions on several aspects of medicinal plants. This author continues to say most studies on medicinal plants, however, remained more of a survey nature and the outputs were mere listing of plants used as remedies for various ailments usually with incomplete description and mainly with uncertain recipes.

## 2.4. Plants in ethno-veterinary medicine

In Ethiopia as well as in most developing countries, animal disease remains one of the principal causes of poor livestock performance, leading to an ever increasing gap between the supply and the demand for livestock products. Pharmacotherapy is one of the most important means of controlling livestock diseases, but it is possible only if livestock owners can afford to cover the cost of treatments. Cost of treatment is therefore an important determinant of the usefulness of veterinary drugs. Livestock owners cannot rely on veterinary services for control of various important livestock diseases. A practical solution to this problem is to develop socially acceptable and effective remedies from reasonably inexpensive sources that can complement modern medicine (Teshale *et al*., 2004).

Livestock production remains crucial and represents a major asset among resource-poor smallholder farmers by providing milk, meat, skin, manure and traction. However, the economic benefits of livestock populations remain marginal due to prevailing livestock diseases which are among the principal bottle necks of livestock performance and cause of high economic losses of the resource poor farmers (Mesfin and Lemma, 2001).

## 2.5. Part used and modes of preparation of medicinal plants

Traditional medicine is prepared from different part of medicinal plants. The plant parts used widely to treat human and livestock ailments include leaves, seeds, fruit, roots, bark, bulb, rhizome, stem and root. The most commonly used plant parts for herbal preparation in most parts of Ethiopia are leaves, root and seeds (Hunde *et al.,* 2006; Giday *et al*., 2010). Wide harvesting of leaves and seeds compared to roots which are important for survival of plants has a less negative influence on the survival and continuity of useful medicinal plants and does not affect sustainable utilization of the plants (Yineger *et al*., 2008).

The medicinal plants have various methods of preparation and application for different types of ailments and they have various preparation forms like concoction, decoction, powder, crushed and homogenized in water, squeezed, smoked, extracted by boiling stem and enclosed in a piece of close. Concoction constituted the highest type of preparation form, followed by crushed and homogenized in water and powder form (Lulekal *et al*., 2008; Hailemariam *et al.*,2009). The preparation and application methods vary based on the type of disease treated and the actual site of the ailment (Hunde *et al*., 2006; Lulekal *et al*., 2008; Giday *et al.*, 2010).

## 2.6. Treats and conservation of medicinal plants

Plant diversity remains indispensable for human well being in providing a significant number of traditional and modern remedies required in healthcare. The growing recognition of the importance of medicinal plants in meeting local and global healthcare needs provides an important opportunity for conversationalists, traditional medicine proponents, local communities and others to work together to develop mutually supporting solutions to problems associated with forest loss and biodiversity erosion (Parrotta, 2002). However, it is a matter of great concern to realize that the annual extinction rate of plant species is estimated to be about 3,000 (Cunninghum, 1992). Nowadays, sustained and coordinated efforts are needed to transform currently unsustainable practice of medicinal plant mining from wild sources to more ecologically sustainable, socially acceptable and economically equitable production and utilization system. Generally, there is some conservation measures that have been undertaken around the world aimed at protecting threatened medicinal plant species from further destruction (Cunninghum, 1993).

Most of medicinal plants utilized in Ethiopia are harvested from the wild (Bekele, 2007). Wild occurring medicinal plant species and the associated traditional knowledge are getting eroded due to natural and manmade factors (traditional value undermined by the new generation). It is often the roots that are used for medicinal purposes (IBC, 2009).

The findings of different studies showed that ethno medicinal plants were under serious threat mainly due to deforestation and drought. Environment degradation, agricultural expansion, loss of forests and woodlands, over-harvesting, fire, cultivation of marginal lands, overgrazing and urbanization also appear to be the major threats to the medicinal plants of Ethiopia (Yineger and Yewhalaw, 2007; Teklehaymanot and Gidey, 2007; Yineger *et al.*,2008;Giday *et al*., 2010). Endemic medicinal species restricted to Ethiopia and of primary concern to Ethiopia and to the world as well. There are two ways to conserve threatened species of medicinal plants: restrictions on their extraction and trade; and their sustainable cultivation on large scale. In addition to contributing to conservation, cultivation of medicinal plants can

also provide additional income to farmers in developing countries (Alam and Belt, 2009). According to Wassihun *et al*. (2003) in Ethiopia, 6% of medicinal plants are primarily cultivated in homegardens for their medicinal value and can Play a role in easing the pressure on those plants that are scarce in native vegetation (Demissie, 2001).

In addition, Zemede (2001) argues that medicinal plants are considered to be at conservation risk due to over use and destructive harvesting (roots and barks collection). The problem is further compounded by the fact that traditional knowledge on traditional medicine is also being lost at an alarming rate. There is some conservation actions that have been undertaken around the world designed to protect threatened medicinal plants from further damage (Cunninghum, 1996). This includes *in-situ* and *ex-situ* conservation measures. Both *in-situ* and *ex-situ* conservation efforts are implemented to capture medicinal plant genetic resources. *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 (Zemede, 2001). Medicinal plants can also be conserved by ensuring and encouraging their growth in special places, as they have been traditionally (Zemede, 2001), this can be possible in places of worship (churches, mosques, grave yards, scared grooves, farm margins, river banks, road sides, live fences of gardens and fields.

### 2.6.1. Conservation of medicinal plants in home gardens

The home garden agro ecosystem in Ethiopia maintains a wide range of taxa of perennial and annual crop plants. According to Zemede, (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. For poor rural people, medicinal plants represent affordable and locally available resources to address many diseases and health problems.

# 3. MATERIAL AND METHODS

## 3.1. Description of the study area

### 3.1.1. Geographical location

The study was conducted in Gera woreda, Jimma zone, Oromia National Regional State and is located 97km from Jimma town and 445km from Addis Ababa, the capital city of Ethiopia. It is bordered by Goma to the south and Ginbo *woredas* to the SNNPR, by the Sigmo *woreda* to the west, and Gumay woreda to the north.

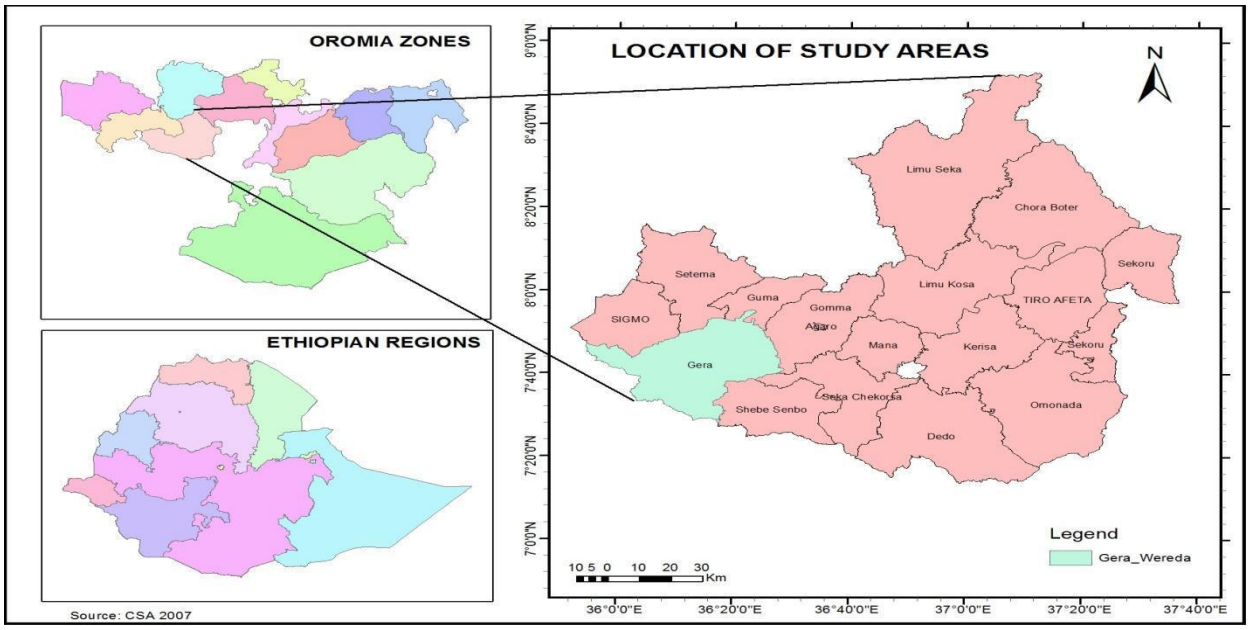


Figure 1 Geographic location of the study area

### 3.1.2. Land use and livelihoods or local economy

Most of the farmers are involved in coffee production in one way or another. A few relatively wealthy farmers are engaged in the collection and trading of coffee, while the majority of the farmers are suppliers of raw coffee. Highest proportion of crop cultivation takes place around the wetland. Landless farmers enter into sharecropping agreements with land owners, exchanging their labor for a share of the crop harvested. Middle-income farmers and the better-off farmers make their living from coffee and generate considerable income from fruit production. Livestock production also plays a key role in supplementing the income of

farmers. Most of the agricultural lands can be found on hilly slopes, which are quite steep in places and highly susceptible to erosion. Soil and water conservation structures have not been built to arrest soil erosion. There is also a natural forest, which is planted in coffee, and shared among individual farmers. Many of the farmers in the area depend on coffee for their livelihood (Solomon *et al*., 2014).

### 3.1.3. Climate

The District has 3 agro- climatic zones, those climatic features is explained as 50.2% is considered to be highland, 46% of the area is mid-altitude, while 3.7% is low land. The altitude of the study area is between 1,500 to 2,200m above sea level, giving the area ecologically district areas. Rainfall is often in between 1,880 to 2,080 millimeter per annum.

### 3.1.4. Study Population

According to Gera District Agriculture and rural development, the average population is 147,120 with a total of 73,175 male headed holds and 73,945 female headed houses. The two major ethnic groups are the Oromo, who are the main indigenous people and Amhara people is the second major ethnic group.

### 3.1.5. Vegetation type

The study area lies in moist evergreen montane forest of Jimma zone in southwestern Ethiopia and the area contains different shrubs, herbs and trees. However, there is very fast encroachments of the forest area due to high population pressure.

### 3.1.6. Livestock population

Livestock production is the second agricultural activity of the people next to crop cultivation and the total livestock population in this district is estimated to about 263,629 Cattles 97,571 Sheep, 22,466 Goats, 44,333 horses, 9372 mules, 2574 donkeys and 151,814 poultry.

## 3.2. Materials required

Plant specimens were collected using collecting bags, cutting tool scissors, permanent markers and field note books, pre-printed collection formats such as printed checklists of semi-structured questions for interview, plant diggers, photographic camera, GPS and topographic maps. In addition to that, specimen pressing and drying equipment with wooden frames, straps, cardboards, blotters, news papers, plasters, ethanol alcohol (70%) and plastic bags that have various sizes for storage of many plant parts

## 3.3. Methods of Data Collection

### 3.3.1. Reconnaissance survey and data collection

#### 3.3.1.1. Reconnaissance survey

A reconnaissance survey of the study area was conducted from January5 to 20, 2016. The study sites were purposively selected based on recommendation from elders, local authorities and those knowledgeable persons. Out of 31 kebeles the study was carried out in six kebeles, these are Chira, Ganji Chala, Tuma Teso, Wenja Kersa, Sadi Loya and Oba Toli.

Table1. Study sites with their respective location

| S.No | Name of kebeles | Location | Elevation(m.a.s.l) |
|---|---|---|---|
| 1 | Chira | 07º 44' 42.1''N, 036º 14' 59.4''E | 1999-2098 |
| 2 | Ganji Chala | 07º 45' 08.9''N, 036º 16' 17.7''E | 2000-2250 |
| 3 | Tuma Teso | 07º 46' 05.4''N, 036º 25' 46.8''E | 1923-1925 |
| 4 | Wenja Kersa | 07º 47' 17.4''N, 036º 21' 46.2''E | 1954-1960 |
| 5 | Sadi Loyaa | 07º 47' 07.3''N, 036º 25' 35.5''E | 1942-1966 |
| 6 | Oba Toli | 07º 34' 24.9''N, 036º 08' 26.4''E | 1776-1797 |

#### 3.3.1.2. Sampling of Informants

A total of 60 individuals (55 males and 5 females) in the age of 30 and above were selected from 6 kebeles purposively based on the intensive knowledge on medicinal plants they have. The informants were selected from the local people of the study area to see the general knowledge of medicinal plants of the people depending on their willing to participate. The choice of informants was following the suggestion made by Martin (1995). Of the total informants 10 key informants (9 males and 1 female) were selected based on recommendation from elders and local authorities. Local healers were also considered as key informants since they are expected to have intensive knowledge of medicinal plants.

