

**FULL-LENGTH ARTICLE****Ethnobotanical Study of Medicinal Plants Used to Treat Human and Livestock Ailments in Dessie Zuria District, South Wollo Zone, Ethiopia**Dagmawit Addis<sup>1</sup>, Tamene Belude<sup>2\*</sup> and Shelema Guzo<sup>2</sup><sup>1</sup>Department of Biology, Aksum University, Aksum, Ethiopia<sup>2</sup>Department of Biology, Jimma University, P.O. Box 378, Jimma, Ethiopia**\*Corresponding author:** [kura.2006@yahoo.com](mailto:kura.2006@yahoo.com)**Abstract**

Plant remedies are still vital therapeutics to treat various human and livestock diseases in Ethiopia though most knowledge is transmitted orally. The study was done to identify and document the indigenous knowledge how to use plant species for human and livestock diseases treatment. It was conducted in Dessie Zuria District in 2019. The study site was selected purposefully based on the recommendation of elders and local authorities because of widespread use of medicinal plants. Ethnobotanical data was collected using semi-structured interviews, field observations and group discussion. Both qualitative and quantitative data were gathered. Quantitative data were analyzed using descriptive statistics whereas qualitative data was analyzed through thematic analysis. A total of 100 plant species distributed in 48 families and 88 genera were collected and identified to treat 52 different human and livestock ailments. The Asteraceae family, containing 13 species (13 %) was dominant family. *Rumex nervosus* stood first based on preference and efficacy while *Cupressus lusitanica* ranked first in its multi-purpose use and *Ocimum lamiifolium* got highest informant consensus value. Herb constituted the highest proportion of medicinal plants represented by 47 species (47%) followed by shrubs 31 species (31%) and most collection was from wild (56%). Leaf is the most plant parts used (64.6%) and preferred route of application was oral (55.3%). The common method of preparation was crushing (45.4%). Using medicinal plant as firewood (40.9%) was threatening the availability of plants. Therefore, local people should be trained, encouraged and supported on how to conserve and manage medicinal plants.

**Keywords:** Ailments; Dessie Zuria District; Ethnobotany; Indigenous knowledge; Medicinal Plants

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**Introduction**

Natural therapies are treatments used to cure diseases using the body's natural healing power (Parekh and Chandra, 2007). These include plants, animals, minerals, microorganisms and their metabolites (Ahn, 2017). It is known, the products of animal and microbial sources have been used by humans for millennia either in the pure forms or crude extracts to treat different diseases (Parekh and Chandra, 2007). In some African

countries, up to 80% of the population relies on traditional medicine for their primary health care needs ( Alebie and Mahammed, 2016).

Africa is a continent highly endowed with an abundance of medicinal plants, which indigenous people are familiar with and have been using it over time (Alebie and Mahammed, 2016). Traditional medicine in Africa is the oldest and perhaps the most diverse of all medical systems (Issa, 2015). Likewise, traditional medicinal practices are common in Ethiopia in which about 80% of the population in the country uses plant-based traditional medicine as their major primary human health care system and about 90% of the population uses traditional medicine for their livestock of which 95% of medicines are of plant origin (Regassa, 2016). Besides, traditional medical practice in Ethiopia has been in existence before the development of modern medicine in the country and continues to be widely accepted and used in the prevention and treatment of ailments (Gebeyehu, 2011). Similarly, the perception of indigenous knowledge has originated from local people, which has the potential to redress some of the weaknesses of modern western knowledge (Chama, 2017). That means it is more culturally acceptable and meets the physical needs in a way modern medicine does not (Abebe, 2011). Therefore, this study is aimed in identifying and documenting medicinal plants and their indigenous knowledge which have been used to cure human and livestock ailments in Dessie zuria District. Furthermore, this study also played a role in preserving traditional medical knowledge for the future generations.

In most parts of Ethiopia, traditional medicine is mostly collected from plant sources while animal and mineral sources contribute little to traditional medicine use (Tolasa, 2007). Similarly, in North Central Ethiopia in South Wollo Zone of Dessie Zuria District plants play vital role in traditional medicinal practice for human and livestock diseases treatment. However, in many Districts of Ethiopia including Dessie Zuria District traditional medicinal plants and the associated knowledge is endangered due to various human activities. Moreover, in spite of accelerated destruction of plant resources and loss of indigenous knowledge, ethnobotanical studies in Ethiopia lack adequate attention over the years (Tirfessa *et al.*, 2017). Research and documentation on medicinal plants have started recently even though plants have been used traditionally as a source of medicine since ancient times (Deribe *et al.*, 2006). In most scenarios, indigenous knowledge is passed verbally from generation to generation and valuable information can be lost whenever a traditional medical practitioner passes away without conveying his or her traditional medicinal plant knowledge to others (Amenu, 2007). If this deed continues, there are probabilities of losing IK of the medicinal plants from Ethiopia including in the study area.

## **Materials and Methods**

### **Description of the Study Area**

This study was carried out in Dessie Zuria District in South Wollo Zone of Amhara Region, Ethiopia. It is located 31km away from Dessie administrative city (the capital city of South Wollo Zone) and 431km north of Addis Ababa, the capital of the country.

The District is situated 10° 50' 0" - 11° 10' 0" N latitude and 39° 20' 60" - 39° 50' 0" E longitude with an altitude of 1,800 -3,500m above sea level. The total area of the District is 973.76 square kilometer with an average population density of 183 persons per square kilometer (Dessie Zuria District Administrative Office, 2018). The study area has three distinguished climatic zones; high land (47%), mid land (45%) and low land (8%). The average annual rainfall of the District is 1,100-1,300 mm with an average humidity of 20-28%. The average annual temperature of the District is 21.5 °c (DZDAGO, 2019). The District is largely occupied by the Amhara ethnic group (99.93%) who speaks Amharic language (DZDAGO, 2018).

### Site Selections

A reconnaissance survey was conducted from March 19 to March 29, 2019. Following the survey, 10 the smallest administrative units from a total of 33 smallest administrative units (all were rural areas) were selected as study sites for data collection purposively by considering criteria such as agro-climatic zone, availability of traditional practitioners and more vegetation particularly medicinal plants and livestock populations.

