# Trends in
# **Applied Sciences Research**

# Research Article
# Ethnomedicinal Plant Diversity Study Around Yotyet-yewezera and Amba Natural Forest, Ezha District, Gurage Zone, Central Ethiopia

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## Abstract

**Background and Objective:** Traditional medicine is an ancient medical practice that is still widely used in prevention and treatment of various health problems human and livestock in Ethiopia. This study was aimed to document information on the Ethnomedicinal plant diversity around Yotyet-yewezera and Amba natural forest in Ezha district, Gurage zone, central Ethiopia. **Materials and Methods:** Forty informants were involved in the study of which 10 key informants were also selected purposively by indigenous knowledge and service delivery. Ethnomedicinal data was collected through semi-structured interview, guided field observation and group discussion. Descriptive statistics, Informant Consensus Factor (ICF), preference ranking and direct matrix ranking was carried out to analyze the data. **Results:** A total of 70 medicinal plants belonging to 64 genera and 40 families were identified. The most commonly used plant families were Asteraceae (7 species), Euphorbiaceae (5 species), Rosaceae, Lamiaceae and Poaceae (4 species each), Myrsinaceae, Solanaceae, Polygonaceae and Fabaceae (3 species each), Acanthaceae, Rutaceae and Cucurbitaceae (2 species each). The major habits of the medicinal plants were herbs. Most medicinal plants were collected from wild habitat. The most frequently harvested plant parts for herbal preparations were leaves (50%). About 84.29% of remedy preparations were made from fresh. The routes of administration of traditional remedies are oral, dermal, nasal, ocular and auditoria. The medicinal plants were used to treat a total of 38 human and livestock ailments. These health problems are generally categorized as infections, general complications, diet related, toxicity related, allergies, devil sickness, wounds and others. **Conclusion:** The study area is better experience in *in situ* conservation but to ensure sustainability of medicinal plants; more emphasis should be given to the traditional medicine and associated indigenous knowledge.

## INTRODUCTION

Ethiopian is characterized by a wide range of ecological, edaphic and climatic conditions that harbors higher flora and fauna diversity[1]. There are about 887 medicinal plants species that are currently used by Ethiopian peoples of which 12% endemic[2]. The higher diversity of medicinal plants found in the south and southwestern part of the country[3]. Medicinal plants and traditional medicine play a crucial role in the health care system of most developing countries[4]. In Ethiopia about 80% of human population and 90% of livestock still rely on medicinal plants to fight a number of disease because of several reasons such as cost-effectiveness, affordability, biomedical benefits and accessibility[5,6] and more than 95% of medicinal plant remedy preparations in Ethiopia are made from plant origin[7]. Local communities in Ethiopia are also endowed with diverse indigenous knowledge, related to the rich biodiversity of the country[4]. In most scenarios, the traditional knowledge in Ethiopia is transferred verbal communication from one generation to next generation and valuable information can be lost whenever a traditional medicinal practitioner passes without conveying his/her traditional medicinal plant knowledge[2,8]. In addition to this, the loss of valuable medicinal plants due to population pressure, road construction, expansion of agricultural land and deforestation is widely reported by different scholars[3,9]. As a result, the need to perform ethnobotanical researches and to document the medicinal plant diversity and the associated indigenous knowledge must be an urgent task. The aim of study is to investigate and document the ethnomedicinal plants diversity and their associated indigenous knowledge in and around Yewetet-yewezera and Amba Natural forest, southwestern Ethiopia.

## MATERIALS AND METHODS

**Description of the study area:** The study area is located in Ezha district, Gedeb and Yesray kebele of the Gurage zone, Southern Nations Nationalities and Peoples Regional State (SNNPRS), Ethiopia (Fig. 1). It is located in the south-west part of the country 210 km away from Addis Ababa.

**Selection of informants:** A total of 40 informants were selected purposively based on their medicinal plant knowledge and residence of the forests located kebeles by the recommendations of knowledgeable elders, local

administers of the Kebeles and development agents exist in the communities. The informants were local inhabitants aged between 30-82 years old. Ten key informants were selected based on the indigenous knowledge and service delivery that particular informants give during an interview. Local healers qualified as key informants being traditional experts who are custodians of indigenous knowledge on medicinal plants.

**Ethnomedicinal data collection techniques:** Before collecting the data, official permission was secured from Wolkite University research office to the office of the district and permission was obtained from the administrator of Gedeb and Yesray Kebele. Ethnomedicinal data was collected between March 15-August 15, 2017. Ethnomedicinal investigations were carried out to collect data on medicinal plants used to treat both human and livestock disease through semi-structured interviews, group discussion and guided field observation with key informants.

**Semi-structure interview:** Semi-structure interviews and discussions were undertaken based on checklist of questions prepared in English and translated to 'Guragigna' by local translator. The individual semi-structured interview was asked information on local names of medicinal plants, parts used, methods and conditions of gathering and preparation, disease treated, dosage used, route of application, adverse effect, use other than medicinal uses, their management by indigenous people and distribution in local vegetation was collected[10,11]. Eventually, the semi-structured interviews were followed by independent walks in the natural forests and homegarden, which allowed for more discussion with individual informant and the practical identification and collection of medicinal plants that was found in and around the natural forest.

**Field observation:** Field observations were performed with the help of field assistances on the natural forests and homegarden for practical observation on morphological features, growth form and habitats of each medicinal plant species that was existed in and around the natural forests.