#### 3.3.1.3. Ethnobotanical Data Collection

Ethnobotanical data was collected from February 2017 to April 2017 on the way of utilization and conservation of medicinal plants by the people of Gera District applying the methods described in Martin (1995) and Cotton (1996).The Key informants share their knowledge on the method of preparation and mode of application of different medicinal plants that used to treat both human and livestock ailments. Additionally the medicinal plants that have other uses (multipurpose) than medicinal activity were recorded. The techniques employed for data collection were group discussion, semi- structured interviews, guided field walks and observations with informants.

#### 3.3.1.4. Semi- structured interviews and group discussion

Semi- structured interviews were conducted with 60 informants in “Afan Oromo” language to collect ethnobotanical data. The data collected include informants name, sex, age, address, common human and livestock ailments in the area, conservation methods, preparation methods, and route of administration, threats of medicinal plants and other uses of medicinal plants.

### 3.3.1.5. Field walk and observation

Field walk and observation were performed with the help of local guides and interviewed informants in the study area, habit and habitat characteristics of the plants were recorded on sites.

Figure 2. Semi- structured interview with key informant in Tuma teso kebele (Photo taken by Netsanet Gonfa, February, 2017).

### 3.3.1.6. Specimen Collection and Identification

At the end of each interview, sample specimens of the plants cited for their medicinal use were collected, numbered, pressed and dried for identification. The local names and growth habits of the medicinal plants were recorded for each plant species. Preliminary identification was done in the field. The voucher specimens which could not be identified in the field have

been taken to Jimma University Herbarium and identified by using taxonomic keys, Flora of Ethiopia and Eritrea.

## 3.4. Data Analysis

### 3.4.1. Descriptive statistics

Data obtained from questionnaire survey were recorded, coded and stored using Microsoft® Excel for Windows 2007. The collected data were analyzed using Statistical Package for Social Sciences software version 20 (SPSS software V.20). Thereafter the most useful information gathered on medicinal use, plant habit, habitat, methods of preparation and route of administration of medicinal plants was analyzed through descriptive statistics.

### 3.4.2. Preference ranking

It was conducted following Martin (1995), for five important medicinal plants used to treat Stomachache. Five randomly selected informants from total key informants were participated in this exercise in order to identify best preferred medicinal plants for treatment of Stomachache. The informants were given the plants and asked to arrange the medicinal plants based on their preference of efficacy by assigning the highest value (5) for plant species most preferred and the lowest value (1) for the least preferred plant and value in between for the remaining. Thereafter, the resulting numbers was summed for all respondents and ranked based on the total scores obtained for each medicinal plant.

### 3.4.3. Direct Matrix Ranking

Direct matrix ranking exercise was employed following Martin (1995) and Cotton (1996) in order to compare multipurpose uses of a given plant species based on information gathered from informants. The numbers of multipurpose species were selected out of the total medicinal plants and use diversities of these plants were listed for four randomly selected key informants to assign use value to each species. Each chosen key informant was asked to assign use value (5=best, 4=very good, 3=good, 2=less used, 1=least used and 0=not used). The average score of each species was summed up and ranked.

### 3.4.4. Paired comparison

In paired comparison, ten key informants were selected and asked to choose the best six medicinal plants from every pair according to personal perception in treating Wound. The total number of possible pairs was obtained by applying the formula **n (n-1)/2,** when n is the number of medicinal plants being compared. A total rank of paired comparison was obtained by summing the number of times each plant was chosen. An item with highest frequency of choices had the highest score.

### 3.4.5. Informant consensus

During the course of the study, each informant was visited 2-3 times in order to confirm the reliability of the ethnobotanical information. Consequently, the responses of an informant that were not in agreement with each other were rejected since such responses were considered as unreliable.

### 3.4.6. Informants consensus factor (ICF)

ICF was calculated for each category to identify the agreements of the informants on reported cures for the group of ailments. The ICF was calculated as follows (Heinrich *et al*., 1998).

ICF= nur-nt/nur-1

When, ICF= Informants consensus factor

nur= number of use citation in each category

nt = number of species used

# 4. RESULTS

## 4.1. Local beliefs on medicinal plants

The local people exploit their shared knowledge in order to manage health problems at home by using different plants found around them, before looking for other options regardless of the type of health problem and its intensity. In the study area, the traditional systems regarding medicinal plants play a vital role in their healing strategies and in the local primary healthcare systems. According to the respondents of the study area, their preference to traditional medicine was due to lack of substituent's they would not get better medication for some of the diseases in modern health services. For example, diseases believed to be caused by urine of bat, in addition to that of easy access and low cost of treatment for traditional medicine.

## 4.2. Medicinal plants of the study area

The result showed that a total of 63 medicinal plant species recorded and identified for treating 50 human ailments and 18 livestock ailments. Of the 63 medicinal plant species, 56 (88.8%) of them were used by local people of the study area to treat various human ailments, 15 (23.8%) medicinal plants are used to treat livestock ailment and 7 (11.1%) medicinal plants are used to treat both human and livestock ailments (Appendix 2 and 3). Out of the total medicinal plant species, 51 species (80.9%) were collected from wild, 6 species (9.5%) were collected from home garden and 6 (9.5%) medicinal plant from cultivated lands. Among the families of plant species Fabaceae and Asteraceae represented by five species (7.9%) each followed by Rutaceae, Solanaceae and Cucurbitaceae represented by four species (6.34%) Lamiaceae, malvaceae, Euphorbiaceae and Rosaceae represented by three species (4.76%) each, Rubiaceae, Acanthaceae and Orchidaceae represented by two species (3.17%) each. The rest 23 families represented by one species (1.58%) each (Appendix 1).

### 4.2.1. Medicinal plants used to treat human ailments

The result indicates that a total of 56 plant species were identified by local community were used for treatment of 50 human ailments. Those medicinal plants that used to treat human ailments were represented by 32 families. Regarding the families of medicinal plant, Asteraceae contributed 5 species (8.9%), Rutaceae and Fabaceae accounted 4 species (7.1%), Lamiaceae, malvaceae, Euphorbiaceae, Solanaceae, Rosaceae and Cucurbitaceae accounted 3 species

(5.35%) each, Rubiaceae, Acanthaceae and Orchidaceae accounted 2 species (3.57%) each and the remaining families contributed one species (1.78%) each. Of the medicinally important plant species that are used to treat human ailments recorded in six kebeles of Gera District, 41 species (73.2%) were collected from wild, 4 species (7.1%) collected from home garden and 11species (19.6%) medicinal plant collected from cultivated land (Fig 3).

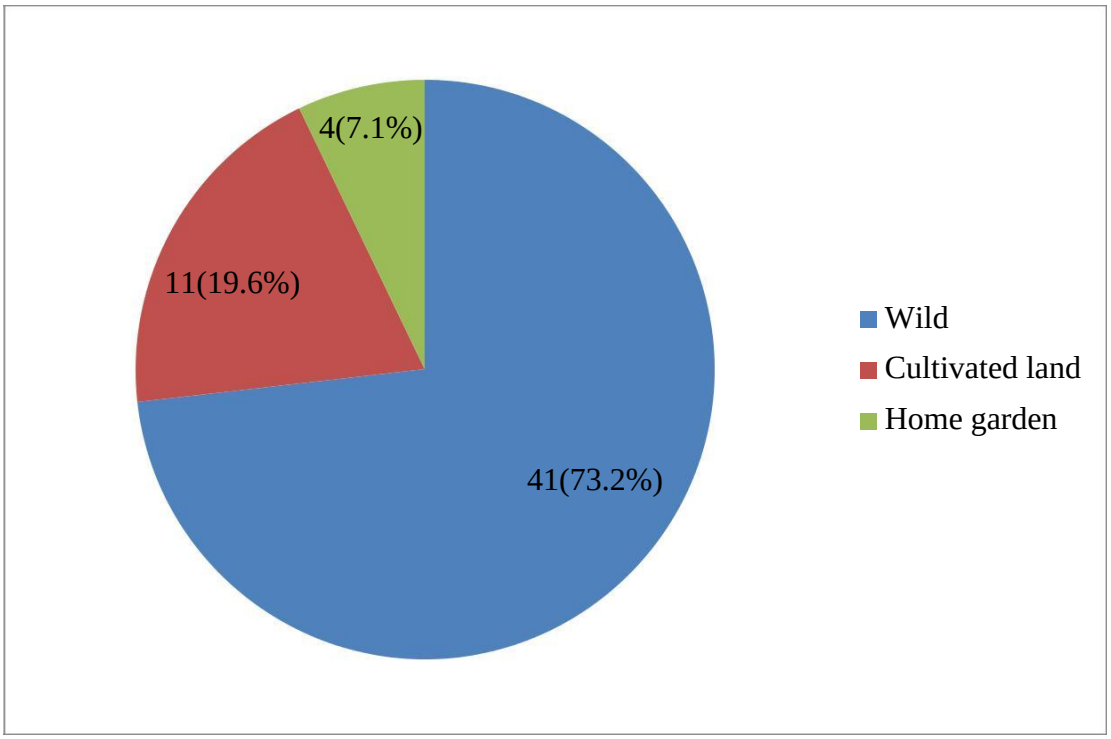


Figure 3. Habitat of medicinal plants that used to treat human ailments in Gera District

#### 4.2.1.1. Growth form of human medicinal plants

In terms of the growth form distribution of the medicinal plant species were represented by herbs, shrubs, trees, climbers and epiphytes. Herbs were the dominant growth form followed by shrubs (Fig. 4).

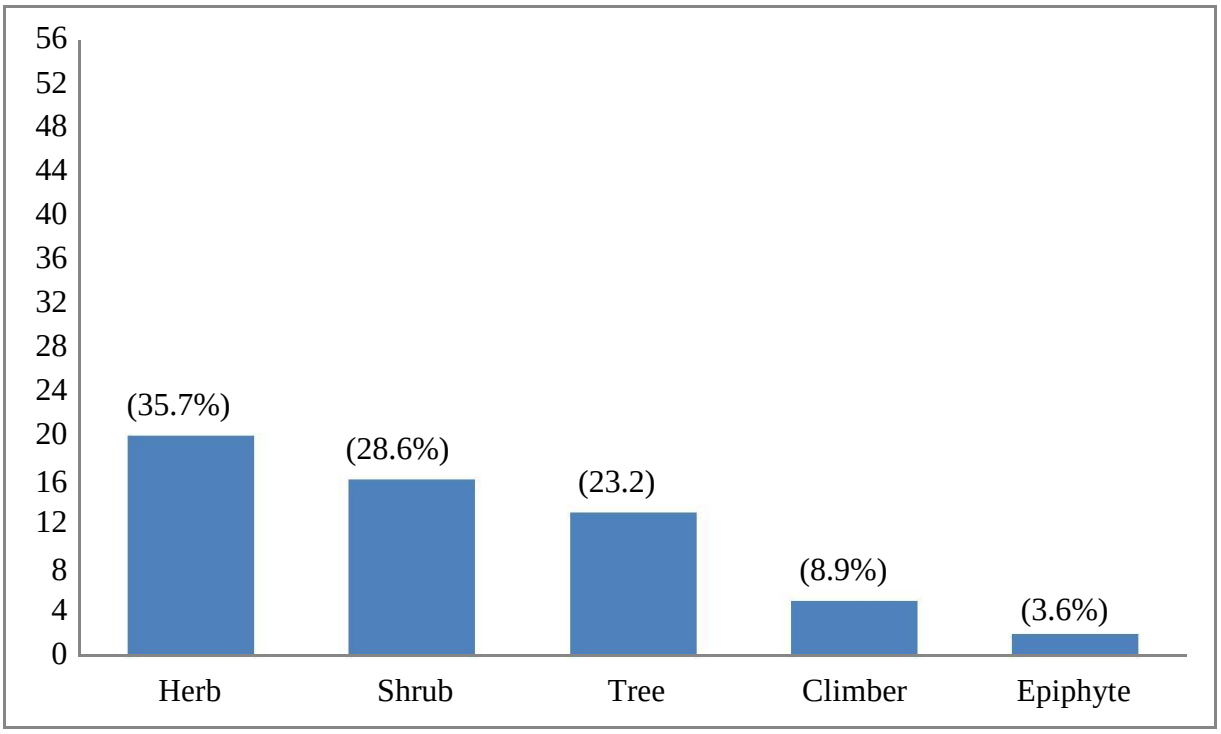


Figure 4. Habits of medicinal plants used to treat human ailments in Gera District

### 4.2.1.2. Plant parts used to treat human ailments

People of the study area harvest different plant parts for the preparation of traditional medicines such as leaves, roots, seeds, fruit and stem, bark and flower. In the study area, leaves was the dominant part used followed by seeds. (Fig 5).