### Sample Size and Informant Selection

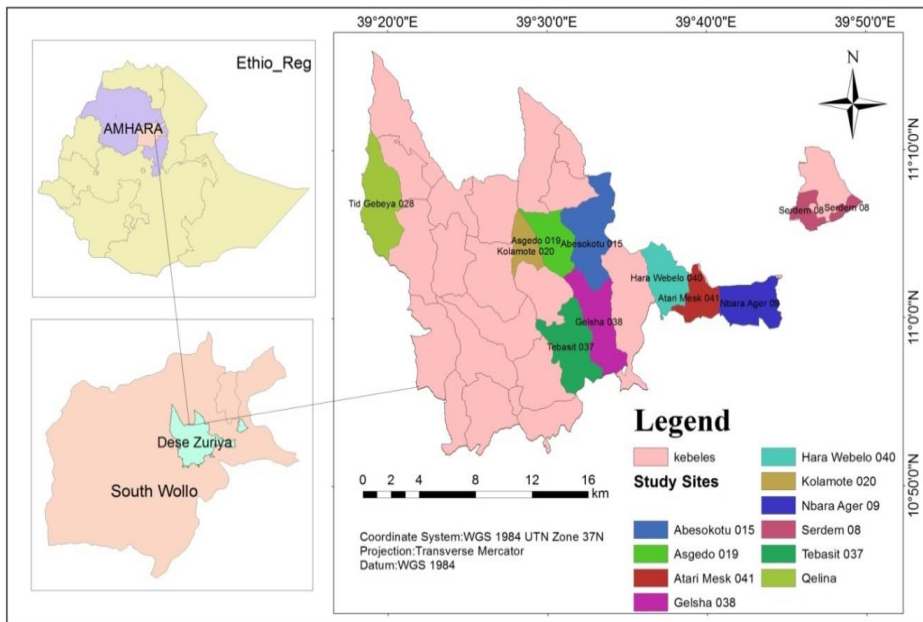
Sample size determination was by using Yamane (1967) simplified formula. Accordingly 95% confidence level and p value 0.5, size of the samples was calculated using the formula:

$$n = \frac{N}{1 + N(e^2)}$$

where, n = sample size; N = the population size and e was the level of precision;

Total house hold in the district is 41,830 so N = 41,830, e = 0.05 since the confidence level is 95%, then:

$$n = \frac{41,830}{1 + 41,830(0.05)^2} = 399$$



**Fig. 1. Map of the study area, 2019**

(Data Source: South Wollo Zone Administration Office)

After determining the sample size, 399 household heads were selected from all sample sites. For data collection, household heads were selected by random sampling method (281 informants were men and the rest informants were women). From each smallest administrative unit 25 to 40 household informants were selected by considering the proportion of population size (from 2 smallest administrative units ( $25 \times 2 = 50$  informants); from one administrative unit ( $1 \times 35 = 35$  informants); from three smallest administrative units ( $3 \times 38 = 114$  informants); from 5 smallest administrative units ( $5 \times 40 = 200$  informants). Selection of households was done according to Martin (1995) by flipping a coin in front of every house when the head was out they were selected for interview and tail out rejecting the house until desired number was obtained.

### **Data Source and Collection Method**

Primary data sources were used for this study. In this regard, data was collected from April to June 2019 through administering semi-structured interview, questionnaires, observation and focus group discussion. The semi-structured interview was prepared in English and translated into Amharic language. It has three parts including personal information, basic medicinal plant information for human and livestock treatments and indigenous knowledge and risk level of medicinal plants and other information. Key informants interview guide questions were set and asked using prepared questionnaires. Field observation was done to understand in what manner peoples are utilizing medicinal plants for themselves and their livestock. Group discussion was made before and during data collection. The first group discussion was made to notify all informants in each study site about the objective of the study as it is for educational purpose; also during ethnobotanical data collection group discussion was held by six participants. The

participants were selected elders and traditional healers. In addition, the place and time were arranged based on the interest of the participants in both group discussions.

### **Plant data Collection and Identification**

Specimens from home gardens as well as wild plants were collected, numbered, pressed, and dried for identification based on ethnobotanical information provided by informants from April to June 2019, in Dessie Zuria District. Preliminary identification was attempted in the field. But the confirmation and the identification of unidentified specimens was done at Jimma University Herbarium by using Flora of Ethiopia and Eritrea books volumes (1-8) and with the assistance of experts.

### **Ethnobotanical Data analysis**

Ethnobotanical data were analyzed using descriptive statistics. Therefore, using Microsoft excels spreadsheets quantitative data such as frequency, distribution and percentages were calculated, analyzed, tabulated and summarized. Also, the qualitative data was computed by parameters such as preference ranking, direct matrix ranking, paired comparison and ICF (informant consensus factor). On the other hand, the qualitative data was analyzed manually through thematic contents which are used to provide additional information for the study.

### **Preference Ranking, Direct Matrix Ranking and Paired Comparison**

In Preference Ranking, key informants were provided with best medicinal plants used to treat both human and livestock ailments and the key informants arranged these medicinal plants based on their personal preference. Each rank was given an integral value 1,2,3,4, and 5 and the most important medicinal plant was given the highest score (5) while the least important medicinal plant was given (1). For each plant species the given value was summed up and preference ranking was done for five medicinal plants used to treat both human and livestock ailments. For paired comparison, couples of medicinal plants were given to eight key informants to choose the best pair based efficacy of the plant to treat diseases. Also, the informants were told to give the highest mark to the best medicinal plant and the score was summed up and lastly rank was given to each medicinal plant based on the comparison.

In Direct Matrix Ranking, six multipurpose plants that have the highest use-value were selected based on data collected from the informants. Again seven use attributes of the plant were identified. To accomplish the process eight informants were selected by random sampling method from elders and traditional healers and told to give values to each medicinal plant-based on the listed attributes. Finally, the given values were added and ranked. The values used for ranking was: 5-best, 4-very good, 3-good, 2-less used, 1-least used and 0-no value.

### **Informant Consensus**

To verify the reliability of the information given by participants during the interview, they were asked more than one time. If their responses were different from the former one it was rejected from the data as faulty information. While informant responses related to the former one was accepted as important information. Further, Informants Consensus Factor was calculated by using the formula;  $ICF = Nur - Ns / (Nur - 1)$  (Heinerich *et al.*, 1998). Where, ICF= Informants Consensus Factor; Nur= number of use citation in each category and Ns= number of species used.

## Materials

For this study material such as plant press, plastic bag, GPS, photo camera were used in the field and audio recorder was used to interview key informants.