**Group discussion:** Five key informants for group discussions from Yotyet-yewezera and Amba Natural forests, respectively with a total of 10 key informants were selected randomly from the total informants selected for ethnomedicinal data collection to gain further informations on medicinal plants at
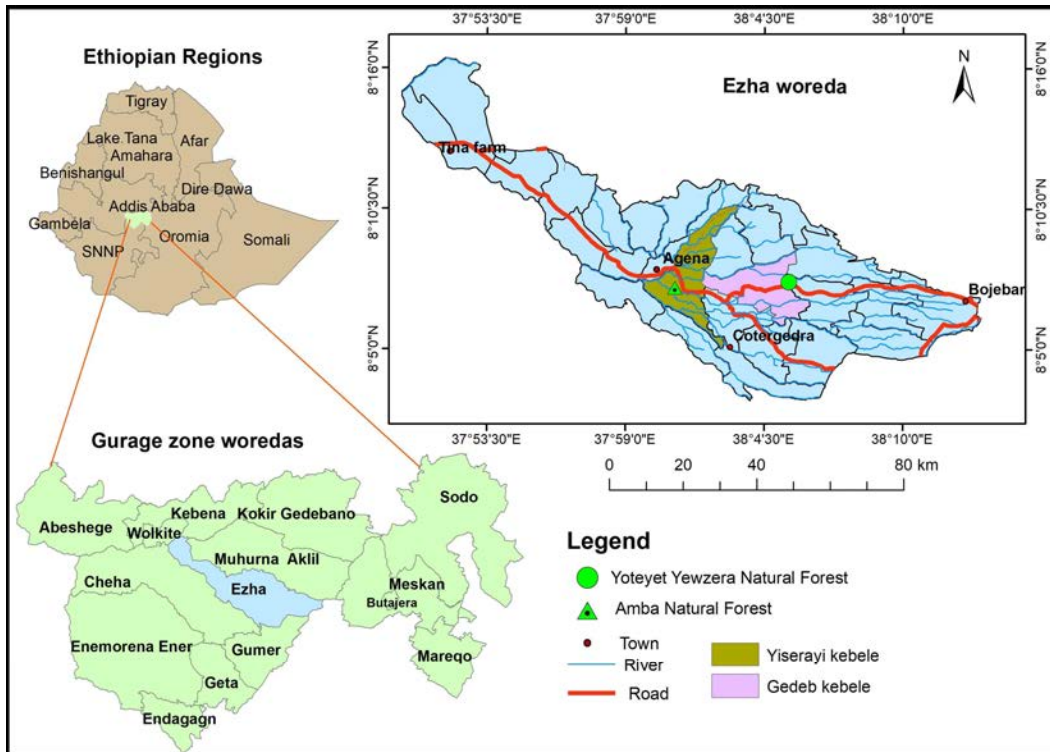
Fig. 1: Location of Yotyet-yewezera and Amba Natural Forest, in Gedeb Kebele, Ezha district of Gurage zone (SNNPR)

the district level. The information collected by group discussion was important to triangulate the ethnomedicinal information collected through semi-structured interviews[10].

**Plant specimen collection and identification:** The reported medicinal plants were collected from in and around natural forests during the field walks; habits, habitat of the plants, local name, date of collection, name of collector was recorded. Preliminary identification was done at the natural habitat and the collected plant specimens were taken to the National Herbarium of Ethiopia (ETH) and medicinal plant identification were performed.

**Data analysis techniques:** The collected ethnomedicinal data was analyzed and summarized by using Microsoft Excel spreadsheet software. The collected data were entered into excel spreadsheet and summarized using descriptive statistical methods such as frequency and percentages. Informant consensus, preference ranking and direct matrix ranking was carried out to analyze the data.

**Descriptive statistics:** Descriptive statistical methods such as percentages and frequency were carried out to analyze and summarize the data on medicinal plants, use and associated knowledge. The most useful information was gathered on medicinal plants are medicinal value, application, methods of preparation, routes of administration, disease treated, parts used, habit and habitat were analyzed through descriptive statistics.

**Informant Consensus Factor (ICF):** The Informant Consensus Factor (ICF) was calculated for each category to identify the agreements of the informants on reported cures for the group of ailments following[12]. The ICF was calculated as follows:

$$ICF = Nur-Nt/(Nur-1)$$

where, ICF is informants consensus factor, Nur is the number of individual plant use reports for a particular illness category and Nt is the total number of species used by all informants for this illness category.

**Preference ranking:** Five key informants were selected to assess the degree of effectiveness of five medicinal plants that treat a particular human disease by following[10]. The medicinal plants believed to be most effective to treat the illness was given the highest value (5) and the least effective was gotten the lowest value (1). The value of each species was summed

up and the rank for each species was determined based on the total score. This was helped to indicate the most effective medicinal plants used by the community to treat the diseases.

**Direct matrix ranking:** Direct matrix ranking was carried out in order to compare the multipurpose medicinal plant species based on information obtained from informants[11]. The multipurpose species were selected out of the total medicinal plants and the uses of these plants were listed and 5 randomly selected key informants were asked to assign use values to each species. Each selected key informants were asked to assign use values (5: Excellent, 4: Very good, 3: Good, 2: Less used, 1: Least used). Based on data were obtained from informants, average value of each use values for a species was taken and finally the values of each species was summed up and ranked[11].

## RESULTS AND DISCUSSION

**Medicinal plant diversity and their distribution:** A total of 70 medicinal plant species used to treat human and livestock ailments were recorded in the study areas which belonged to 64 genera and 40 families. The identified plant families included: Asteraceae (7 species), Euphorbiaceae (5 species), Rosaceae, Lamiaceae and Poaceae (4 species each), Myrsinaceae, Solanaceae, Polygonaceae and Fabaceae (3 species each), Acanthaceae, Rutaceae and Cucurbitaceae (2 species each) and the remaining 28 families were represented by only a single species (Table 1). The medicinal value of these families in the flora of Ethiopia is also reported by different ethnobotanists[8,13-15]. From these 43 species of them were used to treat for human disease, 19 species of medicinal plants treat for livestock and the remaining 8 species for both human and livestock ailments.