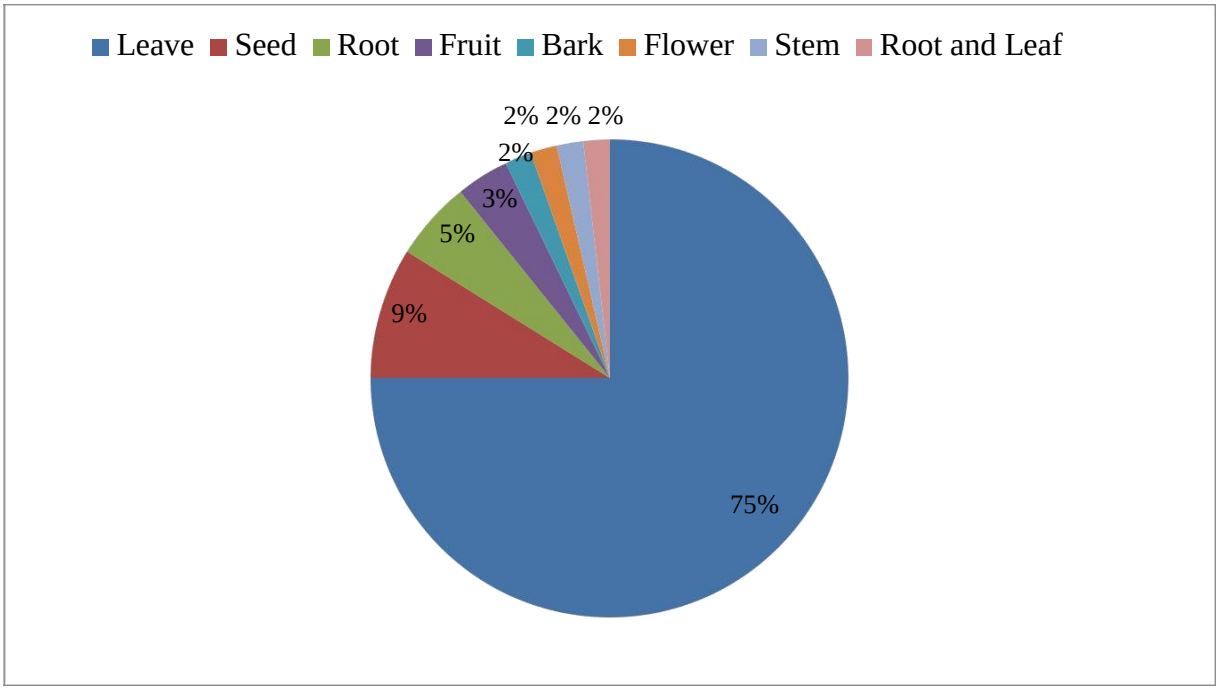


Figure 5. Part of medicinal plants used to treat human ailments in Gera District

### 4.2.1.3. Method of preparation and rout of administration of medicinal plants

#### 4.2.1.3.1 Preparation of medicine

For human ailments, the local community employs various methods of preparation of plant remedies for different types of ailments. The principal methods of plant remedy preparation were reported to be through crushing, exudation, squeezing, cutting, concoction and pounding. Crushing was the dominant preparation form for human remedy followed by exudation. (Fig. 6).

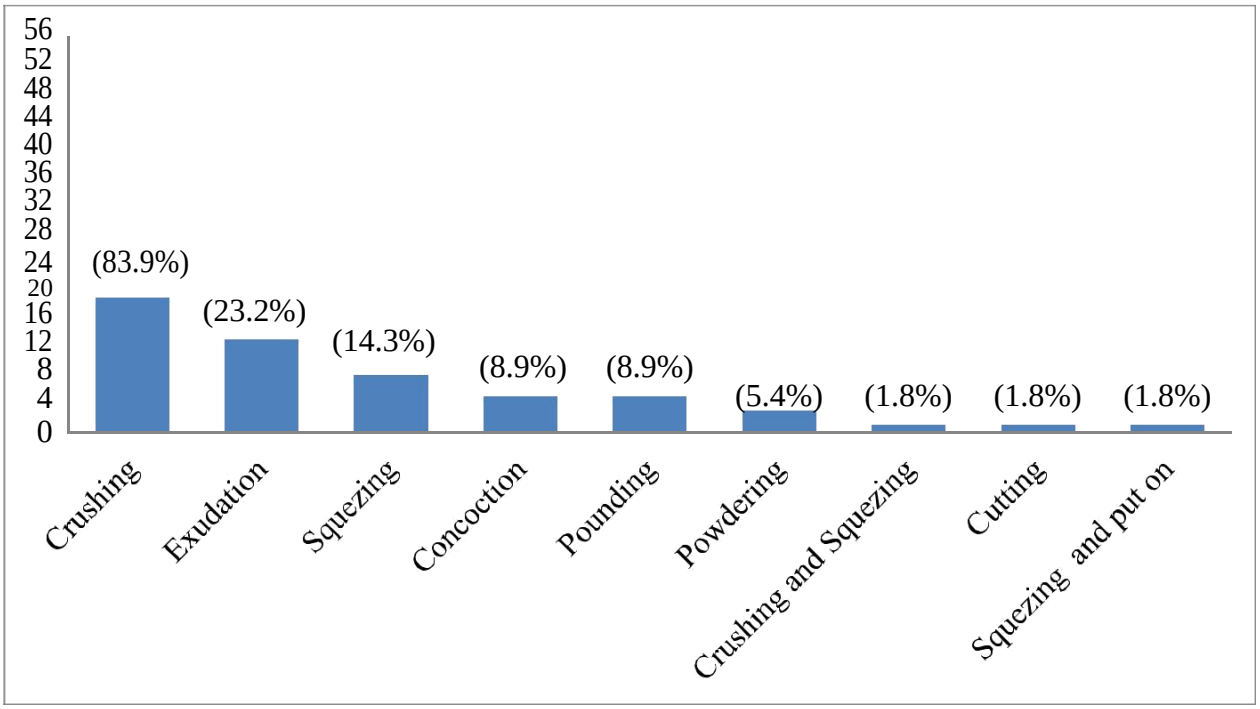


Figure 6. Method of preparation of traditional medicinal plant remedies in Gera District

#### 4.2.1.3.2. Mode of application of human medicine

Medicinal plants are applied through different routes of administration. These routes of administration was oral, dermal, tie on, put on, smoking, through ear, oral and dermal together, chewing, brushing, inhalation, through eye, dermal and inhalation and dermal and through eye. The dominant route of administration was oral followed by dermal.

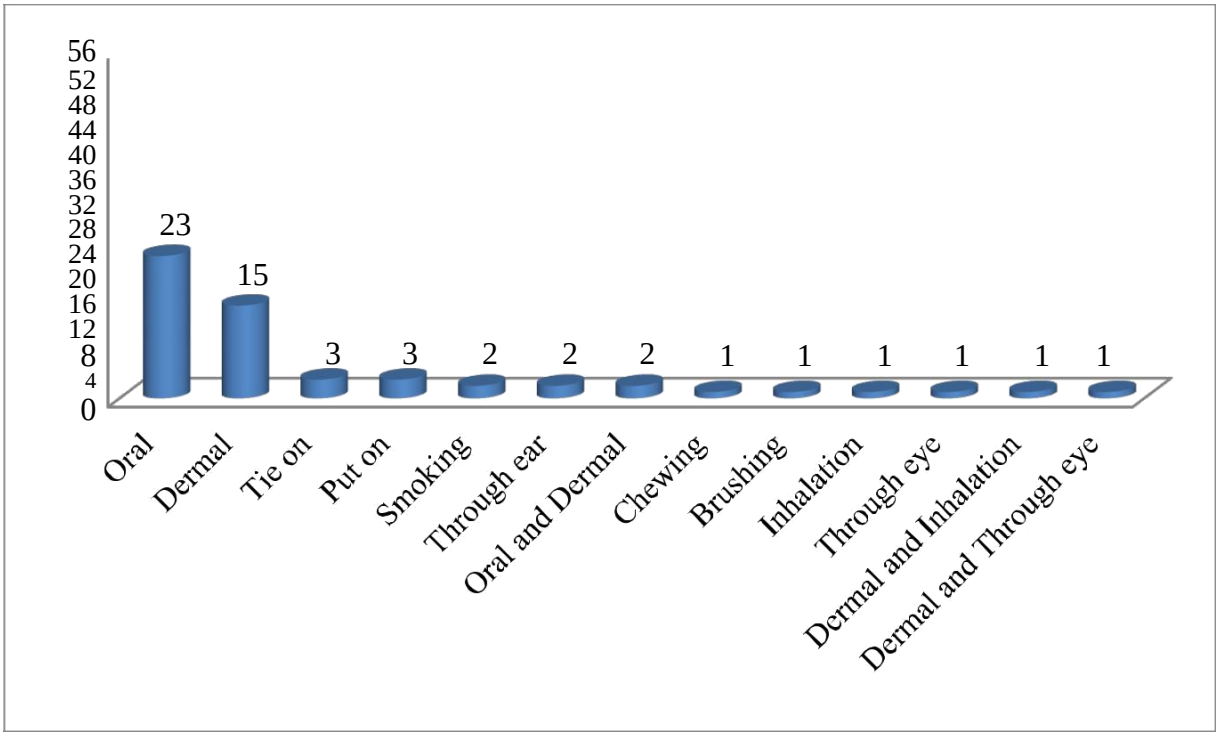


Figure 7. Route of application of medicinal plants to treat human ailments in Gera District

### 4.2.2. Medicinal plants used to treat livestock health problems

In comparison to human disease livestock diseases are treated with a few number of plant species in the study area. A total of 18 livestock ailments were identified that are treated by medicinal plants in the area. There are 15 medicinal plants collected and identified in the study area which used for treating livestock ailments. Those medicinal plants that used to treat livestock ailments are distributed into 12 families. Regarding the families of medicinal plants Euphorbiaceae is represented by three species (20%), followed by Cucurbitaceae which is represented by two species (13.3%) and the rest (Solanaceae, Asteraceae, Aliaceae, Fabaceae, Phytolacaceae, Acanthaceae, Amaryllidaceae and Meliaceae) represented by one species (6.6%) each.

#### 4.2.2.1. Growth form of livestock medicinal plants in the study area

In the study area there are different growth forms for treating livestock ailment, those growth forms was herbs, shrubs, trees and climbers. The study revealed that in the study area shrubs was the dominant growth form for treating livestock ailment followed by herbs.

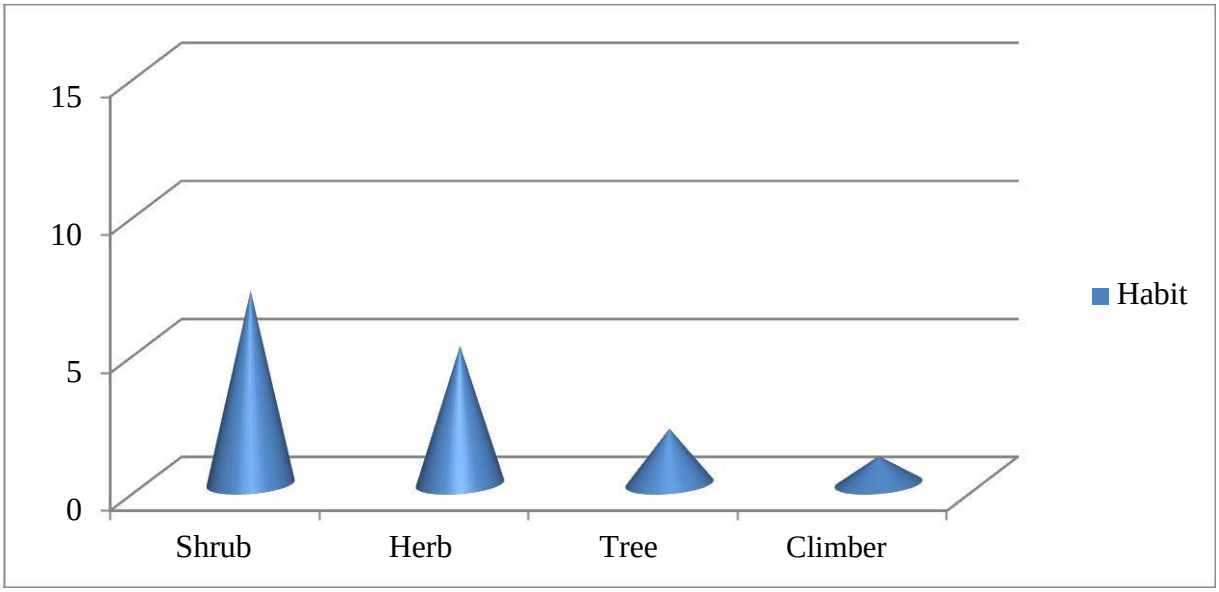


Figure 8. Habits of medicinal plants to treat livestock ailments in Gera District

#### 4.2.2.2. Plant Parts used for treating livestock ailments

Regarding the plant parts which are used for treating livestock ailments leaves were widely used for a range of preparation than the other parts followed by roots, stem and seed.