## Results

### Medicinal plants Diversity of the Study Area

In the study area, 98.2% of the informants responded that they cultivate medicinal plants. Of these, 55.35% cultivate in their home garden, 35.24% in farmland and the rest 9.41% in both places. The reason why may be the livelihood of the community is based on cultivation of various crop plants including medicinal plants. Medicinal plants are very useful for both human and livestock health and can be grown easily in the home garden. Moreover, there is no taboo in using medicinal plant and to some extent there is a restriction for pregnant women and children in using medicinal plants. This implies that the community believes that medicinal plants use restriction might be due to the fearing of side effect during pregnancy and early age growth.

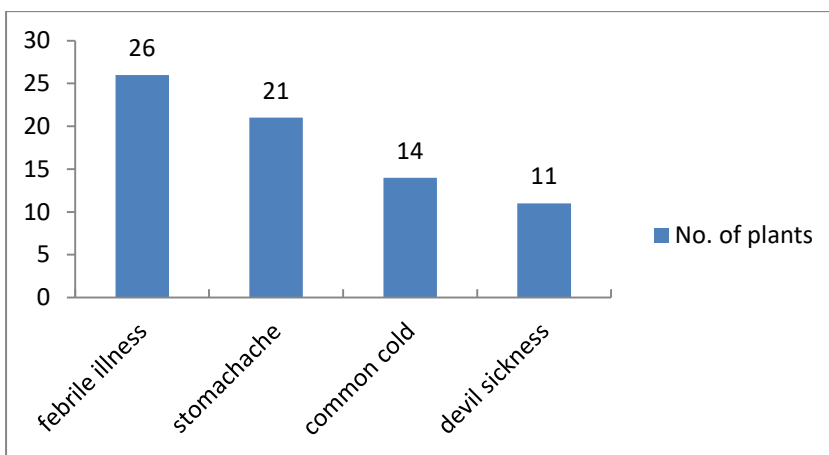
A total of 100 medicinal plant species were gathered, identified and documented from the study area which are used to treat humans and livestock diseases. From these 99% are angiosperm and 1% are gymnosperm that are distributed in 88 Genera and 48 Families. Of these, Asteraceae is the dominant family followed by Euphorbiaceae (Table 1).

**Table 1: Families and Genera of medicinal plants of the study area**

| No.   | Family                       | No. of Genera | %    | No. of Species | %    |
|-------|------------------------------|---------------|------|----------------|------|
| 1.    | Asteraceae                   | 10            | 11.4 | 13             | 13   |
| 2.    | Euphorbiaceae                | 6             | 6.8  | 9              | 9    |
| 3.    | Solanaceae                   | 5             | 5.7  | 6              | 6    |
| 4.    | Fabaceae                     | 5             | 5.7  | 5              | 5    |
| 5.    | Lamiaceae                    | 4             | 5.4  | 4              | 4    |
| 6.    | Amaranthaceae                | 3             | 3.3  | 3              | 3    |
| 7.    | Apiaceae                     | 3             | 3.3  | 3              | 3    |
| 8.    | Rosaceae                     | 3             | 3.3  | 3              | 3    |
| 9.    | Rubiaceae                    | 3             | 3.3  | 3              | 3    |
| 10.   | Rutaceae                     | 2             | 2.2  | 3              | 3    |
| 11.   | Brassicaceae                 | 2             | 2.2  | 3              | 3    |
| 12.   | Myrtaceae                    | 2             | 2.2  | 3              | 3    |
| 13.   | Poaceae                      | 2             | 2.2  | 2              | 2    |
| 14.   | Ranunculaceae                | 2             | 2.2  | 2              | 2    |
| 15.   | Oleaceae                     | 2             | 2.2  | 2              | 2    |
| 16.   | Cucurbitaceae                | 2             | 2.2  | 2              | 2    |
| 17.   | Polygonaceae                 | 1             | 1.1  | 2              | 2    |
| 18.   | Acanthaceae                  | 1             | 1.1  | 2              | 2    |
| 19.   | 30 Families each one species | 30            | 34.2 | 30             | 30   |
| Total |                              | 88            | 100% | 100            | 100% |

### Plants used to treat both human and livestock diseases

In total, 52 different ailments were recorded in which 3 ailments occurred in humans only and 14 ailments in livestock. From medicinal plants 63 species were used to treat human diseases and 26 species were used to treat livestock diseases. The remaining species were less used because of their less efficacies. From human illness, febrile illness, stomach ache, common cold and devil sickness were the major human ailments treated by many plant species (Fig. 2).



**Fig. 2. Types of Human ailments treated by many plant species**

### Livestock diseases treated by medicinal plants

In this study, 14 livestock ailments were treated by 26 medicinal plants. From 14 ailments 7 types are common in the District. For instance, Blackleg was the main ailments of livestock because the area is prone to overgrazing and the grass size was too short and the cattle come in contact with soil while grazing in which soil borne disease is easily infect the animals. The other ailments are leech infection, diarrhea, blotting and stomach ache (Table 2).

**Table 2: Livestock ailments treated by medicinal plants species**

| Disease         | No. species | %    |
|-----------------|-------------|------|
| Black leg       | 5           | 19.2 |
| Leech           | 3           | 11.5 |
| Diarrhea        | 3           | 11.5 |
| Blotting        | 3           | 11.5 |
| Stomach ache    | 3           | 11.5 |
| Shivering       | 1           | 3.8  |
| Sudden sickness | 1           | 3.8  |
| Expel parasite  | 1           | 3.8  |
| Body swelling   | 1           | 3.8  |
| Diuretic        | 1           | 3.8  |
| Antiabortion    | 1           | 3.8  |
| Eye             | 1           | 3.8  |
| Liver fluke     | 1           | 3.8  |
| Cough           | 1           | 3.8  |
| Total           | 26          | 100% |

**Medicinal plant used to treat both human and livestock ailments**

In Table 3, 12 plant species grouped under 8 families were used to treat seven different ailments which occur in both human and livestock. In this case, Asteraceae and Solanaceae families were more utilized plant families which are used to treat both human and livestock ailments. This is probably due to the widespread nature of species in the families, and their medicinal ingredients.