The most frequently reported species were *Ruta chalepensis* (27 and 67.5%) followed by *Hagenia abyssinica* (25 and 62.5%) *Ocimum lamiifolium* (23, 57.5%) and *Allium sativum* (20 and 50%). Frequently reported of particular medicinal plant species could indicate potentially higher bioactive content to treat different aliments. Such evidence is pertinent for prioritizing future *in vivo* and *in vitro* pharmacological research investigation.

**Habitat of medicinal plants:** With regard to the collection or distribution of medicinal plants in the study area, the majority of medicinal plants were collected from forest or natural vegetation (26 species, 37.14%) followed by home garden (25 species, 35.71%) (Table 2). Other studies also reported

Table 1: Plant families, genera, number of medicinal plant species and proportions

| Family names | No. of genera in each | Total (%) | No. of species in each | Total (%) |
|---|---|---|---|---|
| Asteraceae | 5 | 7.81 | 7 | 10.00 |
| Rosaceae | 4 | 6.25 | 4 | 5.71 |
| Lamiaceae | 4 | 6.25 | 4 | 5.71 |
| Poaceae | 4 | 6.25 | 4 | 5.71 |
| Euphorbiaceae | 3 | 4.69 | 5 | 7.14 |
| Myrsinaceae | 3 | 4.69 | 3 | 4.29 |
| Solanaceae | 3 | 4.69 | 3 | 4.29 |
| Fabaceae | 3 | 4.69 | 3 | 4.29 |
| Rutaceae | 2 | 3.13 | 2 | 2.86 |
| Acanthaceae | 2 | 3.13 | 2 | 2.86 |
| Cucurbitaceae | 2 | 3.13 | 2 | 4.225 |
| Polygonaceae | 1 | 1.56 | 3 | 2.86 |
| Malvaceae | 1 | 1.56 | 1 | 1.43 |
| Brassicaceae | 1 | 1.56 | 1 | 1.43 |
| Aloaceae | 1 | 1.56 | 1 | 1.43 |
| Araceae | 1 | 1.56 | 1 | 1.43 |
| Icacinaceae | 1 | 1.56 | 1 | 1.43 |
| Urticaceae | 1 | 1.56 | 1 | 1.43 |
| Alliaceae | 1 | 1.56 | 1 | 1.43 |
| Menispermaceae | 1 | 1.56 | 1 | 1.43 |
| Apocyanaceae | 1 | 1.56 | 1 | 1.43 |
| Crassulaceae | 1 | 1.56 | 1 | 1.43 |
| Verbenaceae | 1 | 1.56 | 1 | 1.43 |
| Stilbaceae | 1 | 1.56 | 1 | 1.43 |
| Myrtaceae | 1 | 1.56 | 1 | 1.43 |
| Asparagaceae | 1 | 1.56 | 1 | 1.43 |
| Amaryllidaceae | 1 | 1.56 | 1 | 1.43 |
| Lobeliaceae | 1 | 1.56 | 1 | 1.43 |
| Caricaceae | 1 | 1.56 | 1 | 1.43 |
| Arecaceae | 1 | 1.56 | 1 | 1.43 |
| Melianthaceae | 1 | 1.56 | 1 | 1.43 |
| Linaceae | 1 | 1.56 | 1 | 1.43 |
| Ranunculaceae | 1 | 1.56 | 1 | 1.43 |
| Apiaceae | 1 | 1.56 | 1 | 1.43 |
| Hypericaceae | 1 | 1.56 | 1 | 1.43 |
| Simaroubaceae | 1 | 1.56 | 1 | 1.43 |
| Oleaceae | 1 | 1.56 | 1 | 1.43 |
| Asphodelaceae | 1 | 1.56 | 1 | 1.43 |
| Loganiaceae | 1 | 1.56 | 1 | 1.43 |
| Myricaceae | 1 | 1.56 | 1 | 1.43 |

Table 2: Habitats of medicinal plants in the study area

| Habitats | No. of medicinal plants | Percentage |
|---|---|---|
| Forest | 26 | 37.14 |
| Homegarden | 25 | 35.71 |
| Homegarden and main field | 12 | 17.14 |
| All habitats (Homegarden, forest and main field) | 4 | 5.71 |
| Forest and main field | 3 | 4.29 |

that most of plant species used for medicinal purpose in Ethiopia is collected from forest or natural vegetation[2,16,17].