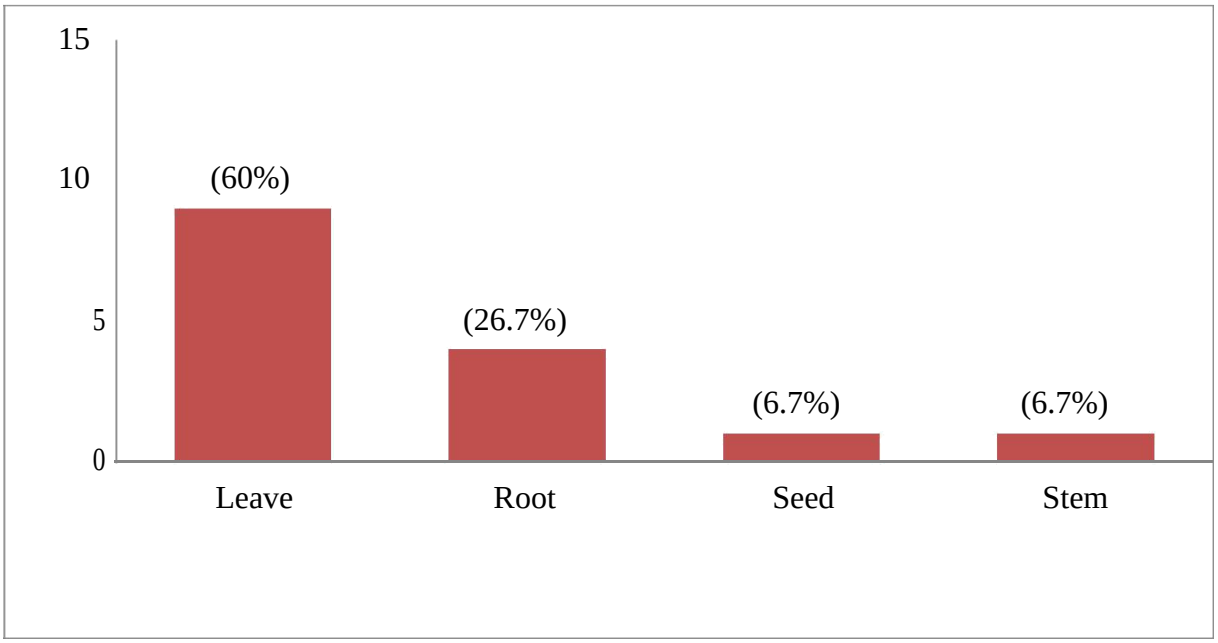


**Figure 9. Part used of medicinal plants to treat livestock ailments in Gera District**

#### 4.2.2.3. Methods of preparation of livestock traditional medicine

Preparation method of livestock medicine includes various techniques such as crushing, exudation, burning, cutting and pounding. Crushing and pounding was the dominant method of preparation followed by exudation, cutting and burning.

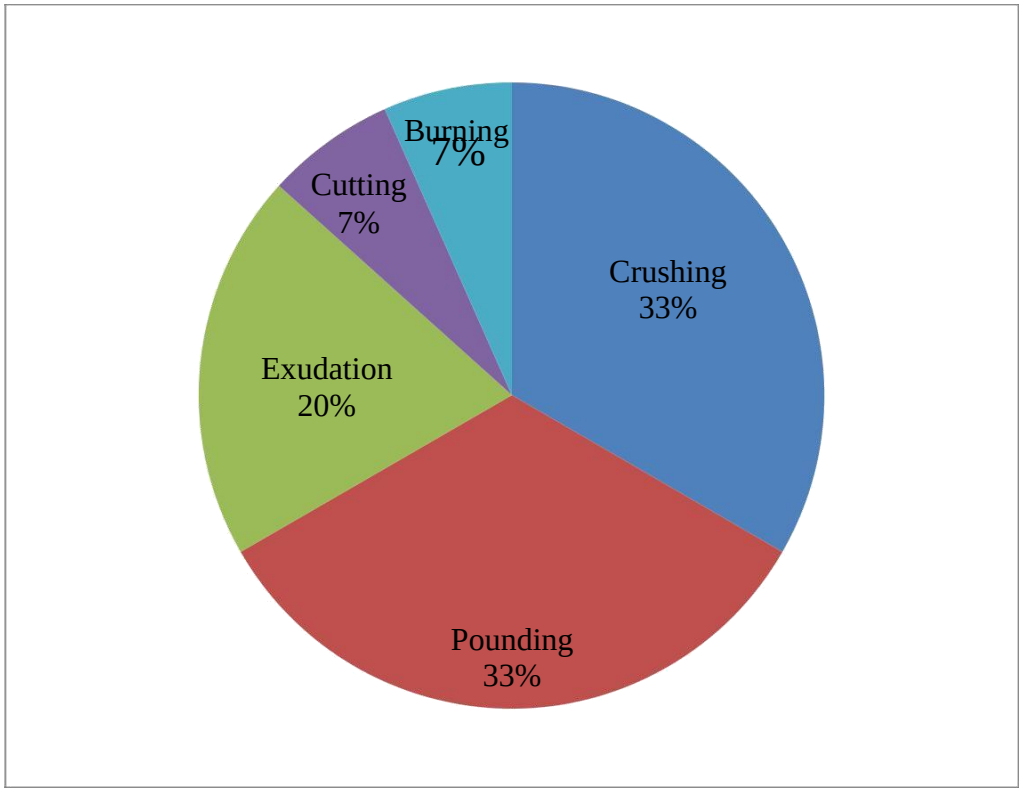


**Figure 10. Preparation of medicinal plants used to treat livestock‟s ailments in Gera District**

### 4.2.2.4. Mode of application of livestock medicine

The study show that there are different routes of administration was used for livestock remedies. The mode of applications was oral, dermal, put on, inhalation and brushing, put on and smoking. Oral was the dominant routes of administration followed by dermal.

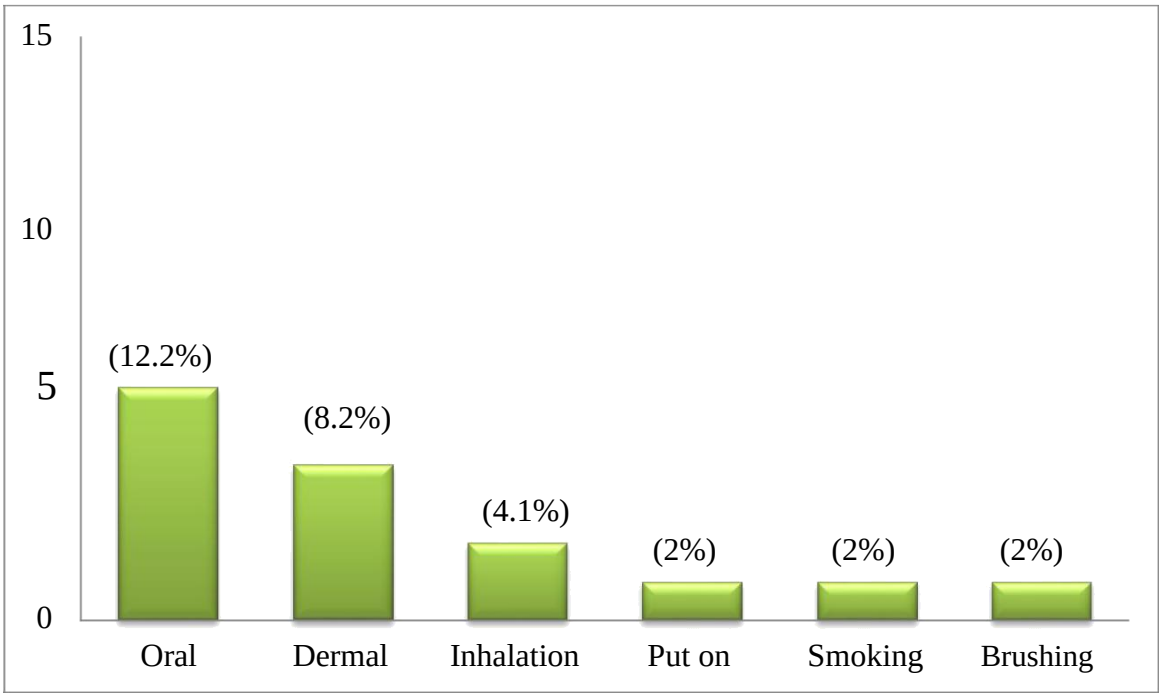


Figure 11. Route of application of medicinal plants to treat human ailments in Gera District

**4.2.2.5. Habitat of livestock medicinal plants**

The study revealed that most of the plants were harvested from wild followed by cultivated land and homegarden.

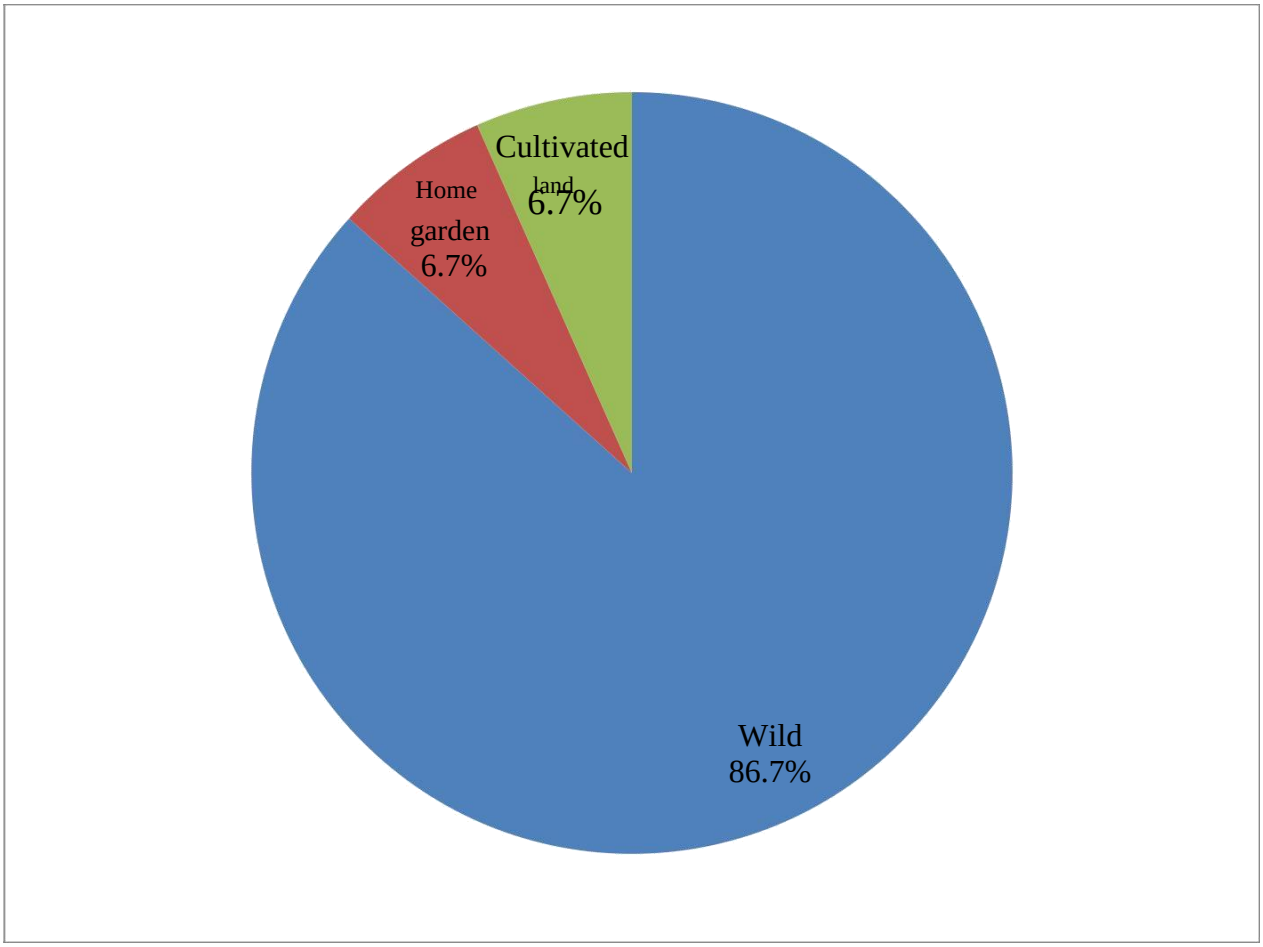


Figure 12. Habitats of medicinal plants for livestock ailments in Gera District

## 4.4. Importance of different medicinal plants used by the local people

The degree of importance of medicinal plants was checked by conducting various exercises including preference ranking, direct matrix ranking and paired comparison.

### 4.4.1. Preference ranking

When there are different species prescribed for the same health problem, people show preference for one over the other. Preference ranking of five medicinal plants that were reported for treating stomachache was conducted after selecting 6key informants. The informants were asked to compare the given medicinal plants based on their efficacy and to give the highest number (5) 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. Among the five selected medicinal plants used to treat stomachache, *Solanum*

*tarderemotum*Bitter stood first, hence is the most effective medicinal plants to cure stomachache, followed by *Vernonia amygdalina, Ruta chalepensis, Croton macrostachyus* and *Ocimum urtiicifolium* (Table 2).