**Table 3: Some medicinal plants used to treat both human and livestock ailments**

| Plant species                                  | Local name           | Family          | Disease       |
|--|----------------------|-----------------|---------------|
| <i>Cupressus lusitanica</i> Mill.              | Yeferenji tid        | Cupressaceae    | Blotting      |
| <i>Foeniculum vulgare</i> Mill                 | Ensilale             | Apiaceae        | Diuretic      |
| <i>Allium sativum</i> L.                       | Nech Shenkrut        | Amaryllidaceae  |               |
| <i>Artemisia abyssinica</i> Sch. Bip. Ex Engl. | Chekughn             | Asteraceae      | Diarrhea      |
| <i>Nicotiana tabacum</i> L.                    | Tinbaho              | Solanaceae      | Cold          |
| <i>Solanum marginatum</i> L.f., Suppl.         | Gaber enboye         | Solanaceae      | Leech         |
| <i>Rumex nervosus</i> Vahl                     | Embwacoe             | Polygonaceae    |               |
| <i>Achyranthes aspera</i> L.                   | Talegh/ Dame adereke | Amaranthaceae   | Stop Bleeding |
| <i>Verbascum sinaiticum</i> Benth              | Yaheya joro          | Asteraceae      |               |
| <i>Withania somnifera</i> (L) Dunalin DC.      | Ede buda             | Solanaceae      |               |
| <i>Rhamnus prinoides</i> L'Helt                | Gesho                | Rhamnaceae      | Stomachache   |
| <i>Silene macrosolen</i> A.Rich                | Wegert               | Caryophyllaceae |               |

### Growth form and Habitats of medicinal plants

Trees, shrubs, herbs and climbers were the habits of medicinal plants found in the study area. The most abundant medicinal plants were herbs 47 species (47%) followed by shrubs 31 species (31%) and trees 15 species (15%) (Appendix I). The reason why herbs are abundant may be growing and the management of herbs at home garden is easy compared to other growth habits of medicinal plants. According to this study both wild and home garden were places where medicinal plants were collected. Wild (54%) was the main source for medicinal plants collection followed by home garden (45%).

### Plant parts used

Different parts of plants such as leaf, root, bark, stem, sap (from the stem), bulb, seed, fruit and juice were used to treat both human and livestock ailments in the study area. From these, leaves (64%) were frequently mentioned by most respondents as the best part followed by root (13.4%) and seed (10.4%). This could be due to biomolecule synthetic center of a leaf for both primary and secondary metabolites than the other parts of the plant.

### Mode of preparation

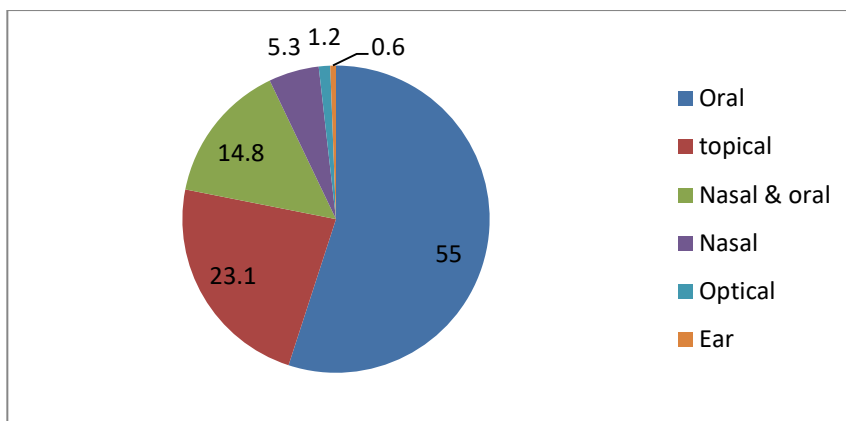
The local people use different methods in the preparation of plant remedies. Accordingly, most informants use crushing (45.3 %) as the best method of medicinal plant preparation followed by grinding (18.3%) and smoking (18.3 %) (Table 4). Most remedies are taken by oral, due to this crushing is the appropriate mechanism to easily access through oral and assimilated easily to the body.

**Table 4: preparation method of medicinal plants in Dessie zuria District, 2019**

| Way of preparation               | No. of Rt | %    |
|----------------------------------|-----------|------|
| Crushing                         | 79        | 45.3 |
| Smoking                          | 32        | 18.3 |
| Grinding                         | 16        | 9.1  |
| Un processed                     | 12        | 6.8  |
| Pounding                         | 5         | 2.8  |
| Squeezing                        | 5         | 2.8  |
| Boiling                          | 4         | 2.3  |
| Grinding and boiling             | 4         | 2.3  |
| Cutting and smoking              | 3         | 1.7  |
| Roasting                         | 3         | 1.7  |
| Socketing                        | 3         | 1.7  |
| Burning                          | 2         | 1.1  |
| Cutting                          | 2         | 1.1  |
| Boiling and Crushing             | 1         | 0.6  |
| Boiling and Grinding             | 1         | 0.6  |
| Grind and crushing               | 1         | 0.6  |
| Roasting ,Crushing and Powdering | 1         | 0.6  |
| Socketing and crushing           | 1         | 0.6  |
| Total                            | 175       | 100  |

**Route of Application of Traditional Medicines**

Medicinal plants in both human and livestock ailments are mostly taken orally, through nasal, eye, ear and topically. Oral application is the first route (55%) followed by topical (23.1%) and nasal and oral routes (14.8%) respectively (Figure 3). This is because most internal ailments require assimilation of medicine to inner structures than externally put on.



**Fig. 3. Route of application of medicinal plants**

### Measurement of Dosage

Dosage of most medicine were measured by using different traditional tools such as coffee cup, glass, hand, tea cup, and counting number of leaf, seed and fruit, pinching and so on. Coffee cup (21.7%) was the main tool used to measure the dosage followed by glass (15.9%). This is due to the belief that the coffee cup is small and reasonable tool which didn't affect human health and enough to cure the human disease.

### Additives taken with medicinal plants

The study participants indicate that most preparations taken with additives which include water, butter, honey, boiled coffee, injera and oil. From these water (65.5%) was highly stated by participants followed by butter (11%) and honey (9.5). While boiled coffee (8.3), injera (3.5) and oil (2.2) were also mentioned as least preferred additives. More preference is to water because most medicines are taken orally and water is good solvent and used for easy movement through the gut.

### Ranking of medicinal plants

#### Preference ranking

Seven most cited medicinal plants used to treat similar human and livestock ailments were selected and traditional healers ranked them based on their preference. Consequently, *Rumex nervosus* was chosen as the most preferable medicinal plant followed by *Withania somnifera*, *Cupressus lusitanica* and *Ocimum lamifolium*. While *Rhamnus prinoides*, *Vernonia adoensis*, and *Verbascum sinaiticum* were least preferred medicinal plants (Table 5). This is probably because of the efficacy of the chemical compounds they produce and the ability to react to cure different human and livestock ailments in the study area.