**Habit of medicinal plants used for the treat of human and livestock disease:** The major habits of the medicinal plants were herbs (47.14%) followed by shrubs (27.14%), trees
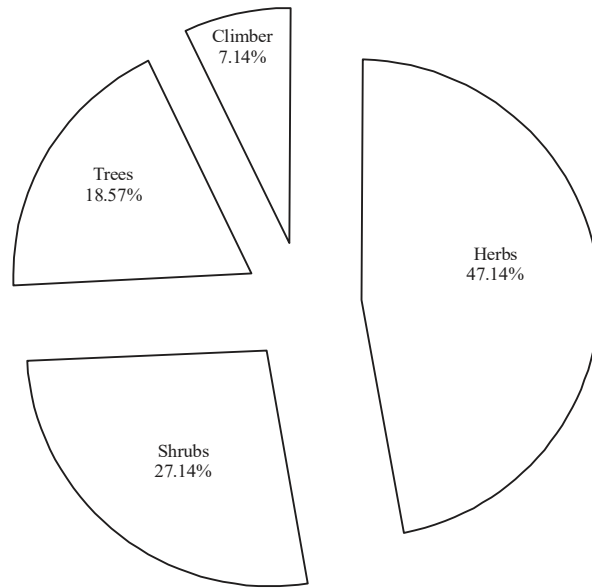
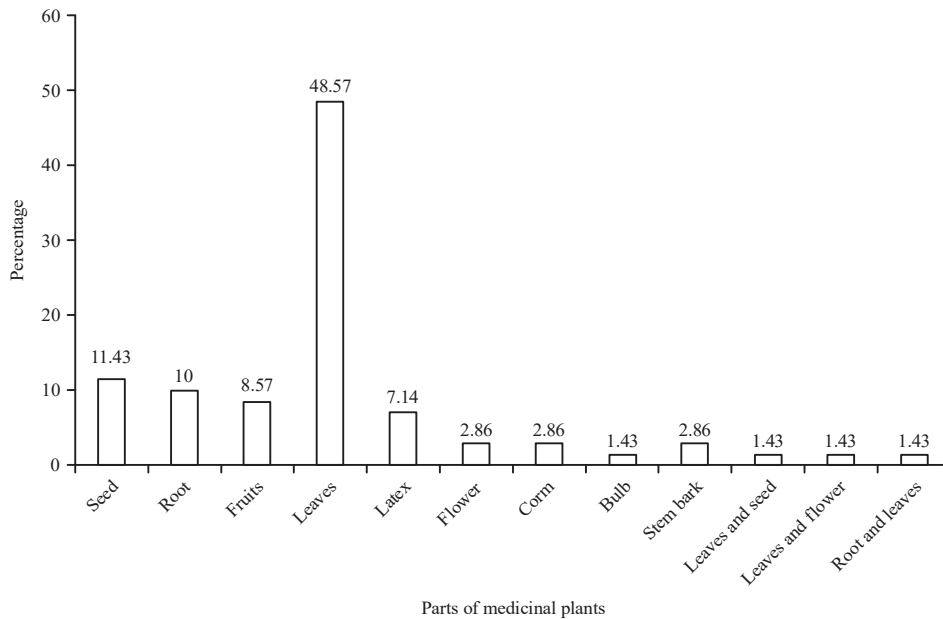Fig. 2: Percentage distribution of habits of medicinal plants

Fig. 3: Percentage distribution of plant parts used for remedy preparation

(18.57%) and climbers (7.14%) (Fig. 2). Similar result reported that ethnobotanical investigation conducted in different part of Ethiopia showed that herbs account for higher proportion of medicinal plants[13,15,17-22].

**Parts and condition used for remedy preparation:** The plant parts most commonly used to treat human and livestock ailments include leaves, root, fruits and others. The most commonly used plant parts for herbal preparations in the study area were leaves (48.57%) followed by seed (11.43%), fruits (8.57%), root (10%). In addition, latex, flower, corm, bulb, stem bark and flower were used for remedy preparation (Fig. 3). In some cases, different parts of the same plant are used for treatment of different ailments. Similarly, other ethnobotanical studies conducted in Ethiopia and elsewhere also showed that leaves as the most commonly used plant parts for remedy preparation[15,17,22-25]. One of the reasons that wide utilization of leaves as remedy preparation is

that leaf harvesting is relatively a sustainable conservation practice compared to utilization of other plant parts such as root and stem[26]. The second reason for utilization of leaves for remedy preparation is important because of secondary metabolites or bioactive compounds such as inulins, tannins and other alkaloids which may be account for their medicinal properties are reside on leaves[27].

**Methods of remedy preparation, dosage and route of administration:** Medicinal plant remedies are prepared using grinding, crushing, squeezing, powdering and infusion etc. grinding (38.36%) and crushing (15.07%) were the two commonly used methods in herbal remedies preparation followed by powdering and sniffing (5.48% each) as showed in Table 3. Some of the remedy preparations were prepared from the plant parts either individually or in some cases by the combination of two or more parts of medicinal plants. For instance; leaves of *Olea europea* subsp. *cuspidate* for the treatment of Herpes; flower of *Hagiena abyssinica* with fruit of *Embelia schimeri* and leaves of *Myrsine africana* are homogenized together for the treatment of tapeworm; leaves of both *Arudinaria alpine* and *Rumex nervosus* with root of *Stephania abysinica* are homogenized for treatment sudden sickness; dry leaves of *Kalanchoe petitiana* with fresh leaves of *Rumex nervosus* for the treatment of homorrage and bulb of *Allium sativum* with fresh leaves of *Foeniculum vulugare* for treatment of urinary problem etc. In some medicinal plants have different way of remedy preparation and dosage for the treatment of different types of disease. Water is the major medium in which the decoctions are made. Sometimes, other additives like honey, milk, butter, salt, sugar, coffee or tea were mixed for plant remedies preparation. Some of the remedy preparations had side effects and resulted in vomiting and diarrhea. When such side effect happened, antidotes like milk, whey, cheese, cabbage, chicken soup and ale (local beer) were used to reverse the adverse effect of medicinal plants. Most of the remedy preparations given did not have standardized doses. Therefore; in most cases dosages were determined based on age of the patient, sex and health status of the patient. Pregnant women are also not given those medicines with observable adverse effects such as vomiting and diarrhoea. Some of the medicinal plant preparations were measured in a cup of tea, a glass, jug, nail or full of spoon.