Table 2. Preference ranking of medicinal plants used for treating stomachache

| **Medicinal plant used** | **Respondents (A-F)** | | | | | | **Total** | **Rank** |
|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | | |
| *Vernonia amygdalina* | 5 | 4 | 5 | 4 | 5 | 5 | 28 | 2 |
| *Ruta chalepensis* | 5 | 5 | 4 | 3 | 4 | 5 | 26 | 3 |
| *Croton macrostachyus* | 4 | 3 | 4 | 4 | 3 | 4 | 22 | 4 |
| *Solanum tarderemotum* | 5 | 5 | 5 | 5 | 5 | 5 | 30 | 1 |
| *Ocimum urtiicifolium* | 4 | 3 | 3 | 2 | 2 | 3 | 17 | 5 |

### 4.4.2. Direct Matrix Ranking

In the study area, the majority of the community relies on wild plants for various purposes such as charcoal, construction, fencing, firewood, furniture making, medicinal. To assess the relative importance and to check the major impact on such plants direct matrix ranking was performed (Table 3). In the study area, a number of medicinal plants were found to be multipurpose species being utilized for a variety of uses. The result of the direct matrix showed that *Crotonmacrostachyus* is the most multipurpose use medicinal plant followed by *Eucalyptus globulus, Prunus africana, Euphorbia abyssinica* Gmel, *Albizia gummifera* and *Vernonia amygdalina.*

Table 3. Direct matrix ranking of six plant species by four informants based on six use categories (5= best; 4=Very good; 3= good; 2=less used; 1=least used and 0=no value)

| Use categories | Medicinal plants | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Croton macrostachyus* | | | | *Albizia gummifera* | | | | *Eucalyptus globulus* | | | | *Prunus africana* | | | | *Vernonia amygdalina* | | | | *Euphorbia abyssinica Gmel.* | | | |
| | Informants (1-4) | | | | Informants | | | | Informants | | | | Informants | | | | Informants | | | | Informants | | | |
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Charcoal | 5 | 4 | 4 | 5 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 1 | 1 | 2 | 1 | 0 | 0 | 0 | 0 |
| Construction | 4 | 3 | 4 | 3 | 2 | 2 | 1 | 1 | 5 | 5 | 5 | 5 | 1 | 4 | 3 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 |
| Fence | 5 | 4 | 3 | 3 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 5 | 5 | 5 | 5 |
| Fire wood | 5 | 5 | 5 | 5 | 3 | 4 | 5 | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 4 | 3 | 3 | 2 | 3 | 3 | 1 | 1 | 1 | 1 |
| Furniture | 5 | 5 | 5 | 4 | 2 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 5 | 5 | 5 | 5 |
| Medicinal | 5 | 5 | 5 | 5 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 4 |
| Individual Total | 29 | 26 | 26 | 25 | 14 | 16 | 16 | 16 | 19 | 17 | 17 | 19 | 16 | 19 | 17 | 16 | 13 | 12 | 15 | 14 | 17 | 16 | 17 | 16 |
| Grand total | 106 | | | | 62 | | | | 72 | | | | 68 | | | | 54 | | | | 66 | | | |
| Rank | 1 | | | | 5 | | | | 2 | | | | 3 | | | | 6 | | | | 4 | | | |

### 4.4.3. Paired comparison

The medicinal plants that were identified by the informants to be used in treating wounds, a paired comparison was made among six of them using ten informants to know their rank. The results that were obtained from all the informants were obtained from all the informants were summed up and compared plants were abbreviated in the table. Accordingly, Senecio schimperi. Bip.ex A. Rich.Selected ten times and stood first indicating that it is the most effective in treating wound followed by Rumex napalensis spreng, Acmella caulirhiza Del,Croton macrostachyus A. Rich, Vernoni rueppelli Sch.Bip.ex walp and Kosteletzekya adoensis (Hochst.ex A.Rich) Mast.

Table 4. Paired comparisons of medicinal plants used to treat wound (Cm- Croton macrostachyus, Vr- Vernoni rueppelli, Rn- Rumex napalensis spreng, Ac- Acmella caulirhiza, Ka- Kosteletzekya adoensis)

| **Plant species** | *Croton macrostachyus* | *Vernonia rueppellia* | *Rumex napalensis spreng* | *Senecio schimperi* | *Acmella caulirhiza* | *Kosteletzekya adoensis* |
|---|---|---|---|---|---|---|
| *Croton macrostachyus* | | Cm | Rn | Ss | Ac | Cm |
| *Vernonia rueppelli* | Cm | | Rn | Ss | Ac | Vr |
| *Rumex napalensis Spreng* | Rn | Vr | | Ss | Rn | Rn |
| *Senecio schimperi* | Ss | Ss | Ss | | Ss | Ss |
| *Acmella caulirhiza* | Ac | Ac | Rn | Ss | | Ac |
| *Kosteletzekya adoensis* | Cm | Ka | Rn | Ss | Ac | |
| Frequency | 4 | 2 | 7 | 10 | 6 | 1 |
| Rank | 4 | 5 | 2 | 1 | 3 | 6 |

## 4.5. Informant consensus

The study show that, *Ruta chalepensis* was ranked 1$^{st}$, cited by 41 (68.3%) informants for its medicinal value for treating cough, stomachache and fibril illness. *Croton macrstachyus*, *Eucalyptus globulus* and *Ocimum lamiifolium* were cited by 39 informants (61.9%) each and followed by *Zingiber officinale Roscoe* cited by 38 informants (60.3%), ranking 3$^{rd}$ and 4$^{th}$ respectively (Table 5).

**Table 5. List of medicinal plants and the corresponding informants**

| S.no | Medicinal plants | No. of informants | % of informants |
|---|---|---|---|
| 1 | *Asparagus africanus Lam.* | 27 | 42.8 |
| 2 | *Pentas lanceolata* | 29 | 46 |
| 3 | *Rumex nepalensis Spreng* | 33 | 52.3 |
| 4 | *Senecio schimperi* | 35 | 55.5 |
| 5 | *Vernonia amygdalina* | 27 | 42.8 |
| 6 | *Hagenia abyssinica* (Bruce) J.F.Gmel. | 26 | 41.2 |
| 7 | *Zehneria anomala* | 32 | 50.7 |
| 8 | *Bersema abyssinica* Fresen. | 29 | 48.3 |
| 9 | *Ocimum lamifolium* Hochst. Ex Benth. | 39 | 61.9 |
| 10 | *Solanum tarderemotum* Bitter | 30 | 47.6 |
| 11 | *Ruta chalepensis* | 41 | 65 |
| 12 | *Zingiber officinale Roscoe* | 38 | 60.3 |
| 13 | *Croton macrostachyus* A.Rich | 39 | 61.9 |

## 4.6. Informant consensus factor (ICF)

The disease of the study area have been grouped into various categories based on the site of occurrence of the disease, condition of the disease as well as treatment resemblance of the disease to the local people. The informant consensus factors have been calculated for each category (Table 6). The highest ICF (0.9) value was obtained for disease related to Fibril illness, Diarrhea, Snake bite, Poison of snake, Fungus and malaria and the least one (0.3) was associated with evil eye, eye problem, rabies, kidney, colic and amoeba, exoparasite, abdominal bloating.

Table 6. Informant consensus factor by categories of disease in the study area

| Disease categories | No. of species | Use citation | ICF |
|---|---|---|---|
| Common cold, Colic, headache, Intestinal problem | 4 | 19 | 0.8 |
| Wound | 8 | 25 | 0.7 |
| Stomachache | 5 | 40 | 0.89 |
| Fibril illness, Diarrhea, Snake bite, Poison of snake, Fungus and malaria | 3 | 35 | 0.9 |
| Evil eye, Eye problem, Rabies, Kidney, Colic and Amoeba, Exoparasite, Abdominal bloating | 8 | 11 | 0.3 |
| Earache, Pneumonia, Blood pressure, Anemia, Influenza, Skin problem, Tapeworm, Indoparasite, Sudden death, Enlargement of gland, Urination, urine of bat | 12 | 28 | 0.6 |

## 4.7. Threat and Conservation of Medicinal Plants of the Study Area

### 4.7.1. Threat to medicinal plants

The cause of threats to medicinal plants can be generally grouped in to natural and human induced factors. However, as reported in this study most of the causes for the threats to medicinal plants and associated knowledge are the anthropogenic factors such as deforestation due to over exploitation of plants for different uses/charcoal, fire woods, construction, overgrazing, cutting and burning of plants to create new agricultural lands ,medicinal plants trade for different uses and others.

**Table 7. Major threats on Medicinal Plants of the study area**

| S,no | Threat to medicinal plants | No of informants | Percentage (%) |
|---|---|---|---|
| 1 | Agricultural expansion | 25 | 41.6 |
| 2 | Charcoal production | 10 | 16.6 |
| 3 | Fire wood | 17 | 28.3 |
| 4 | Construction | 8 | 13.3 |

The major factor for plant destruction is agricultural expansion which accounted for 41.6% followed by fire wood (28.3%), charcoal production (16.6%) and Construction is accounted 13.3% (Table 7). The destruction of forests for different reasons, forced the people to go far away from their home to collect medicinal plants and some informant claimed that the scarcity of medicinal plants in their area is one factor that forced them to visit the expensive health institutions even for those diseases that could have been easily treated by medicinal plants. Some healers also reported that, the scarcity of medicinal plants is now forcing them to stop the practice. Informants also reported that young generation refused to know or inherit knowledge and use traditional medicine as a result a lot of valuable information could be lost whenever traditional medicinal practitioners die without sharing their knowledge to others.

### 4.7.2. Conservation of medicinal plants

Indigenous people of the area have strong belief on healing power of plants and they know their habitat, harvesting technique and time of harvest. In the study area, there were only 6 medicinal plants found in home garden. This indicated that there were little attempts of cultivating medicinal plants at their home garden due to easy access to wild medicinal plants in the past and some medicinal plants are difficult to domesticate. However, the elders and practitioners know the importance of conserving medicinal plants and believed that, home gardens are good places for conservation of medicinal plants as well as for better transfer of indigenous knowledge to the younger generation. Some traditional practitioners have started to conserve medicinal plants by cultivating at their home garden. For instance, medicinal plants like *Pentas lanceolata*, *Hagenia abyssinica* (Bruce) J.F.Gmel, *Brucea antidysenterica* J.F.Mill and *Ruta chalepensis* are found in some family gardens and farm borders in the study area, as they need these plants in their daily life as medicine.

# 5. DISCUSSION

## 5.1. Medicinal Plants of the Study Area

The study show that there are different types of medicinal plant was documented in the study area to treat both human and livestock ailments. Most of the medicinal plant species collected and identified in this study were also found to be used in other parts of Ethiopia. This result is in line with Tolasa (2007) who reported 34 species in Gimbi Woreda Western Wellega, 21 species reported by Mengistu (2010) from seru wereda Arsi zone of Oromia region and 8 species reported by Kelayu *et al*. (2013) in Gemad District, Northern Ethiopia as medicinally important species to cure human and livestock ailments. From these findings, one can boldly say that the local people over a wide area in Ethiopia show the tendency to use same medicinal plants and this can be an indicator for the genuine therapeutic value of these medicinal plants as well as the indigenous knowledge on medicinal plants and to a certain extent their efficacy.

## 5.2. Medicinal plants used to treat human ailments

The study revealed that there are different plant remedies for treatment of several ailments. These plant species belonging to different families. Family Asteraceae and Fabaceae represented by 5(8**.9%)** which was the leading families among human medicinal plants. This finding show that family Asteraceae and Fabaceae contributed the highest number of medicinal plant species when compared to other familiesand the finding is in line with a study from Seru wereda, Arsi zone of Ethiopia, by Mengistu (2010), in which Asteraceae contributed highest number of species (8.26%). Regarding the habitat where medicinal found in the study area show that 41(73.2%) plants harvested from wild, 11(19.6%) are from cultivated land and 4 (7.1) from home garden. This result is similar with the result of Mengistu (2010) in which the highest number (81.82%) of medicinal plants collected from wild in Seru wereda and a study by Etana (2007) reported that the majority of (43.52%) of medicinal plants were harvested from wild in Gimbi woreda.

### 5.2.1. Growth form of human medicinal plants

In the study area, all plant growth forms are not equally used as remedies. This is because of the difference in distribution among the growth forms. This leads to the wide use of shrubs and herbs for their medicine. Accordingly herbs were found to be the highest which accounted for 20(35.5%) and followed by shrubs 16(28.6%).This study agrees with similar studies elsewhere in Ethiopia (Tesfaye Awas and Sebsebe Demissew, 2009).

### 5.2.2. Plant parts used to treat human ailments

According to this finding, the part of the plant which is highly used for preparation of the remedies were leaves 42 (75%) followed by seeds 5 (8.9%). This is because it is believed that leaves contain more concentration of active ingredients. The finding of this study agrees with the finding of Etana (2007) in which leaves (48.2%) reported as the most widely used plant parts. As study by mengistu (2010) showed that leaves 41% as a major plant part used and Eskedar (2011) also documented leaves 50.3% as a major plant parts used in treatment of human ailments. Additionally the report by Bahailu (2010) indicated that leaves contributed 64.5% as a major plant parts used in the treatment of human ailments.