**Table 5: Preference ranking for seven medicinal plants-based on treating both human and livestock ailments.**

| Medicinal plants used       | R | R2 | R3 | R4 | R5 | R6 | R7 | Total | Rank            |
|-----------------------------|---|----|----|----|----|----|----|-------|-----------------|
|                             | 1 |    |    |    |    |    |    |       |                 |
| <i>Rumex nervosus</i>       | 5 | 5  | 4  | 4  | 5  | 4  | 3  | 30    | 1 <sup>st</sup> |
| <i>Withania somnifera</i>   | 2 | 4  | 1  | 4  | 4  | 5  | 5  | 25    | 2 <sup>nd</sup> |
| <i>Cupressus lusitanica</i> | 3 | 4  | 2  | 5  | 4  | 3  | 3  | 24    | 3 <sup>rd</sup> |
| <i>Ocimum lamiifolium</i>   | 4 | 5  | 4  | 3  | 3  | 2  | 1  | 22    | 4 <sup>th</sup> |
| <i>Rhamnus prinoides</i>    | 2 | 3  | 2  | 4  | 1  | 5  | 4  | 21    | 5 <sup>th</sup> |
| <i>Vernonia adoensis</i>    | 3 | 4  | 5  | 3  | 2  | 2  | 1  | 20    | 6 <sup>th</sup> |
| <i>Verbascum sinaiticum</i> | 2 | 1  | 2  | 5  | 3  | 4  | 2  | 19    | 7 <sup>th</sup> |

\*R1-R7=respondents

#### Direct matrix ranking

In the study area, medicinal plants were not only used for human treatment, but have multi-purpose functions such as livestock treatment, fodder, firewood, construction, charcoal preparation, fencing and for food. To assess relative usage of medicinal plants in the study area six multipurpose plant species and seven use-values were selected and their scores were calculated. As a result of direct matrix ranking, *Cupressus lusitanica* was ranked first which is the most preferable plant in its multi-usage and *Carissa spinarum* was the least preferred plant species (Table 6). In this study, why *Cupressus lusitanica* was ranked first may be due to its highly valuable in livestock treatment, construction, firewood, fodder, charcoal making and fencing than the other plant species. In addition, it is a very accessible and fast-growing plant species.

#### Paired comparison

Top five most preferred plant species were chosen and given to eight key informants for comparison. The traditional healers selected the best pair based on the efficacy of the medicinal plants to treat both human and livestock ailments. *Rumex nervosus*, *Withania somnifera* and *Ocimum lamiifolium* were ranked 1st to 3rd respectively (Table 7). *Cupressus lusitanica* and *Rhamnus prinoides* were medicinal plants with fewer efficacies compared to the other three. Selection of *Rumex nervosus*, *Withania somnifera* and *Ocimum lamiifolium* indicates that these plant species were highly effective plant species than the other collected plants. It may be because the plants were rich with several chemical contents that enable them to cure different human and livestock ailments (Aweke, *et al.*, 2018).

**Table 6: Average rank for direct matrix ranking of six medicinal plants on their use value**

| Use of medicinal plant | <i>Rumex nervosus</i> | <i>Dovyalis abyssinica</i> | <i>Cupressus lusitanica</i> | <i>Carissa spinarum</i> | <i>Eucalyptus globulus</i> | <i>Vernonia amygdalina</i> |
|------------------------|-----------------------|----------------------------|-----------------------------|-------------------------|----------------------------|----------------------------|
| Livestock treatment    | 4                     | 5                          | 5                           | 0                       | 0                          | 0                          |
| Construction           | 0                     | 2                          | 5                           | 0                       | 5                          | 5                          |
| Firewood               | 3                     | 5                          | 5                           | 4                       | 5                          | 3                          |
| Fodder                 | 5                     | 2                          | 3                           | 2                       | 4                          | 5                          |
| Charcoal making        | 1                     | 3                          | 5                           | 2                       | 5                          | 3                          |
| Fence                  | 1                     | 5                          | 5                           | 3                       | 5                          | 4                          |
| Food                   | 3                     | 0                          | 0                           | 5                       | 0                          | 0                          |
| Total                  | 17                    | 22                         | 28                          | 16                      | 24                         | 20                         |
| Rank                   | 5 <sup>th</sup>       | 3 <sup>rd</sup>            | 1 <sup>st</sup>             | 6 <sup>th</sup>         | 2 <sup>nd</sup>            | 4 <sup>th</sup>            |

Key: - (Ranking value: 5-best, 4-very good, 3-good, 2-less used, 1-least used and 0-no value)

**Table 7: Paired comparison of five selected medicinal plants used to treat both human and livestock ailments based on group discussion with informants**

| Plant species               | R1-R8               |                    |                       |                     |                      | Frequency of selection | Rank            |
|-----------------------------|---------------------|--------------------|-----------------------|---------------------|----------------------|------------------------|-----------------|
|                             | <i>R. prinoides</i> | <i>R. nervosus</i> | <i>O. lamiifolium</i> | <i>W. somnifera</i> | <i>C. lusitanica</i> |                        |                 |
| <i>Rhamnus prinoides</i>    |                     | Rn                 | Ol                    | Ws                  | Cu                   | 0x                     | 5 <sup>th</sup> |
| <i>Rumex nervosus</i>       |                     |                    | Rn                    | Rn                  | Rn                   | 4x                     | 1 <sup>st</sup> |
| <i>Ocimum lamiifolium</i>   |                     |                    |                       | Ws                  | Ol                   | 2x                     | 3 <sup>rd</sup> |
| <i>Withania somnifera</i>   |                     |                    |                       |                     | Ws                   | 3x                     | 2 <sup>nd</sup> |
| <i>Cupressus lusitanica</i> |                     |                    |                       |                     |                      | 1x                     | 4 <sup>th</sup> |

Keys: Rn= *Rhamnus prinoides*; Rn= *Rumex nervosus*; Ol= *Ocimum lamiifolium*; Ws= *Withania somnifera*; Cl= *Cupressus lusitanica*

#### Informant consensus

According to the result obtained certain medicinal plants were highly cited by most participants than the others. For instance, *Ocimum lamiifolium* Hochst. Ex Benth was cited by 302 (78.23%) informant to treat different human and livestock ailments followed by *Allium sativum* 209 (54.14%), *Rumex nervosus* 201(52.07%) and *Echinops*

*kebericho* 194 (50.25%) (Table 8). This is probably due to the efficacy of *Ocimum lamiifolium* against the diseases.