The local healers of the study area employ several collections of plant conditions. About 58 species (82.86%) preparations are made from fresh form, followed by dry 11 species (15.71%) and both dry and fresh 15 (1.43%). The routes of administration of traditional remedies in the study

Table 3: Percentage of remedy preparation methods

| Methods of remedy preparation | Frequency | Percentage |
|---|---|---|
| Grinding | 28 | 38.36 |
| Crushing | 11 | 15.07 |
| Powdering | 4 | 5.48 |
| Sniffing | 4 | 5.48 |
| Squeezing | 3 | 4.11 |
| Grinding and bathing | 3 | 4.11 |
| Boiling | 2 | 2.74 |
| Chewing | 2 | 2.74 |
| Infusion | 2 | 2.74 |
| Grinding and infusion | 2 | 2.74 |
| Grinding and squeezing | 2 | 2.74 |
| Crushing and squeezing | 2 | 2.74 |
| Smoking | 1 | 1.37 |
| Eating | 1 | 1.37 |
| Roasting and grinding | 1 | 1.37 |
| Grinding and roasting | 1 | 1.37 |
| Grinding and boiling | 1 | 1.37 |
| Bathing | 1 | 1.37 |
| Boiling and fumigation | 1 | 1.37 |
| Crushing and boiling | 1 | 1.37 |

area are various such as Oral, Dermal, Nasal, Ocular and Auditoria. Most of the traditional remedies are taken orally (36 spp., 51.43%) followed by dermal (17 spp., 24.29%) and nasal (5 spp., 7.14) (Fig. 4). This is because of the fact that most of the medicinal plants recorded in the study area are used to treat internal health problem such as stomach ache, intestinal parasites, urinary problem and hepatitis etc., this results are in line with other ethnobotanical investigation conducted in Ethiopia and elsewhere also showed that traditional remedies are mostly administered orally[14,17,18,28-31].

**Informant Consensus Factor (ICF):** During the survey, the medicinal plants of the study area were used to treat a total of 38 ailments (29 in human, 5 in livestock and 4 in both human and livestock ailments). These health problems are generally categorized as infections, general complications, diet related, toxicity related, allergies, devil sickness, wounds and others.

The highest number of medicinal plant species were reported to be used for treatment of sudden sickness (10 species, 14.29%) followed by devil sickness (7 species, 10%); Stomach ache (7 species, 10 %); Wound (5, 7.14%); Common cold, Coughing, Dermal disease (4 species, 5.71% each); Epistaxis (Nose bleed), Headache, Black leg (*Shimetere*), Taenicides (3 species, 4.29%); Bone fracture, Eye infection, Febrile mill, Hemorrhage, Hepatitis (*Koye*), Tonsillitis, Tooth ache, Toxic plants (2 species, 2.86% each) as shown in Table 4.

Hence, In this study, the ICF values range from 0.0 for Tonsillitis, Tooth ache, Diabetes, Insect bite, Lash, Malaria etc.,
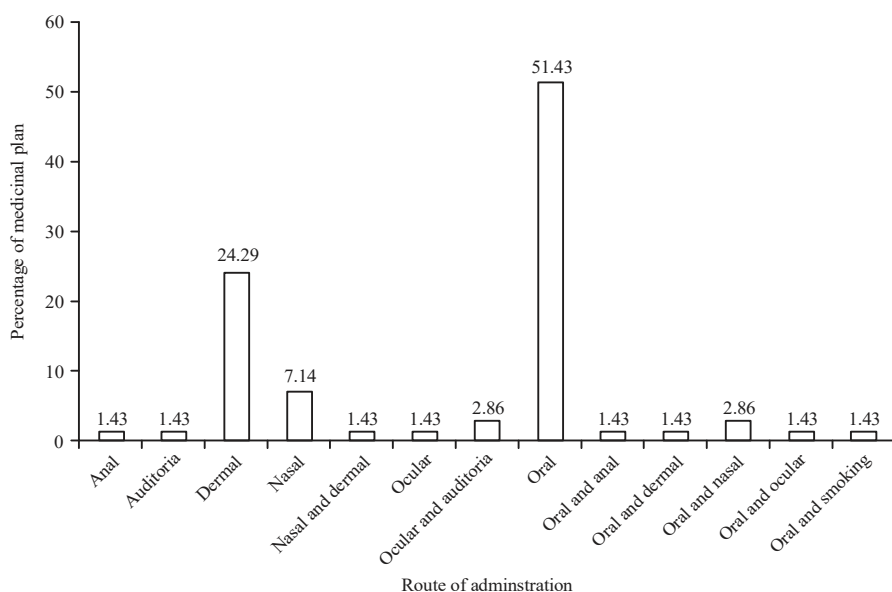
Fig. 4: Percentage of route of administration of medicinal remedies in the study area

Table 4: ICF values of ailments treated using the medicinal plants of the study area

| Disease category | No. of plants used for treatment of the ailment (Nt) | Medicinal plants used (%) | No. of use reports (Nur) | ICF value |
|---|---|---|---|---|
| Sudden sickness | 10 | 14.29 | 53 | 0.83 |
| Devil sickness | 7 | 10.0 | 10 | 0.33 |
| Stomach ache | 7 | 10.0 | 30 | 0.79 |
| Wound | 5 | 7.14 | 6 | 0.2 |
| Common cold | 4 | 5.71 | 36 | 0.91 |
| Coughing | 4 | 5.71 | 10 | 0.67 |
| Dermal disease (*Tinea capitis, Herpes, Quakucha, Dandruff*) | 4 | 5.71 | 6 | 0.2 |
| Epistaxis (Nose bleed) | 3 | 4.29 | 4 | 0.33 |
| Headache | 3 | 4.29 | 7 | 0.67 |
| Black leg (*Shimetere*) | 3 | 4.29 | 11 | 0.8 |
| Taenicides | 3 | 4.29 | 50 | 0.96 |
| Bone fracture | 2 | 2.86 | 6 | 0.8 |
| Eye infection | 2 | 2.86 | 11 | 0.9 |
| Febrile mill | 2 | 2.86 | 54 | 0.98 |
| Hemorrhage | 2 | 2.86 | 4 | 0.67 |
| Hepatitis (*Koye*) | 2 | 2.86 | 5 | 0.75 |
| Tonsillitis | 2 | 2.86 | 2 | 0.0 |
| Tooth ache | 2 | 2.86 | 2 | 0.0 |
| Toxic plants | 2 | 2.86 | 5 | 0.75 |
| *Amoebiasis* | 1 | 1.43 | 2 | 1.0 |
| *Ascriasis* | 1 | 1.43 | 2 | 1.0 |
| Diabetes | 1 | 1.43 | 1 | 0.0 |
| Dysentery | 1 | 1.43 | 4 | 1.0 |
| Ear infection | 1 | 1.43 | 2 | 1.0 |
| Gastritis | 1 | 1.43 | 1 | 1.0 |
| Insect bite | 1 | 1.43 | 1 | 0.0 |
| *Lash* | 1 | 1.43 | 1 | 0.0 |
| Leech worm | 1 | 1.43 | 2 | 1.0 |
| Loss of appetite | 1 | 1.43 | 13 | 1.0 |
| Loss of weight | 1 | 1.43 | 1 | 0.0 |
| Malaria | 1 | 1.43 | 1 | 0.0 |
| Snake repellent | 1 | 1.43 | 1 | 0.0 |
| Swelling | 1 | 1.43 | 5 | 1.0 |
| Tuberculosis | 1 | 1.43 | 1 | 0.0 |
| Urinary problem | 1 | 1.43 | 1 | 0.0 |