### 5.2.3. Method of preparation and route of administration of human medicine

The study revealed that there are different preparation forms for plant remedies. The principal methods of plant parts remedy preparation forms were reported to be through crushing, which accounted for 19 preparations (33.9%) followed by exudation accounted for 13 preparations (23.2%) This finding is in line with the result of mengistu (2010) from Seru Wereda, which reported 50.3% of preparations were by crushing. However, Mohammed *et al*. (2008) in similar study from Chencha District, Gamo gofa, Ethiopia reported that concoction was a dominant method of preparation of remedy and Kelayu *et al*. (2013) documented that the people of Gemad District prepared their remedies mostly by crushing (22.5%).

Medicinal plants are applied through different routes of administration. In the study area oral is the dominant route of administration accounted 23 medicinal plants (41.1%), followed by dermal accounted for 15 medicinal plants (26.8%).This result the findings of Mersha *et al*. (2016) from Bule Hora District of Borana Zone, they reported that, oral administration accounted for 67.19% and dermal is the second most important rout of administration. Also the result of Kalayu *et al*.

(2013) from Gemad District northern Ethiopia, indicated that oral rout of administration accounted for (64.5%) followed by dermal application which accounted (25.8%) and the result of Mohammed and Seyoum (2008) revealed that oral administration accounted for 67% and followed by dermal 25% in Chencha District, Gamo gofa Ethiopia.

### 5.3.1. Growth form and part used of livestock medicinal plants in the study area

The result shows that there are different types of growth form for treating livestock ailment. The growth forms indicated that shrubs constitute most of the medicinal plants used for treating livestock ailments in the study area. This result shows that people rely on shrubs and herbs because they are relatively common in the area when compared to tree species. A study conducted by Mesfin *et al*. (2009) indicated that the shrubs are the major plants habit that harvested followed by herbs (22.58%) as a major plant habit harvested for livestock disease treatment. However, the findings of Teklehaymanot and Giday (2007) showed that herbs are the most frequently used plant parts. Regarding the plant parts documented for various medicines to livestock ailments, leaves accounted the highest represented by 9 species (18.4%) followed by roots 4 species (8.2%). The finding of Hailmariam *et al*. (2009) revealed that leaves are the most (34.2%) used parts of medicinal plants followed by roots (30.9%) and Adefa and Abrah (2011) indicated that 48% of livestock remedies were prepared from leaves in Tehuledere district, South Wollo, Ethiopia. However, Balemie *et al*. (2004) obtained a result that the Kereyu Oromo people mostly prepared livestock remedy from roots. Also the findings of Yineger *et al*. (2007) showed that roots were the major plant part used for veterinary medicine (41.54%) hen compared to leaves (36.15%) in Bale National park.

### 5.3.2. Method of preparation and mode of application of livestock medicine

The study revealed that there are different preparations for livestock remedies. Crushing and pounding was the dominant preparation form followed exudation. This finding was in line with the finding of Hunde *et al.* (2006) which revealed that crushing (17%) is the leading remedy preparation in Boosat sub District, Central Eastern Ethiopia. The finding show that the common adopted route of application was oral which accounted for 6 (12.2%) preparations followed by 4 (8.2%) preparation through dermal. This studies inline with the study by Amenu (2007) from Chelya District and Lulkal *et al*. (2008) from Mana Angetu District were showed that, the oral routes of administration was more prominent represented by 60.5% and 50.5% respectively.

## 5.4. Ranking of Medicinal plants

Ranking of medicinal plants showed that there are medicinal plants that are preferred by local people than the other. This indicated that local people acquire the knowledge through experience and could differentiate medicinal plants that are effective for treatment of their ailment or their livestock ailments. Of the medicinal plants used to treat stomachache, Solanum tarderemotum stood first and hence is the most effective medicinal plant to cure stomachache, followed by Vernonia amygdalina.

In the study area, a number of medicinal plants were found to be multipurpose species being utilized for a variety of uses. Direct matrix ranking showed that, of the total medicinal plants *Croton macrostachyus* is the most multipurpose use medicinal plant followed by Eucalyptus globules. This is in line with the finding of Amsalu (2010) which reported Croton macrostachyus as highest multipurpose use in Farta District South Gonder Zone of Amhara Regional State. However, the study by Megersa (2010) reported that Croton macrostachyus as third multipurpose medicinal plant in Wayu Tuka District, East Wollaga Zone of Oromia Regional State.

## 5.5. Threat and Conservation of Medicinal Plants of the Study Area

### 5.5.1. Threats

Medicinal plants are at increasing risk from destruction of their habitats (agricultural expansion, charcoal production, fire wood and construction) and over harvesting of known medicinal species (Cunningham, 1993). According to Roberson (2008) about 15,000 medicinal plant species may be threatened with extinction world widely due to habitat loss and over harvesting. It is estimated that the earth is losing one potential major drug every two-years. In the study area, the people also rely on medicinal plants for various purposes such as charcoal, medicine, fire wood, live fence and construction. The major threat to medicinal plants in the study area was agricultural expansion which accounted for 41.6%, charcoal production 16.6%, fire wood accounted for 28.3% and construction accounted for 13.3%. The result of Giday *et al*. (2003) indicated that intense deforestation became the major threat to medicinal plants in Zay people. Also Yineger and Yewhalaw (2007) reported that agricultural expansion (12.5%) were the most threat to medicinal plants in Sokoru District of Jimma Zone. Lulekal *et al*. (2008) reported

deforestation (90%) as the principal threat to medicinal plants in Mana Angetu District, Southeastern Ethiopia.

Availability of medicinal plants has been affected by a dramatic decrease in the area of native vegetation due to agricultural expansion, deforestation, fire, overgrazing and charcoal (Cunningham, 1996; Balemie *et al*., 2004).

### 5.5.2. Conservation of medicinal plants in the study area

The influences of human on the natural habitat of medicinal plants are the problems for the conservation of medicinal plants and associated knowledge. The effort to conserve medicinal plants in the District was observed to be very poor. Some informants have started to conserve medicinal plants by cultivating at home gardens. About 20.6%, of the medicinal plants collected were reported as found at cultivated land (crop land) and about 9.1% of medicinal plants were reported as cultivated at home gardens and these include plants like *Carica papaya* and *Ocimum lamifolium*. The result of Lulkal *et al*. (2008) indicated that only 5.7% of medicinal plants were cultivated in home garden showing minimal effort of medicinal plant conservation in Mena Angetu District.

The issues of medicinal plant conservation have been focus of many formal and informal discussions at national and international forums, seminars, workshops, conferences and congresses in the last 10 years. In order to have a sustainable utilization of these plants, the best practical solution is to launch conservation measures. This would help to reduce the pressure on these medicinal plants considerably. Many actions are recommended in declarations and documents like the guidelines on the conservation of medicinal plants. From the global perspective, many questions relating to the conservation status of medicinal plants still remain unanswered (Hamilton, 2003).

Cunninghum (1992) suggested that natural resources could be utilized best in sustainable way if management practices are complete. In fact, such valuable activities requires appropriate action and changes by the full range of societies and stakeholders involved in the conservation, production and management as well as use of medicinal plants. Since an action on conservation and sustainable use of medicinal plants need involvement of various sectors and greater public support, it needs continuous task of creating public awareness (Shankar, 1993).

# 6. CONCLUSION AND RECOMMENDATION

## 6.1. Conclusions

A study on medicinal plants utilization in Gera District, Jimma zone of Oromia region, Ethiopia revealed that the communities commonly use medicinal plants for maintaining their primary healthcare and they have rich traditional knowledge on use, preparation and application of local plants to cure various ailments of man and animals. The study has resulted in the collection and identification of 63 medicinal plant species spread in 35 families. Regarding the families of medicinal plants Asteraceae and Fabaceae represented by five species (7.9%) each followed by Rutaceae, Solanaceae, Cucurbitaceae. Out of the 63 medicinal plants 51 species are occurring in wild and 6 are found in home gardens and cultivated lands.

The medicinal plants are used for treating a total of 68 ailments among which 50 ailments found in human and 18 ailments are found in livestock. Out of the 63 medicinal plants documented from the study area 56 medicinal plants are used for treating human ailments, 15 medicinal plants are used for treating livestock ailments.

Herbs were found the dominant growth form of medicinal plants used for preparation of human remedies. However, shrubs are the dominant growth form of medicinal plant used for preparation of livestock traditional remedies. Leaves were also found to be the most frequently used plant parts followed by seeds for preparation of human remedies and leaves were the most used plant parts followed by roots for the preparation of livestock remedies. Traditional medicinal plant preparation mostly involves single plants and the method of preparation was mainly crushing followed by exudation for human ailment and crushing followed by pounding for livestock preparation of remedies; the mode of administration was mainly internal which oral administration is the common route.

Depletion of indigenous knowledge among the people of the district was serious because of disinterest of young generation to gain the knowledge, oral based knowledge transfer, unavailability of the species and influence of modern education. The main threat for medicinal plants in the area arises from agricultural expansion, fire wood, charcoal production and construction. In addition, the multipurpose use of some of the medicinal plants was

leading to overexploitation followed by the depletion of the natural population became a highly threatening factor for the medicinal plants in the study area. Even though there was no conservation measure taken in the area, the people of the district had started conservation in their home gardens.

## 6.2. Recommendations

Based on the result of the study, the following recommendations are forwarded:

- The indigenous knowledge and skill of preparing traditional medicine of indigenous people should be encouraged and protected. This could be the way through which such people could exercise their knowledge boldly.
- Identifying effective medicinal plants and promoting their production and cultivation. This is task to be accomplished through genuine collaboration between local administrators and local people.
- Establishing conservation strategies to ensure the sustainability of medicinal plants as most medicinal plants are obtained from the wild.
- Encouraging people to grow medicinal plants in their home gardens, mixing with crops in farmlands, as live fences and on degraded land.
- The uses of medicinal plants for treatment of different ailments indeed need to be confirmed through scientific investigations to identify those that may provide alternative for modern drugs.

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# 8. APPENDIXES

Appendix 1. List of Medicinal plants of the study area

(Cl-cultivated, Hab- habitat A/O-Afanoromo)

