



## **Indigenous Knowledge and Practices on Medicinal Plants Used by Local Communities of Gambella Region, South West Ethiopia**

**Jemberu Alemu Megenase<sup>1</sup>, Ketema Tilahun Gelaye<sup>1</sup> and Prem Kumar Dara<sup>1\*</sup>**

<sup>1</sup>Gambella University, Gambella, Ethiopia.

### **Authors' contributions**

*This work was carried out in collaboration among all authors. Author JAM designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors KTG and PKD managed the analyses of the study. All authors read and approved the final manuscript.*

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### **ABSTRACT**

Indigenous knowledge and practices on medicinal plants used by local communities of Gambella region, south west Ethiopia was conducted to investigate those potential and popular medicinal plants used for the treatment of various diseases in Gambella region. A total of 100 purposively selected inhabitants were employed in the study of which 84 were male and 16 were females. A traditional use of plants information was obtained by semi structured oral interviews from experienced rural elders, Focus group discussion and through questionnaire administered to traditional herbal medicine practitioners of the study area. 81 medicinal plants were identified for the traditional treatment of both human (25) and animal (16) disease. The highest numbers of medicinal plants for traditional uses utilized by this community were belonging to shrubs 30(37.03%) followed by trees (32.10%). The result revealed that 15.2% of the remedies are prepared from root part and

\*Corresponding author: Email: [drpkdara@gmail.com](mailto:drpkdara@gmail.com);

squeezing accounts 17(20.99%) followed by chewing 14(17.28%). The major routes of administration of traditional medicines were reported oral 50(61.73%). Urine, placental retention and milk let down accounts higher informants' consensus factor value (0.96). The findings showed that sheferaw and leele have higher fidelity level which is 100 and 92 respectively. Various factors were recorded as the main threats of medicinal plants in the study area. In conclusion, the community carries a vast knowledge of medicinal plants but this knowledge is also rapidly disappearing in this community. Such type of ethno-botanical studies will help in systematic documentation of ethno-botanical knowledge and availing to the scientific world plant therapies used as antivenin by the Gambella community and further research on plant species identification and chemical extraction is recommended.

*Keywords: Ethno-botanical study; diseases; indigenous knowledge; medicinal plants.*

## 1. INTRODUCTION

It is accepted fact that the tribes all over the world owning their own culture based on that they developed their own system of medical practices, which are being addressed as folk and ethno-medicines, there are numerous herbs available in their surroundings and that herbs are being used by tribal community as food and medicine for curing their diseases they have been continued to live in forest environment since from many generations and developed their own knowledge on flora and fauna of the forest that are known as folk or indigenous knowledge [1].

In Ethiopia, there is a long history of using medicinal plants to treat a variety of diseases [2,3]. Eighty percent 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 [4].

Indeed, application of knowledge and values of communities that are resident within or around key biodiversity areas has been gaining increasing global popularity as significant elements in enriching and improving strategies for conserving biodiversity [5]. This is because integration of such indigenous knowledge into conservation programs facilitates cross-borrowing of ideas, promotes constructive engagement, and instills a sense of common ownership and responsibility towards achievement of a synergy of goals. This echoes the concept of social capital that, apart from amassing local support and goodwill, adoption of local indigenous knowledge in conservation may also promote and provide sustainable insurance against conflicts of purposes. This results in increased chances of achieving the dual goal of biodiversity conservation stewardship as well as community development [6].

Traditional healers are often part of a local community, culture and tradition, and continue to have high social standing in many places, exerting influence on local health practices; it is therefore worthwhile to explore the possibilities of engaging them in primary health care and training them accordingly [7]. Most African people still rely heavily on traditional medicine; traditional healers are often the first and last line of defense against most diseases such as headaches, coughs, diarrhea, and wound healing and skin diseases. One advantage in preferring traditional medicine is that traditional healers are found within a short distance, are familiar with the patient's culture and the environment and the costs associated with treatments are negligible [8]. Traditional medical knowledge of medicinal plants and their use by indigenous healers are not only useful for conservation of cultural traditions and biodiversity but also for community healthcare and drug development in the present and future. Since the beginning of this Century, there has been an increasing interest in the study of medicinal plants and their traditional use in different parts of the world [1].

About 85% of world population uses herbal medicines for prevention and treatment of diseases, and the demand is increasing in developed and developing countries [9]. Herbal remedies are enjoying widespread popularity throughout the world. However, only 10% of medicinal plant species is cultivated today while the larger majority being left under wild stands threat [10].

Ethiopia is endowed with a diverse biological resources including about 6, 500 species of higher plants, with approximately 12% endemic, hence making it one of the six plant biodiversity rich regions and of these, more than 62.5% of the forest areas are found in southwest region of Ethiopia where most of the medicinal plants are

confined and have been used as a source of traditional medicine to treat different human and livestock ailments [11]. A large proportion of the people living in the region depend on direct herbal medicine to treat a wide range of human ailments. Most of the studies on medicinal plants in Ethiopia have so far concentrated in the south, south west, central, north and north-western parts of the country [1] and during the establishment of Center of Nilotic Study (CNS) by Gambella University a participant from *Opo* and *Majang* indicated that the native people are highly specialized in traditional medicine. Therefore, this study area is selected; because there is limited ethno botanical collection, identification and documentation carried out on medicinal plant species of the area. In addition, most of the natural vegetation of the study area is lost due to natural and human impacts.