ICF: Nur-Nt/(Nur-1), where, ICF is informants consensus factor, Nur is the number of individual plant use reports for a particular illness category and Nt is the total number of species used by all informants for this illness category

Table 5: Preference ranking of five medicinal plants used for treating wound

| Medicinal plants | Key informants scored $K_1$-$K_{10}$ | | | | | | | | | | Total | Rank |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $K_1$ | $K_2$ | $K_3$ | $K_4$ | $K_5$ | $K_6$ | $K_7$ | $K_8$ | $K_9$ | $K_{10}$ | | |
| *Bersama abyssinica* | 3 | 1 | 5 | 3 | 2 | 5 | 1 | 2 | 4 | 1 | 27 | 4th |
| *Euphorbia ampliphylla* | 1 | 2 | 1 | 4 | 4 | 3 | 4 | 1 | 2 | 4 | 26 | 5th |
| *Nuxia congesta* | 5 | 3 | 2 | 2 | 3 | 4 | 2 | 5 | 3 | 5 | 35 | 1st |
| *Oncinotis tenuiloba* | 2 | 4 | 3 | 5 | 5 | 2 | 3 | 3 | 5 | 2 | 33 | 2nd |
| *Salivia nilotica* | 4 | 5 | 4 | 1 | 1 | 1 | 5 | 4 | 1 | 3 | 29 | 3rd |

K: Key informants. Use criteria (5: Excellent, 4: Very good, 3: Good, 2: Less, 1: Least, 0: No use)

Table 6: Average score of direct matrix ranking of multipurpose uses of plants in the study area

| Use category | Medicinal plant species | | | | | |
|---|---|---|---|---|---|---|
| | *Allium sativum* | *Cucumis ficifolius* | *Embelia schimperi* | *Hagenia abyssinica* | *Ocimum lamiifolium* | *Ruta chalepensis* |
| Medicine | 5 | 3 | 5 | 5 | 4 | 5 |
| Food/Fodder | 5 | 0 | 0 | 0 | 5 | 4 |
| Market | 5 | 0 | 4 | 4 | 4 | 5 |
| Construction | 0 | 0 | 0 | 5 | 0 | 0 |
| Firewood | 0 | 0 | 3 | 5 | 0 | 0 |
| Total | 150 | 30 | 120 | 190 | 130 | 140 |
| Rank | 2nd | 6th | 5th | 1st | 4th | 3rd |

Use criteria (5: Excellent, 4: Very good, 3: Good, 2: Less, 1: Least, 0: No use)

to 1.00 for *Amoebiasis*, *Ascriasis*, ear infection, gastritis, dysentery etc. Thus, most Informant Consensus Factor (ICF) values were above 0.5, which indicated that ailments were widely distributed among the districts. Hence all of them could be considered for validation of isolation and characterization of the bioactive compound by future phytochemical screening.

**Preference ranking of medicinal plants used for the treatment of wound:** Preference ranking was conducted on the most important five medicinal plants used for the treatment of wound ailments by 10 selected key informants (Table 5). The key informants were selected to identify the best preferred medicinal plant species for treatment of wound and rank the medicinal plants based on their effectiveness against wound and give number 5 for most effective and number 1 for the least effective. The informant consensus revealed that *Nuxia congesta* occupies the first rank followed by *Oncinotis tenuiloba*, *Salivia nilotica*, *Bersama abyssinica* and *Euphorbia ampliphylla*. This study is contrary to the work done by Beche *et al.*[32] that *Acacia negrii* most effective for treatment wound followed by *Acacia senegal*, *Cadaba rotundifolia*, *Senna petersiana* and *Ziziphus spina-christi*. This was due to the indigenous knowledge on medicinal plants by herbalists varies across culture and ethnic group.

**Direct matrix ranking of multipurpose medicinal plants in the study area:** Direct matrix ranking was conducted on six

multipurpose medicinal plants by 10 selected key informants. The medicinal plants that were investigated other than medicinal value, includes *Allium sativum*, *Cucumis ficifolius*, *Hagenia abyssinica*, *Embelia schimperi*, *Ocimum lamiifolium* and *Ruta chalepensis*. The informant consensus indicated that *Hagenia abyssinica*, *Allium sativum* and *Ruta chalepensis* occupy the first to third rank, respectively followed by others. These medicinal plants have other values such as food/fodder, spice, firewood, construction, market use and others. Direct matrix ranking was done to compare these values of the selected multipurpose medicinal plants (Table 6). Similar result reported that ethnobotanical investigation conducted in different part of Ethiopia showed that direct matrix of a multipurpose use medicinal plants were reported by Bekele[3], Bizuayehu and Assefa[22] and Abebe and Ayehu[33].