| S.No | Scientific name | Family | Vernacular name(A/O) | Habit | Habitat | Coll.No. |
|---|---|---|---|---|---|---|
| 1 | *Asparagus africanus* Lam. | Asparagaceae | Sariitii | Shrub | Wild | 001 |
| 2 | Vernoni rueppelli | Asteraceae | Reejjii | Tree | Wild | 002 |
| 3 | *Clerodendron myricoides* (Hochst.) Vatke | Lamiaceae | Marasisaa | Shrub | Wild | 003 |
| 4 | Pentas lanceolata | Rubiaceae | Surma | Shrub | Wild | 004 |
| 5 | *Rumex nepalensis* Spreng | Polygonaceae | Baarudaa | Herb | Wild | 005 |
| 6 | *Senecio schimperi* | Asteraceae | Yeshanqila medanit | Herb | Wild | 006 |
| 7 | *Senna petersiana* | Fabaceae | Samamaki habesha | Herb | Wild | 007 |
| 8 | *Sida rhombifolia L.* | Malvaceae | Karaabaa | Herb | Wild | 008 |
| 9 | Vernonia amygdalina | Asteraceae | Ibicha | Tree | Wild | 009 |
| 10 | *Euphorbia abyssinica Gmel.* | Euphorbiaceae | Adaami | Shrub | Wild | 0010 |
| 11 | *Ricinus communis* | Euphorbiaceae | Qoboo | Shrub | Wild | 0011 |
| 12 | *Justicia schimperiana* (Hochst. Ex Nees) T. Anders | Acanthaceae | Dhumugaa | Herb | Wild | 0012 |
| 13 | Mukia maderaspatana | Cucurbitaceae | Unknown species | Climber | Wild | 0013 |
| 14 | *Nicotiana glauca* Graham | Solanaceae | Tibantimbo | Shrub | Wild | 0014 |
| 15 | Nicotiana tabacum L. | Solanaceae | Tambo | Shrub | Wild | 0015 |
| 16 | *Cucumis ficifolius A.R ich.* | Cucurbitaceae | Faca‟‟aa | Herb | Wild | 0016 |
| 17 | Brucea antidysenterica J.F. Mill. | Simaroubaceae | Qomanyo | Shrub | Wild | 0017 |
| 18 | *Plantago palmate* | Plantaginaceae | Unknown species | Herb | Wild | 0018 |
| 19 | *Hagenia abyssinica* (Bruce) J.F.Gmel. | Rosaceae | Heexoo | Tree | Wild | 0019 |
| 20 | *Millettia ferruginea* (Hochst.) Bak | Fabaceae | Askera | Shrub | Wild | 0020 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 21 | *Erythrina brucei* Schweinf | Fabaceae | Waleensu | Shrub | Wild | 0021 |
| 22 | *Clausenia anisata* (Wild.) Hook. F.ex. Benth | Rutaceae | Ulmaayii | Shrub | Wild | 0022 |
| 23 | *Zehneria anomala* | Cucurbitaceae | Hidda bofaa | Climber | Wild | 0023 |
| 25 | *Satureja paradoxa* (Vatke) Engl.ex Seybold. | Lamiaceae | Nadoo | Herb | Wild | 0025 |
| 26 | Rosa x richardii Rehd | Rosaceae | Tsegereda | Shrub | Home garden | 0026 |
| 27 | Senna didymobotrya | Fabaceae | Samamaki araba | Herb | Wild | 0027 |
| 28 | *Piper capense* L.F. | Piperaceae | Tunjo | Shrub | Wild | 0028 |
| 29 | *Diaphananthe adoxa* Rasm. | Orchidaceae | Harmabuso | Epiphyte | Wild | 0029 |
| 30 | *Ocimum lamifolium* Hochst. Ex Benth. | Lamiaceae | Damaakasee | Herb | Home garden | 0030 |
| 31 | *Fagaropsis angolensis* (Engl.) Dale | Rutaceae | Sigiluu | Tree | Wild | 0031 |
| 32 | *Rangaeris amaniensis* (Kraenzl.) Summerh | Orchidaceae | Harmuukoo | Epiphyte | Wild | 0032 |
| 33 | *Solanum tarderemotum* Bitter | Solanaceae | Acho | Shrub | Wild | 0033 |
| 34 | *Pavonia schimperiana Hochst .ex A.Rich.* | Malvaceae | Togoo | Herb | Wild | 0034 |
| 35 | *Kosteletzekya adoensis (Hochest.ex A.Rich.) Mast.* | *Malvaceae* | Hincini | Herb | Wild | 0035 |
| 36 | Echinops kebericho | Asteraceae | Qabarichoo | Herb | Wild | 0036 |
| 37 | *Plumbago zeylanica* L. | Plumbaginaceae | Amera | Herb | Wild | 0037 |
| 38 | *Rytigynia neglecta* (Hiern) Robyns | Rubiaceae | Mixoo | Shrub | Wild | 0038 |
| 39 | *Prunus africana* (Hook.*f*) Kalkm | Rosaceae | Ommo | Tree | Wild | 0039 |
| 40 | *Gloriosa superba L.* | Colchicaceae | Ramandawa | Climber | Wild | 0040 |
| 41 | *Embelia schmperi Vatke* | Myrsinaceae | Haanquu | Shrub | Wild | 0041 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 42 | *Acmella caulirhiza* | Asteraceae | Barbare kafa | Herb | Wild | 0042 |
| 43 | *Clematis simensis Fresen* | Ranunculaceae | Hidaa fitii | Climber | Wild | 0043 |
| 44 | *Pittosporum viridiflorum* Sims | Pittosporaceae | Sole | Shrub | Wild | 0044 |
| 45 | Crinum ornatum | Amaryllidaceae | Qulubi maja | Herb | Wild | 0045 |
| 46 | Eucalyptus globules | Mrytaceae | Bargamo adi | Tree | Wild | 0046 |
| 47 | Datura stramonium L. | Solanaceae | Asangira | Herb | Wild | 0047 |
| 48 | Lagenaria siceraria | Cucurbitaceae | Buqe | Climber | Home garden | 0048 |
| 49 | *Annona squamosa* | Annonaceae | Gishxa | Tree | Home garden | 0049 |
| 50 | Ruta chalepensis | Rutaceae | Xenadami | Herb | Home garden | 0050 |
| 51 | Persea Americana | Lauraceae | Abokado | Tree | Cultivated | 0051 |
| 52 | *Grewia ferruginea Hochst. ex A.Rich.* | Tliaceae | Doqoonu | Shrub | Wild | 0052 |
| 53 | *Lippia adoensis* Hochst.ex Walp. | Verbenaceae | Kusaayee | Shrub | Home garden | 0053 |
| 54 | *Calpurina aurea* (Ait.) Benth | Fabaceae | Ceekaa | Shrub | Wild | 0054 |
| 55 | Citrus aurantium (L.) | Rutaceae | Lomii | Shrub | Cultivated | 0055 |
| 56 | *Papaya carica L.* | Caricaceae | Papaya | Shrub | Cultivated | 0056 |
| 57 | *Zingiber officinale Roscoe* | Zingiberaceae | Zingibila | Herb | Cultivated | 0057 |
| 58 | *Allium sativum* | Aliaceae | Qulubii adi | Herb | Cultivated | 0058 |
| 59 | *Justitia schimperana* | Acanthaceae | Sansalii | Shrub | Wild | 0059 |
| 60 | Phytolacca dodecandra L.Herit. | phytolaccaceae | Andodee | Herb | Wild | 0060 |
| 61 | *Croton macrostachyus* A.Rich | Euphorbiaceae | Bakanisa | Tree | Wild | 0061 |
| 62 | *Albizia gummifera* (J.F.Gumel.) C.A.Sm | Fabaceae | Hambabbeessa | Tree | Wild | 0062 |
| 63 | *Catha adulis* | Celastraceae | Caatii | Shrub | Cl | 0063 |

Appendix 2. List of medicinal plants used for human Ailments

(Ha- habit, S-shrub, C-climber, T- tree, E- epiphyte, H-herb, A/O- Afan Oromo

| S. No | Scientific name | Family | Vernacular name(A/O) | Ha | Ailments | Part used | Mode of preparation | Route of administration |
|---|---|---|---|---|---|---|---|---|
| 1 | *Asparagus africanus* Lam. | Asparagaceae | Sariti | S | Malaria, Yemareyam mekenet | Whole plant | The leaf crushed and boiled | Oral |
| 2 | *Echinops Kebericho* | Asteraceae | Qebericho | H | Snake bite, Poison of snake, headache, Sudden death | Root | Crushed | Smoking |
| 3 | Allium sativum | Aliaceae | Qulubi adi | H | Intestinal Problem, malaria, headache, Common cold, Pneumonia, Colic | Seed | Crushed | Oral |
| 4 | Ocimum Urtiicifolium | Lamiaceae | Damakase | H | Colic, Stomachache, Indoparasite, Tapeworm, Diharria, Intestinal problem, headeck, Coughing, cold, Eye infection,Fibril illness | Leaf | Exudation | Inhalation |
| 5 | Ruta chalepensis | Rutaceae | Xenadami | H | Intestinal Problem, Stomachache, abdominal pain, Stomach problem, diarrhea, amoeba | Leaf | Crushed | Oral |
| 6 | *Pavonia Schimperiana Hochst .ex A.Rich.* | Malvaceae | Togo | S | Anemia, Fibril illness | Leaf | Exudation | Dermal |
| 7 | Eucalyptus Globules | Mrytaceae | Bargamo adi | T | Coughing, Common cold, Influenza | Leaf | Crushed | Smoking |
| 8 | Vernonia Amygdalina | Asteraceae | Ibicha | T | Wound, Stomach problem, Intestinal problem | Leaf | Crushed and boiled then drink it | Oral |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 9 | Carica papaya | Caricaceae | Papaayee | T | For abdominal bloating, malaria | Leaf | The Leaf Crushed and boiled | Oral |
| 10 | Croton Macrostachyus | Euphorbiaceae | Bakkanisa | T | Wound, Stomach problem, Fungus | Leaf | Exudation | Dermal |
| 11 | *Solanum Tarderemotum* Bitter | Solanaceae | Acho | S | Stomach problem, Colic | Leaf | Crushed and Cooking like a cabbage and eating by enjera | Oral |
| 12 | Hagina abyssinica | Rosaceae | Hexo | T | Tapeworm | Leaf | Crushed | Oral |
| 13 | Azadirachta Indica | Meliaceae | Neem | T | Exoparasite, Abdominal bloating | Seed | Crushed | Oral |
| 14 | *Zinger officinale* Roscoe | Zingiberaceae | Zinjibilaa | H | Cough, common cold and tonsillitis | Root | The root crushed and boiled with tea and taken. | Oral |
| 15 | Vernoni rueppelli | Asteraceae | Rejii | S | Wound, eye problem | Leaf | Crushed and Squeezing | Dermal and through eye |
| 16 | Pentas lanceolata | Rubiaceae | Surma | S | Breaking bones | Leaf | The leaf exudates and boiled then drink it. | Oral |
| 17 | Justitia Schimperana | Acanthaceae | Sansalii | S | Rabies | Leaf | The leaf exudates and drink. | Oral |
| 18 | *Clematis simensis* Fresen | Ranunculaceae | Hida fitii | Cl | Teeth problem | Leaf | Squeezing and Put the plant on the infected teeth | Chewing |
| 19 | Crinum ornatum | Amaryllidaceae | Qulubii warabessa | H | Wound | Root | Crushed and put it on the wound. | Tie on |
| 20 | *Senecio Schimperi* | Asteraceae | Yeshanqila medanit | H | External wounds | Leaf | Exudates and put it on the wound. | Tie on |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 21 | Lippia adoensis | Verbenacea e | Kusayee | H | Wound | Leaf | Exudation | Dermal |
| 22 | Persia Americana | Lauraceae | Avocado | T | Dandruff | Fruit | Concoction | Dermal |
| 23 | *Clerodendron Myricoides* (Hochst.) Vatke | Lamiaceae | Marasisaa | Sh | Evil eye | Stem | Cutting | Brushing |
| 24 | *Rumex nepalensis* Spreng | Polygonace ae | Baarudaa | Herb | Wound, colic and kidney | Root and Leaf | Squeezing and Putting the crushed leaf on the wound and drinking the water of the plant root | Oral and Dermal |
| 25 | *Senna petersiana* | Fabaceae | Samamaki Habesha | Herb | Snake bite and Poison of Snake, Bleeding of nose | Leaf | Crushed, exudated leaf inhaled for bleeding of nose | Dermal and Inhalation |
| 26 | *Sida rhombifolia L.* | Malvaceae | Karaabaa | Herb | Urine of Bat | Leaf | Exudation | Dermal |
| 27 | *Nicotiana glauca* Graham | Solanaceae | Tibantimbo | Shrub | To treat hadha | Leaf | Crushed and put it on infected part | Put on |
| 28 | *Zehneria anomala* | Cucurbitac eae | Hida bofa | Climber | For wound of testis | Root | Crushed and boiled it | Tie on |
| 29 | *Bersema abyssinica* Fresen. | Melianthac eae | Lolchisa | Tree | Rabies | Leaf | Concoction | Oral |
| 30 | *Satureja paradoxa* (Vatke) Engl.ex Seybold. | Lamiaceae | Nadoo | Herb | For manustration unable to stop | Leaf | Exudation | Oral |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 31 | Rosa x richardii Rehd | Rosaceae | Tsegereda | Herb | For manustration unable to stop | Flower | Concoction | Oral |
| 32 | Senna Didymobotrya | Fabaceae | Samamaki Araba | Herb | For poison of snake | Leaf | Exudation | Dermal |
| 33 | *Piper capense* L.F. | Piperaceae | Tunjo | Herb | External wound | Leaf | Squeezing | Dermal |
| 34 | *Diaphananthe adoxa* Rasm. | Orchidaceae | Harmabus O | Epiphyte | Diarrhea and Vomiting and amoeba | Leaf | Squeezing | Oral |
| 35 | *Fagaropsis angolensis* (Engl.) Dale | Rutaceae | Sigilu | Tree | For urination | Seed | Pounding | Oral |
| 36 | *Rangaeris Amanuensis* (Kraenzl.) Summerh | Orchidaceae | Harmuuko | Epiphyte | For ear problem | Leaf | Crushed and mixed with milk the distilled part added into the infected ear | Through ear |
| 37 | *Kosteletzekya Adoensis* (Hochest.ex A.Rich.) Mast. | *Malvaceae* | Hincini | Herb | For External wound | Leaf | Squeezing | Dermal |
| 38 | *Plumbago zeylanica* L. | Plumbaginaceae | Amera | Herb | Enlargement of gland | Leaf | Concoction | Dermal |
| 39 | *Rytigynia neglecta* (Hiern) Robyns | Rubiaceae | Mixo | Shrub | Fibril illness | Leaf | Squeezing | Dermal |
| 40 | *Prunus Africana* (Hook.*f*) Kalkm | Rosaceae | Ommo | Tree | External parasites | Leaf | Pounding | Dermal |
| 41 | *Gloriosa superb L.* | Colchicaceae | Ramandawa | Climber | Enlargement of gland | Leaf | Pounding | Dermal |
| 42 | *Embelia schmperi Vatke* | Myrsinaceae | Hanqu | Shrub | Tape worm | Leaf | Squeezing and boiling then | Oral |