Informant consensus factor was calculated on the identified fifteen highly cited plant species used to treat human and livestock ailment. It was calculated as:  $ICF = \frac{Nur - Ns}{(Nur - 1)}$ . Thus, the highest ICF value was obtained for *Ocimum lamiifolium* (0.66) and the least ICF was for *Calpurnia aurea* (0.01) (Table 8).

**Table 8.** List of top fifteen medicinal plants used to treat human and livestock ailment in the study area, 2019.

| No. | Scientific name              | Local name    | No. of citation | Percent | ICF   |
|-----|------------------------------|---------------|-----------------|---------|-------|
| 1.  | <i>Ocimum lamiifolium</i>    | Damakessi     | 302             | 78.23   | 0.66  |
| 2.  | <i>Allium sativum</i>        | Nech shenkrut | 209             | 54.14   | 0.51  |
| 3.  | <i>Rumex nervosus</i>        | Embwacoe      | 201             | 52.07   | 0.5   |
| 4.  | <i>Echinus kebericho</i>     | Kabericho     | 194             | 50.25   | 0.48  |
| 5.  | <i>Artemisia abyssinica</i>  | Chekughn      | 181             | 46.89   | 0.44  |
| 6.  | <i>Solanum dasyphyllum</i>   | Gaber enboye  | 160             | 41.45   | 0.37  |
| 7.  | <i>Withania somnifera</i>    | Ede buda      | 150             | 38.86   | 0.32  |
| 8.  | <i>Zehneria scabra</i>       | Haregresa     | 130             | 33.94   | 0.21  |
| 9.  | <i>Foeniculum vulgare</i>    | Ensilale      | 125             | 32.63   | 0.18  |
| 10. | <i>Ruta chalepensis</i>      | Tene adam     | 120             | 31.33   | 0.15  |
| 11. | <i>Capparis tomentosa</i>    | Gumero        | 117             | 30.54   | 0.12  |
| 12. | <i>Zingiber officinale</i>   | Zengible      | 113             | 29.50   | 0.098 |
| 13. | <i>Aloe percrassa</i>        | Erat          | 110             | 28.72   | 0.073 |
| 14. | <i>Phytolacca dodecandra</i> | Endode        | 107             | 27.93   | 0.047 |
| 15. | <i>Calpurnia aurea</i>       | Degeta        | 102             | 26.63   | 0.01  |

### Marketability of medicinal plants

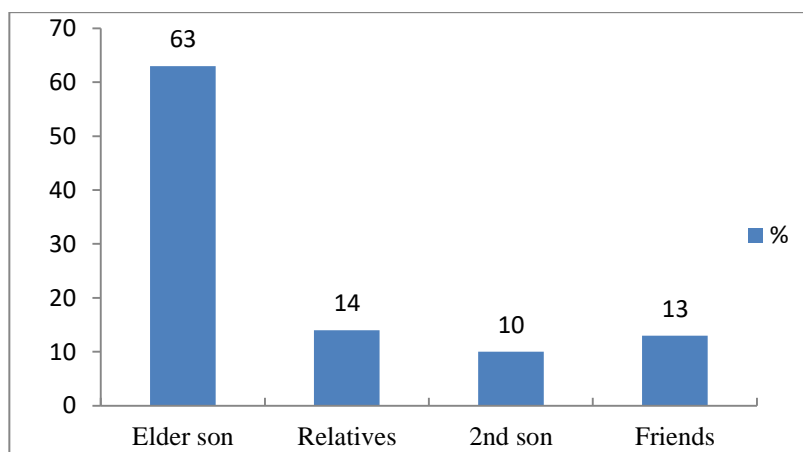
In the study area, 23 (23%) of documented medicinal plants were very accessible in the market. This is due to the local people cultivate some medicinal plant species in their home garden and use as commodity to sale on market when needed. In addition other local people search to buy medicinal plants in market. It is these demand and supply that confirms marketability of medicinal plants. Because of their marketability some species are overharvested and their status in natural habitat is also declining. Besides medicinal plants have additional usage in day to day activities of the society beyond their medicinal value. For instance, *Allium cepa*, *Allium sativum*, *Nigella sativa*, *Zingiber officinale* and *Capsicum annum* were used for spice and *Beta vulgaris*, *Carica papaya* and *Daucus carota* were used as food.

According to most traditional healers who have practiced to treat a particular ailment the cost of traditional medicine depend upon the willing of customer patient known “*Erenesa*”. It may range from 1-50birr. But all of the traditional healers who practiced to treat a particular disease responded that the cost of traditional medicine depends on the willing of the customer (patient). This is because the person who transfers the knowledge to them orders not to ask money from a customer but the customer pays the money known as “*Erenesa*” due to believing the medicine is not working without paying the money.

### Source and method of transferring indigenous knowledge

According to the result, family, observation and traditional healers were a source of indigenous knowledge that is about 49 % of study participants responded that family was the best source of indigenous knowledge followed by observation (38%) and traditional healers (13%). The society needs to keep their indigenous knowledge by transferring to the next generation.

Transferring indigenous knowledge to the elder son (63%) and relatives (14%) are the principal way of keeping the continuity of indigenous knowledge (Figure 4).



**Figure 4.** Method of transferring indigenous knowledge in the study area, 2019

### Abundance and Threat to medicinal plant and conservation mechanisms

Based on interview made with status of medicinal plants three responses were gathered based on informant idea. These were increasing, decreasing and very decreasing. Consequently, most respondents indicated that the status of medicinal plants was decreasing from time to time. About 55.4% informants confirmed the trend. This might be because of the susceptibility of medicinal plants to anthropogenic activities such as deforestation, overgrazing and over harvesting what is known as multipurpose uses.