**Threats and conservation of medicinal plants in the study area:** In this survey, both anthropogenic and natural factors were the major threats of medicinal plant diversity in the study area. Lack of rainfall (25%), deforestation for fire wood (12.5%), lack of awareness on traditional medicine (12.5%), modern public health facilities (10%), over exploitation of medicinal plant, overgrazing by both domestic and wild animals and manufacturing material culture as well as scarcity of land for domestication and/or cultivation of medicinal plant in their homegarden (5% each) and the remaining informants reported that have no threats on medicinal plants in the community. These results are

in line with other ethnobotanical investigation conducted in Ethiopia showed that loss of medicinal plant diversity are mostly by agricultural expansion; Overgrazing, Fire wood, Urbanization, Construction and Drought but the threats are vary from one district to others[14,22,34]. The most locally threatened medicinal plant in the study area is *Hagenia abyssinica*, *Embelia schimperi*, *Ajuga integrifolia* and *Myrsine africana.* Some of the herbalists are interesting to cultivate some of the medicinal plants in their homegarden.

## CONCLUSION AND RECOMMENDATIONS

The study indicated that the Ezha district have rich in medicinal plants and associating traditional knowledge that are concerning the use of medicinal plants for the treatment of both human and livestock diseases. Traditional knowledge's on medicinal plants are play important role to maintain their primary health care of the community.

Many herbalists reported that the poly-herbal medicine have high healing ability than the use single medicinal plant as a remedy. Most of the medicinal plants were collected from natural vegetation, which implies better achievement of *in situ* conservation in the communities and the communities also have the better habit of conserving plant genetic resources in their natural habitat. For the sustainable use of medicinal plants in the community, there is a need to develop a conservation strategy and promote medicinal plants growing in their homegardens and protect it's in their natural habitat.

According to the result of the study, the following recommendations are forwarded:

- The traditional practitioners for herbal preparation shall be supported by the government by providing land for cultivating medicinal plants and assisting their activities with professional guidance helps and benefit from the task they perform by their indigenous knowledge
- The traditional healers association should be established even at the zone level to create hostile environment to the traditional healers
- The district of Biodiversity and Environmental protection office should raise awareness to the communities to develop the habit of cultivating locally threatened medicinal plants such as *Hagenia abyssinica*, *Embelia schimperi*, *Ajuga integrifolia* and *Myrsine Africana* etc. in homegardens which helps to conserve medicinal plants and their associated indigenous knowledge

- The medicinal plant conservationist should give greater emphasis on the establishment of botanical garden for the conservation of multipurpose medicinal plants and widely used medicinal plants as well as the whole natural resources in the study area
- Pharmacists and ethnoveterinaries should forward a new insight towards *in vivo* and *in vitro* phytochemical screening on medicinal plants used for treating both human and livestock disease, respectively

## ACKNOWLEDGMENTS

## REFERENCES

1. Friis, I., S. Demissew and P.V. Breugel, 2010. Atlas of the Potential Vegetation of Ethiopia. The Royal Danish Academy of Sciences and Letters, Copenhagen, Denmark, ISBN: 9788773043479, Pages: 306.
2. Pankhurst, R., 2001. The status and availability of oral and written knowledge on traditional health care in Ethiopia. Proceedings of the National Workshop on Biodiversity Conservation and Sustainable Use of Medicinal Plants in Ethiopia, April 28-May 1, 1998, Addis Ababa, Ethiopia, pp: 92-106.
3. Bekele, E., 2007. Study on actual situation of medicinal plants in Ethiopia. Technical Report, Japan Association for International Collaboration of Agriculture and Forestry, Japan.
4. Fullas, F., 2007. The role of indigenous medicinal plants in Ethiopian healthcare. Afr. Renaissance, 4: 76-80.
5. World Bank, 2001. Ethiopia-conservation and sustainable use of medicinal plants project. Project Appraisal Document, Report No. 21737-ET, January 22, 2001, Africa Regional Office, Addis Ababa, Ethiopia.

6.  Yineger, H. and D. Yewhalaw, 2007. Traditional medicinal plant knowledge and use by local healers in Sekoru District, Jimma Zone, Southwestern Ethiopia. J. Ethnobiol. Ethnomed., Vol. 3. 10.1186/1746-4269-3-24.

7.  Abebe, D., 1986. Traditional medicine in Ethiopia: The attempt being made to promote it for effective and better utilization. SINET. Ethiopia J. Sci., 9: 61-69.

8.  Giday, M., Z. Asfaw, Z. Woldu and T. Teklehaymanot, 2009. Medicinal plant knowledge of the Bench ethnic group of Ethiopia: An ethnobotanical investigation. J. Ethnobiol. Ethnomed., Vol. 5. 10.1186/1746-4269-5-34.

9.  Abebe, D., 2001. The role of medicinal plants in healthcare coverage of Ethiopia, the possible integration. Proceeding of the National Workshop on Biodiversity Conservation and Sustainable Use of Medicinal Plants in Ethiopia, April 28-May 1, 1998, Addis Ababa, Ethiopia, pp: 6-21.

10. Martin, G.J., 1995. Ethnobotany: A Methods Manual. Chapman and Hall, London, UK., ISBN-13: 9780412483707, pp: 267-347.

11. Cotton, C.M., 1996. Ethnobotany: Principles and Applications. John Wiley and Sons Ltd., Chichester, UK., ISBN-13: 9780471955375, pp: 347-374.

12. Heinrich, M., A. Ankli, B. Frei, C. Weimann and O. Sticher, 1998. Medicinal plants in Mexico: Healers' consensus and cultural importance. Soc. Sci. Med., 47: 1859-1871.