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| | | | | | | | drink it | |
| 43 | *Acmella Caulirhiza* | Asteraceae | Barbare kafa | Herb | External wound | Leaf | Crushing | Put on |
| 44 | Datura stramonium L. | Solanaceae | Asangira | Herb | Afura lafaatiif | Leaf | Exudation | Oral |
| 45 | Lagenaria Siceraria | Cucurbitaceae | Buqe | Climber | Tape worm | Seed | Pounding | Oral |
| 46 | *Grewia ferruginea* Hochst. ex A.Rich | Tliaceae | Doqoonu | Shrub | The disease that have black the patient face | Leaf | Squeezing | Dermal |
| 47 | Citrus aurantium (L.) | Rutaceae | Lomii | Shrub | Skin problem, Blood pressure | Fruit | Concoction | Oral and Dermal |
| 48 | *Albizia gummifera* (J.F.Gumel.) C.A.Sm | Fabaceae | Hambabbeessa | Tree | Throat | Bark | Powdering | Oral |
| 49 | *Justicia Schimperiana* (Hochst. Ex Nees) T. Anders | Acanthaceae | Dhumugaa | Herb | Wound | leaves | Squeezing | Dermal |
| 50 | *Catha adulis* | Celastraceae | Caatii | Shrub | Lung Problem | Leaves | Pounding | Oral |
| 51 | *Annona squamosa* | Annonaceae | Gishxa | Tree | Lice | Seed | Pounding | Dermal |
| 52 | *Millettia Ferruginea* (Hochst.) Bak | Fabaceae | Askera | Shrub | Tetanus | Leaf | Crushing | Dermal |
| 53 | *Erythrina brucei* Schweinf | Fabaceae | Walensu | Shrub | Eye disease . | Leaf | Fresh leaves are pounded, squeezed and the juice is | Through eye |

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| | | | | | | | added to the eye | |
| 54 | *Clausenia anisata* (Wild.) Hook. F.ex. Benth | Rutaceae | Ulmaayii | Shrub | Ear problem | leaf | Exudation | Through ear |
| 55 | *Plantago palmate* | Plantaginaceae | Unknown species | Herb | Wound | Leaf | Crushing | Put on |
| 56 | Mukia Maderaspatana | Cucurbitaceae | Unknown species | Climber | Liver | leaf | Pounding | Oral |

Appendix 3. List of medicinal plants used for livestock ailments

(Ha-habitat, A/O-Afan Oromo, S-shrub, C-climber, T-tree, E-epiphyte and H-herb)

| S. NO | Scientific name | Family | Vernacular name(A/O) | Ha | Ailments | Part used | Mode of preparation | Route of administration |
|---|---|---|---|---|---|---|---|---|
| 1 | *Nicotina tabacum* | Solanaceae | Tamboo | S | Common cold, Pastrolaysis, Bloating, Wound, Indoparasite, AlkitFor dry nose of livestock, | Leaf | Crushed | Oral and Inhalation |
| 2 | *Echinops kebericho* | Asteraceae | Qeberic ho | H | Sudden death, Shivering, Poison of snake | Root | Crushed | Smoking |
| 3 | *Allium sativum* | Aliaceae | Garlic | H | Blouting, Pnemmonia | Seed | Crushed | Oral |
| 4 | *Cucumis ficifolius* A.R ich. | Cucurbitac eae | Facaʿaa | H | For dry nose of livestock | Root | Pounding | Oral |
| 5 | *Calpurnea aurea* | Fabaceae | Ceekaa | SH | Trips | Leaf | Pounding | Oral |
| 6 | *Phaytolac A dodecandr A* | Phytolacca ceae | Andodee | SH | Insecticides | Leaf | Exudation | Oral |
| 7 | *Ricinus communis* | Euphorbiace ae | Qoboo | SH | For afura lafaa | Root | Pounding | Oral |
| 8 | *Justitia schimpera Na* | Acanthacea e | Sansal | SH | Rabies | Leaf | Exudation | Oral |
| 9 | *Crinum ornatum* | Amaryllidac eae | Yejib shinkurt | H | Wound | Root | Pounding and put it on the wound | Dermal |
| 10 | *Zehneria anomala* | Cucurbitac eae | Hida bofa | Cl | Bloating | Leaf | Cutting | Put on |
| 11 | *Croton macrostac Hyus* A.Rich | Euphorbiac eae | Mekkannisa/ Bakanisa | T | Bloating | Leaf | Crushing and Heat on the body of the livestock | Dermal |
| 12 | *Euphorbia* | Euphorbiac | Adaamii | Sh | Shake of the | Stem | Burning and | Dermal |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *abyssinica* Gmel. | eae | | | body, Black leg | | Smell it to the infected animal | |
| **13** | *Azadiracht a indica* | Meliaceae | Neem | T | External parasites (Ticks) | Leaf | Crushed and put it on infected body | Put on |
| **14** | *Pittosporu M viridifloru m* Sims | Pittosporac eae | Sole | Sh | Horse malaria | Leaf | Pounding and mix with other plant then inhaled | Inhalation |
| **15** | *Brucea antidysente Rica* J.F. Mill. | Simaroubac eae | Qomango | Shrub | For Livestock wound | Leaf | Crushed and brushing the wound of the livestock | Dermal |

Appendix 4. Medicinal plant that used for both human and livestock ailment

| S. No | Scientific name | Family | Vernacular name(A/O) | Ha | Ailments | Part used | Mode of preparation | Route of administration |
|---|---|---|---|---|---|---|---|---|
| 1 | *Echinops kebericho* | Asteraceae | Qebarichoo | H | Sudden death, Shivering, Poison of snake | Root | Crushed | Oral |
| 2 | *Croton macrostachyus* A.Rich | Euphorbiaceae | Bakanissa | T | Bloating Wound, Stomach problem, Fungus | Leaf | Crushing | Dermal |
| 3 | *Azadirachta indica* | Meliaceaceae | Niimii | T | External parasites (Ticks) | Leaf | Pounding | Inhalation |
| 4 | *Allium sativum* | Aliaceae | Qulubii adii | H | Intestinal Problem, malaria, headache, Commoncold, Pneumonia, Colic and Blouting | Seed | Crushed | Oral |
| 5 | *Justitia schimperana* | Acanthaceae | Sansal | S | Rabies | Leaf | Exudation | Oral |
| 6 | *Crinum ornatum* | Amaryllidaceae | Qulubii waraabessa | H | Wound | Root | Pounding | Dermal |
| 7 | *Zehneria anomala* | Cucurbitaceae | Hida bofaa | Cl | Bloating and For wound of testis | Leaf | Cutting | Put on |

Appendix 5. List of medicinal plants and the corresponding informants

| S.no | Medicinal plants | No. of informants | % of informants |
|---|---|---|---|
| 1 | *Asparagus africanus Lam.* | 27 | 42.8 |
| 2 | *Vernonia rueppelli* | 25 | 39.7 |
| 3 | *Clerodendron myricoides* (Hochst.) Vatke | 10 | 15.8 |
| 4 | *Pentas lanceolata* | 29 | 46 |
| 5 | *Rumex nepalensis* Spreng | 33 | 52.3 |
| 6 | *Senecio schimperi* | 35 | 55.5 |

| | | | |
|---|---|---|---|
| 7 | *Senna petersiana* | 19 | 30.1 |
| 8 | *Sida rhombifolia* L. | 19 | 30.1 |
| 9 | *Vernonia amygdalina* | 27 | 42.8 |
| 10 | *Euphorbia abyssinica* Gmel. | 23 | 36.5 |
| 11 | *Ricinus communis* | 18 | 28.5 |
| 12 | *Justicia schimperiana* (Hochst. Ex Nees) T. Anders | 19 | 30.1 |
| 13 | *Mukia maderaspatana* | 15 | 23.8 |
| 14 | *Nicotiana glauca* Graham | 13 | 20.6 |
| 15 | Nicotiana tabacum L. | 15 | 23.8 |
| 16 | *Cucumis ficifolius* A.R ich. | 14 | 22.2 |
| 17 | *Brucea antidysenterica* J.F. Mill. | 14 | 22.2 |
| 18 | *Plantago palmate* | 18 | 28.5 |
| 19 | *Hagenia abyssinica* (Bruce) J.F.Gmel. | 26 | 41.2 |
| 20 | *Millettia ferruginea* (Hochst.) Bak | 17 | 26.9 |
| 21 | *Erythrina brucei* Schweinf | 23 | 36.5 |
| 22 | *Clausenia anisata* (Wild.) Hook. F.ex. Benth | 24 | 38 |
| 23 | *Zehneria anomala* | 32 | 50.7 |
| 24 | *Bersema abyssinica* Fresen. | 29 | 48.3 |
| 25 | *Satureja paradoxa* (Vatke) Engl.ex Seybold. | 26 | 40 |
| 26 | Rosa x richardii Rehd | 22 | 34.9 |
| 27 | *Senna didymobotrya* | 21 | 33.3 |
| 28 | *Piper capense* L.F. | 12 | 19 |
| 29 | *Diaphananthe adoxa* Rasm. | 22 | 34.9 |
| 30 | *Spathoda campanulata P.Beauv* | 16 | 25.4 |

| | | | |
|---|---|---|---|
| 31 | *Ocimum lamiifolium* Hochst. Ex Benth. | 39 | 61.9 |
| 32 | *Fagaropsis angolensis* (Engl.) Dale | 19 | 30.1 |
| 33 | *Rangaeris amaniensis* (Kraenzl.) Summerh | 25 | 39.7 |
| 34 | *Solanum tarderemotum* Bitter | 30 | 47.6 |
| 35 | *Pavonia schimperiana* Hochst .ex A.Rich. | 24 | 38 |
| 36 | *Kosteletzekya adoensis* (Hochest.ex A.Rich.) Mast. | 19 | 30.2 |
| 37 | Echinops kebericho | 19 | 30.2 |
| 38 | *Plumbago zeylanica* L. | 19 | 30.2 |
| 39 | *Rytigynia neglecta* (Hiern) Robyns | 18 | 28.5 |
| 40 | *Prunus africana* (Hook.f) Kalkm | 17 | 26.9 |
| 41 | *Gloriosa superba* L. | 15 | 23.8 |
| 42 | *Embelia schmperi* Vatke | 15 | 23.8 |
| 43 | *Acmella caulirhiza* | 14 | 22.2 |
| 44 | *Clematis simensis* Fresen | 16 | 25.4 |
| 45 | *Pittosporum viridiflorum* Sims | 17 | 26.9 |
| 46 | *Crinum ornatum* | 17 | 26.9 |
| 47 | *Eucalyptus globulus* | 39 | 61.9 |
| 48 | *Datura stramonium L.* | 15 | 23.8 |
| 49 | *Lagenaria siceraria* | 15 | 23.8 |
| 50 | *Annona squamosa* | 12 | 19 |
| 51 | *Ruta chalepensis* | 41 | 65 |
| 52 | *Percia Americana* | 13 | 20.6 |
| 53 | *Grewia ferruginea* Hochst. ex A.Rich. | 12 | 19 |
| *54* | *Lippia adoensis* Hochst.ex Walp. | *14* | *22.2* |
| 55 | *Calpurina aurea* (Ait.) Benth | 15 | 23.8 |

| | | | |
|---|---|---|---|
| 56 | *Citrus aurantium* (L.) | 17 | 26.9 |
| 57 | *Papaya carica* L. | 20 | 31.7 |
| 58 | *Zingiber officinale* Roscoe | 38 | 60.3 |
| 59 | *Allium sativum* | 18 | 28.5 |
| 60 | *Phytolacca dodecandra* L.Herit. | 18 | 28.5 |
| 61 | *Croton macrostachyus* A.Rich | 39 | 61.9 |
| 62 | *Albizia gummifera* (J.F.Gumel.) C.A.Sm | 22 | 34.9 |
| 63 | *Catha adulis* | 25 | 39.7 |

Appendix .6

Checklists of Semi structured Questions which was used for Discussion and Interviewee with informants to collect Ethno botanical data to be completed for each informant.

I. General Information on Respondents

1. Date Locality

2. Respondent's full name

2.1. Sex 2.2. Age 2.3. Language

2.4. Occupation 2.5. Religion

2.6. Marital status 2.7. Educational status

**II. Ethnobotanical Information**

1. What are the main human health problems in your locality?

2. What are the main livestock‟s health problems in your locality?

3. How do you treat human health problems?

A, Traditionally B, Modern C, Both

D, Specify if others

4. How do you treat livestock health problems?

A, Traditionally B, Modern C, Both D, Specify if others

5. List human health problems which treated by traditional medicine in your locality?

6. List livestock‟s health problems which treated by traditional medicine in your locality?

7. List the medicinal plants used to treat human ailments?

8. List the medicinal plants used to treat livestock ailments?

9. List medicinal plants used to treat both human and livestock ailments?

10. From where are the medicinal plants harvested?

A. Wild B. Cultivated

11. Habits of medicinal plants

A. Climber B. Epiphyte C. Herb D. Shrub E. Tree

12. Plant part used: A. Bark B. Flower C. Fruit D. Leaves E. Root F. Seed G. Stem H. Whole plant

13. Preparation method:

A. Concoction B. Crushed C. Exudation D. Dried F. Fresh G. Powdered

14. List the threats of medicinal plants in your locality?

A, Deforestation B, Urbanization C, Illegal trade D, Plant disease E, mention if others

15. Do you conserve medicinal plants in your home garden?

A. Yes B. No

16. If Yes, List medicinal plants name conserved in your home garden?

17. Is there any medicinal plants that used for other purpose?

A. Firewood B. Charcoal C. Live fence D. Forage G. Shade E. Fruit edible F. medicine

18. Is there any effort made to conserve medicinal plants in the area?

19. What are modes of administration of traditional medicinal plants?

A, Oral B, Dermal C, Intravenous D, Intra muscular E, Smoking F. Others