As the result shows, cutting medicinal plants for medicinal purpose, food, firewood, charcoal, fence, and construction, furniture and agriculture purposes were stated for the threat of medicinal plants in the study area. From these cutting trees for firewood reported to be a major (40.9%) cause of decreasing medicinal plants in the study area followed by agricultural expansion (34.2%) and fence (7.8%). As the study area was rural and most of the people depend on the firewood for their food preparation such as cooking and baking. However, agricultural expansion is a major threat to medicinal plant depletion. The local people were using few conservation methods in the study area. Cultivating medicinal plants in home garden was one of the methods that used to preserve medicinal plants from loss. According to traditional healers most plants used for medicine are harvested on Wednesday and Friday in the study area because there are

cultural believes that medicines are effective on the mentioned dates and this may contribute to minimizing the harvesting rate of the medicinal plants and serve as conservation strategy.

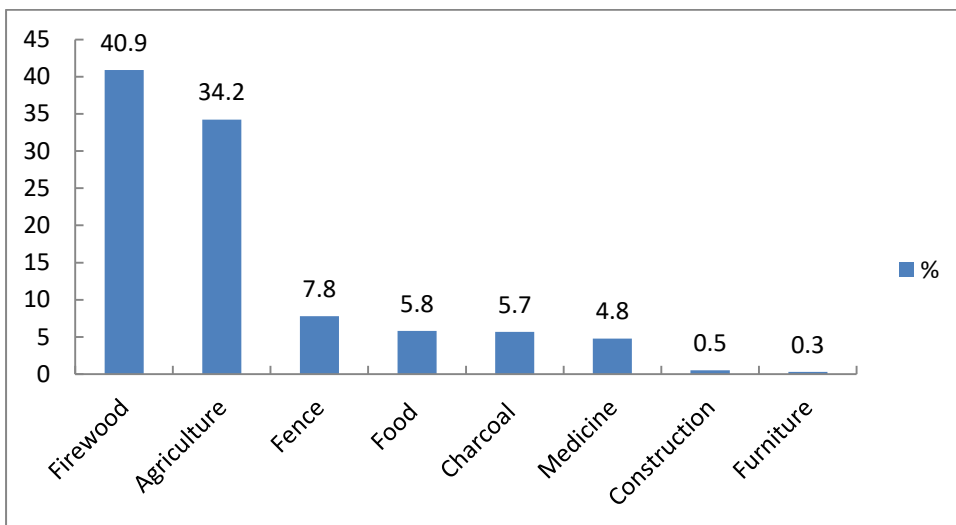


Fig. 5. Risky factors to medicinal plants in the study area, 2019

### Discussion

The study showed that informants grow medicinal plants because most of them are farmers and their livelihood is based on growing crop plants including medicinal plants. This is because most medicinal plants can grow easily in small space of home garden. In this regard, all informants agreed that they use medicinal plants from natural habitats, home garden and market areas. This might be because of the efficacy of medicinal plants in treating different ailments. In addition, most participants believe that taking in medicinal plants is effective only during the time of sickness. Moreover, there is no taboo in using medicinal plant and to some extent there is restriction in using medicinal plant for pregnant women and child. This is because there is a belief that restricts medication fearing side effects of medicinal plant at the time of pregnancy and younger age. This result agrees with Tolasa (2007) which said healers didn't give treatments that are taken internally to pregnant women.

In the study area, family Asteraceae was the dominant plant family which has many medicinal plant species used to treat human as well as livestock ailments. This is probably the plant species found in Asteraceae family are wide spread in the district or else the ingredients may be more effective. This finding is in agreement with the studies conducted in Ethiopia by Mesfin *et al.*, (2009), Amenu (2007), Teklehaymanot (2009); Abebe (2011), Limenih *et al.*, (2015), Birhanu (2015), and W. Yohannis *et al.*, (2018), in which Asteraceae is the dominant family in providing home remedy. However, in finding of Tekele (2014) Solanaceae family is the dominant in providing medicinal plant supplies. From 52 different human and livestock diseases recorded, febrile illness,



stomachache and common cold was the main ones. This is similar to the finding of Tirfessa *et al.*, (2017) in which febrile illness is the major disease followed by stomach ache. But in another study done by Abebe (2011) the largest number of species was used to treat wound.

The growth forms of the plants were herb, shrubs, trees and climbers. Most collected forms were herbs and shrubs. Limited number of trees and climbers were collected. Herbaceous habits were highly abundant because some grew them easily in the home garden. Moreover, Cultivation and the management of herbs are easier than other growth forms of medicinal plants. The result agrees with other studies done by (Tirfessa, *et al.*, 2017; Teklehaymanot, 2009; Kitata *et al.*, 2017; Abebe, 2011; Kebede *et al.*, 2016; Addisie *et al.*, 2012 and Adefa and Abraha, 2011) in which herb is the dominant growth form followed by shrub and tree. Contrary to this result other studies reported that shrub is the dominant growth form followed by herb and tree (Gebeyehu, 2011; Ashagre, 2011 and Tamene, 2011).

From the whole part of the plant, leaf was highly cited as the preferred part to prepare medicinal plants followed by root and seed. It is because leaf is easily accessible aerial part of the plant and with a high content of food due to center of photosynthesis which needs simple preparation or procedures. It also the metabolic center of the plant many useful compounds are made. This result is similar to the finding of many investigators in different parts of Ethiopia (Issa, 2015; Chekole, 2011; Gebeyehu, 2011; Kitata *et al.*, 2017; Tirfessa *et al.*, 2017; Ayana, 2017; Abebe, 2011; Alemayehu *et al.*, 2013; Abrha *et al.*, 2018; Tamene, 2011; Adefa and Abraha, 2011; Enyew *et al.*, 2014; Addisie *et al.*, 2012; W/ Yohannis *et al.*, (2018); Kebede *et al.*, (2016). But other studies in Ethiopia reported root as the most used part of the plant for the preparation of medicinal plant remedy (Amenu, 2007; Lulekal *et al.*, 2008; Limenih *et al.*, 2015; Birhanu *et al.*, 2015; Tekele, 2014; Teklehaymanot, 2009; Tolossa *et al.*, 2013).

According to this result there are different methods of application of medicinal plants in the study area from these drinking is the main intake of plant remedies. The major route of application to treat humans as well as livestock ailments in the study area was oral. Since the major route of administration is oral and the most additive is water this makes the main intake method to be drinking. Abebe, (2011) reported similar finding. Besides, from various methods of traditional medicinal plant preparation in the study area crushing is the most popular way of preparation. Because, in the study area most remedies are taken through oral, due to this crushing is the best mechanism to easily access via oral and assimilated easily to the body. This result is similar to the findings of Tirfessa *et al.*, 2017; Addisie *et al.*, 2012; Kebede *et al.*, 2016. But, it is contrary to the finding of Ayana, 2017; Abebe, 2011; Alemayehu *et al.*, 2015; Mesfin *et al.*, 2009 in which decoction was the popular method of preparation. Also, this finding disagrees with Kitata *et al.*, 2017, Enyew *et al.*, 2014 and W.Yohannis *et al.*, 2018 in which pounding was common way of preparation.