13. Teklehaymanot, T., M. Giday, G. Medhin and Y. Mekonnen, 2007. Knowledge and use of medicinal plants by people around Debre Libanos monastery in Ethiopia. J. Ethnopharmacol., 111: 271-283.

14. Lulekal, E., E. Kelbessa, T. Bekele and H. Yineger, 2008. An ethnobotanical study of medicinal plants in Mana Angetu district, Southeastern Ethiopia. J. Ethnobiol. Ethnomed., Vol. 4. 10.1186/1746-4269-4-10.

15. Bekalo, T.H., S.D. Woodmatas and Z.A. Woldemariam, 2009. An ethnobotanical study of medicinal plants used by local people in the lowlands of Konta Special Woreda, Southern nations, nationalities and peoples regional state, Ethiopia. J. Ethnobiol. Ethnomed., Vol. 5. 10.1186/1746-4269-5-26.

16. Giday, M., 1999. An ethnobotanical study of medicinal plants used by the Zay people in Ethiopia. M.Sc. Thesis, Swedish Biodiversity Centre, Uppsala, Sweden.

17. Temam, T. and A. Dillo, 2016. Ethnobotanical study of medicinal plants of Mirab-Badwacho district, Ethiopia. J. BioSci. Biotechnol., 5: 151-158.

18. Teklehaymanot, T. and M. Gidey, 2007. Ethnobotanical study of medicinal plants used by people in zegie peninsula, Northwestern Ethiopia. J. Ethnobiol. Ethnomedicin, Vol. 3. 10.1186/1746-4269-3-12.

19. Wondimu, T., Z. Asfaw and E. Kelbessa, 2007. Ethnobotanical study of medicinal plants around 'Dheeraa' town, Arsi zone, Ethiopia. J. Ethnopharmacol., 112: 152-161.

20. Yineger, H., D. Yewhalaw and D. Teketay, 2008. Ethnomedicinal plant knowledge and practice of the Oromo ethnic group in southwestern Ethiopia. J. Ethnobiol. Ethnomed., Vol. 4. 10.1186/1746-4269-4-11.

21. Awas, T. and S. Demissew, 2009. Ethnobotanical study of medicinal plants in Kafficho people, Southwestern Ethiopia. Proceedings of the 16th International Conference of Ethiopian Studies, July 2-7, 2007, Trondheim, Norway, pp: 711-726.

22. Bizuayehu, B. and T. Assefa, 2017. Ethnobotanical value of medicinal plant diversity in Cheha district, Guraghe zone, Southern Nations, Nationalities and Peoples (SNNPR) of Ethiopia. J. Med. Plants Res., 11: 445-454.

23. Megersa, M., Z. Asfaw, E. Kelbessa, A. Beyene and B. Woldeab, 2013. An ethnobotanical study of medicinal plants in Wayu Tuka district, East Welega zone of Oromia Regional State, West Ethiopia. J. Ethnobiol. Ethnomed., Vol. 9. 10.1186/1746-4269-9-68.

24. Murad, W., A. Azizullah, M. Adnan, A. Tariq, K. Khan, S. Waheed and A. Ahmad, 2013. Ethnobotanical assessment of plant resources of Banda Daud Shah, District Karak, Pakistan. J. Ethnobiol. Ethnomed., Vol. 9. 10.1186/1746-4269-9-77.

25. Tugume, P., E.K. Kakudidi, M. Buyinza, J. Namaalwa, M. Kamatenesi, P. Mucunguzi and J. Kalema, 2016. Ethnobotanical survey of medicinal plant species used by communities around Mabira Central Forest Reserve, Uganda. J. Ethnobiol. Ethnomed., Vol. 12. 10.1186/s13002-015-0077-4.

26. Ayyanar, M. and S. Ignacimuthu, 2005. Traditional knowledge of Kani tribals in Kouthalai of Tirunelveli hills, Tamil Nadu, India. J. Ethnopharmacol., 102: 246-255.

27. Okoegwale, E.E. and J.U. Omefezi, 2001. Some herbal preparations among the people of Isoko clan of Delta State, Nigeria. J. Applied Sci., 4: 2359-2371.

28. Hunde, D., Z. Asfaw and E. Kelbessa, 2004. Use and management of ethnoveterinary medicinal plants by indigenous people of 'Boosat', Welenchita area. Ethiop. J. Biol. Sci., 3: 113-132.

29. Balemie, K., E. Kelbessa and Z. Asfaw, 2004. Indigenous medicinal plant utilization, management and threats in Fentalle area, Eastern Shewa, Ethiopia. Ethiop. J. Biol. Sci., 3: 37-58.

30. Getaneh, G., A. Zemede, E. Abiyu and R. Nagappan, 2014. Ethnobotanical study of traditional medicinal plants and their conservation status in Mecha Wereda, West Gojjam zone of Ethiopia. Int. J. Pharmaceut. Health Care Res., 2: 137-154.

31. Amri, E. and D.P. Kisangau, 2012. Ethnomedicinal study of plants used in villages around Kimboza forest reserve in Morogoro, Tanzania. J. Ethnobiol. Ethnomed., Vol. 8. 10.1186/1746-4269-8-1.

32. Beche, D., G. Gebeyehu and K. Feyisa, 2016. Indigenous utilization and management of useful plants in and around Awash National Park, Ethiopia. J. Plant Biol. Soil Health, Vol. 3, No. 1.

33. Abebe, D. and A. Ayehu, 1993. Medicinal Plants and Enigmatic Health Practices of Northern Ethiopia. Berhanina Selam Printing Enterprise, Addis Ababa, Ethiopia, Pages: 511.

34. Mesfin, F., S. Demissew and T. Teklehaymanot, 2009. An ethnobotanical study of medicinal plants in Wonago Woreda, SNNPR, Ethiopia. J. Ethnobiol. Ethnomed., Vol. 5. 10.1186/1746-4269-5-28.