In the administration of medicinal plants most are taken with additives. Water was main additive followed by butter and honey. This is because most of the medicines were taken orally and water is good solvent and used to easily move through the mouth. The result is similar with findings of (Ayana, 2017; Issa, 2015; Abebe, 2011; Teklehaymanot, 2009). But it was different from the finding of (Birhanu, 2013 and

Yirga, 2010) in which the highest additive is honey. In the study area coffee cup was the common tool to measure the dosage of the medicine. This is due to the belief that coffee cup is reasonable which didn't affect human health and enough to cure the human disease. But this result is different from other finding such as (Issa, 2015) in which most doses are determined by approximation.

*Rumex nervosus* was the most preferable plant followed by *Withania Somnifera*, *Cupressus lusitanica* and *Ocimum lamiifolium*. This is probably because of the efficiency of chemical compounds they produce and ability to react to various human and livestock ailments on application. In this study, *Cupressus lusitanica* was ranked first which is the most preferable plant in its multi-usage. This is possibly *Cupressus lusitanica* is highly valuable in the mentioned use-value that is livestock treatment, construction, firewood, fodder, charcoal making and fencing than the other plant specimens. Besides, it is a very accessible and fast growing plant species. But this result was quite different from Amenu, 2007 finding in which *Syzygium guineense* was ranked first. During comparison of five preferred medicinal plants, *Rumex nervosus*, *Withania somnifera* and *Ocimum lamiifolium* were ranked 1<sup>st</sup> to 3<sup>rd</sup> respectively. This showed that these plant species were highly effective plant species than the other used ones. This may be because of the plants were rich with several chemical ingredients which enable them to cure different human and livestock ailments.

*Ocimum lamiifolium* (78.23%) is the most cited plant species by many respondents followed by *Allium sativum* (54.14%) and *Rumex nervosus* (52.07%). This is probably due to the efficacy of *Ocimum lamiifolium* against many diseases. This result is different from Gebeyehu (2011) in which the dominant plant species is *Embelia schimperi* followed by *Justicia schimperiana* and *Allium sativum*. The highest ICF value was obtained from *Ocimum lamiifolium* (0.66) and the least ICF was from *Calpurnia aurea* (0.01)

In this study most medicinal plants were collected from wild and the remains were from home garden and purchase from market. This finding is also similar with the findings of (Abebe, 2011; Lulekal, 2005; Amenu, 2007; Birhanu *et al.*, 2015; Tekele, 2014; Tirfessa *et al.*, 2017; Addisie *et al.*, 2012; Tamene, 2011; Kebede *et al.*, 2016 and Adefa and Abraha, 2011).

Though a few have contradictory opinions about abundance of medicinal plants, most informants said that medicinal plants were decreasing in type and number from time to time. It is because of their prone to much human interventions such as deforestation, overgrazing and over harvesting. This result is similar to Abrha *et al.*, 2018 in which decrease in availability of medicinal plants was reported.

Some Medicinal plants were marketable in the study area. This indicates the communities wide spread interest in using plants for medication and most plant remedies have additional usage beyond their medicinal value which is useful in day to day activity of the society. Moreover, most traditional healers who practiced to treat a particular disease responded that the cost of traditional medicine depends on the willing of the customer (patient). This is because the person who treats an individual is not asking money from customers but the patient pays the money known as "eranssa" due to believing the medicine is not working without payment.

Most participants said members of traditional healer family are the source of indigenous knowledge. This is because the practitioners need to keep their indigenous knowledge being transferred to the next generation and the top secrets should be disguised. In so doing they transfer their indigenous knowledge from generation to generation. This result is similar to the finding of (Abebe, 2011; Gebeyehu, 2011; Birhanu *et al.*, 2015; W.Yohannis *et al.*, 2018 and) who reported that the main source of indigenous knowledge is gained from the family line that is from parents to offspring and relatives (72.2%) followed by observation (18.4%). This process started with elder son, elder daughter, brother, relatives and ends with the best friends. Transferring indigenous knowledge to the elder son (63%) is a major way following by best friends (14%).

Cutting medicinal plants for firewood was the main cause of local threat to medicinal plants in the study area. This is because the study area is rural area and most of them depend on plants for different purposes such as energy sources for cooking and baking. The same result was reported by Gebeyehu (2011) and Tamene (2011) in which the major threats to medicinal plants are cutting medicinal plants for firewood purpose. But it is different from the result of Birhanu *et al.*, 2015 and W. Yohannis *et al.*, 2018 in which agricultural expansion is described as the main threat to medicinal plants.

As the informants suggested, replacing harvested medicinal plants and using electricity as alternative power sources for baking, cooking and other activities were the major conservation methods that is vital and crucial measurement to extract sustainable benefits from medicinal plants. This is because as described in previous work cutting plants for fire wood is the major local threat to medicinal plants which makes deterioration of both medicinal plants and biodiversity resources thus appropriate conservation strategies enable to use medicinal plants continuously through minimizing the main threat factors such as utilizing a single species for many purposes, over harvesting and agricultural expansion in the study area.

### **Conclusion**

Generally, 100 plant species which were categorized into 48 different families and 82 genera were recorded which are used to treat different human and livestock ailments. From these *Ocimum lamiifolium* (78.23%) is the most preferable plant species and Asteraceae is the dominant family represented with 10 plant species. Moreover, 38 different human diseases and 14 livestock ailments recorded. Febrile illness and blotting are main human and livestock ailments found in the survey respectively. Leaves are the most used part of the plants. Oral is the major route of administration and crushing is the best mode of preparation compared to other methods. Besides, the collected medicinal plants grow mostly in wild and most of the plants are herbs. Risk factors for medicinal plants diversity is their usage for multiple purposes. Knowledge transferring is via family members primarily to elder son is the common practice.

### **ACKNOWLEDGMENTS**

We would like to thank Dessie Zuria District Agriculture Office staff specially Mr. Ayelew for his great support and all people who participate in this research by giving important information through questionnaire and interviews. We would also like to

acknowledge Aksum University and Jimma University for their financial support during this study.

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