Therefore, the general objective of the study is designed to investigate those potential and popular medicinal plant species used for the treatment of various diseases in Gambella region and specifically:

- To assess and document indigenous knowledge of the people on the use of medicinal plants
- To identify those potential and popular medicinal plant types used for the treatment of various diseases in the community and in animals.
- To identify medicinal plant part (s) used, methods of preparation and ways of administration in the study area
- Identify the major threats of medicinal plants in the study area.

### 1.1 Significance of the Study

The information generated enhances the ethno-botanical knowledge of the region and provides recommendations that would help to combat problems in the conservation and sustainable use of medicinal plants and serve as baseline information for future pharmacological and phytochemical studies.

## 2. MATERIALS AND METHODS

### 2.1 Description of the Study Area

The study was conducted in Gambella regional state, southwest Ethiopia from August 2018 to April 2019. The Gambella People's Regional State is located in south western part of Ethiopia

between the geographical coordinates of 6° 28'38" to 8° 34' North Latitude and 33° to 35° 11'11" East Longitude, 766 km far from Addis Ababa which covers an area of about 34,063 km<sup>2</sup>. The Region is bounded to the North, North East and East by Oromya National Regional State, to the South and Southeast by the Southern Nations and Nationalities People's Regional State and to the Southwest, West and Northwest by the Republic of south Sudan [12].

The mean annual temperature of the Region varies from 17.3°C to 28.3°C and absolute maximum temperature occurs in mid-March and is about 45°C and the absolute minimum temperature occurs in December and is 10.3°C. The annual rainfall of the Region in the lower altitudes varies from 900-1,500 mm; at higher altitudes it ranges from 1,900-2,100 mm. The annual evapotranspiration in the Gambella reaches about 1,612 mm and the maximum value occurs in March and is about 212 mm [13].

Based on the Census conducted by the Central Statistical Agency of Ethiopia (CSA), the Gambella region has total population estimation of 406,000 [14] and the Gambella Regional State is predominantly inhabited by five indigenous ethnic groups, namely the 'Anywa', 'Nuer', 'Majang', 'Opo' and 'Kumo'. In addition to these five indigenous ethnic groups, there are other Ethiopians of different ethnic origins in the region who are collectively referred to as "highlanders". The identity boundary between the 'indigenous peoples' vs. 'highlanders' is constructed along: linguistic origins (the highlanders being mainly from 'Semitic and Cushitic' linguistic group, while the indigenous groups are from the 'Nilo-Saharan' linguistic group) and ethnic background.

### 2.2 Reconnaissance Survey Study and Selection of Study Sites

Reconnaissance survey was conducted from November 2018 to May 2019 to select potential Elders from: AboboWoreda, LareWoreda, GodereWoreda and Itang special woredafor ethno-botanical data collections. These study area were purposively selected based on the availability of traditional medicine practitioners, traditional medicine use history and altitudinal variation between the local communities.

### 2.3 Ethno-botanical Data Collection

Before the commencement of ethno-botanical data collection, respondents were selected from

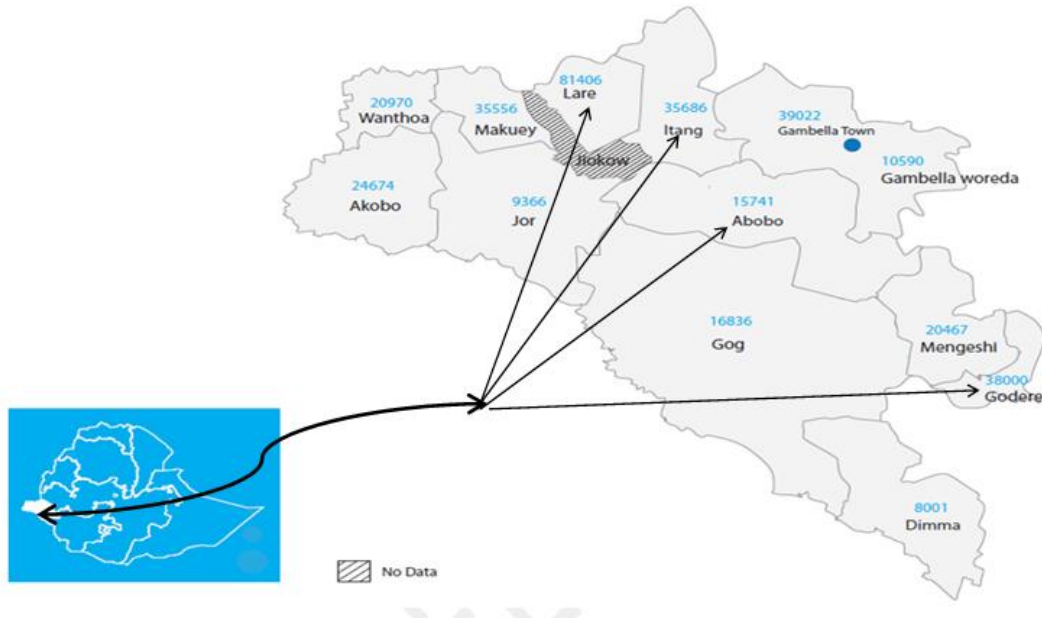


Fig. 1. Map of the study area



Fig. 2. Focus group discussion with Lareworeda communities

the communities. Totally, 100 respondents (aged  $\geq 25$  years) participated in the study. Traditional medicine practitioners were used as key informants. Key informants were selected by purposive sampling from the study areas based on the information gathered from the local people while other respondents were randomly selected. Data collection methods were through semi-structured interviews, group discussions, and guided field walks with key informants for field observations. Key informants were first interviewed individually to mention about the

local names of the plants they use to treat diseases, diseases treated, part(s) of plants used, methods of preparation of remedies, route of application of the remedies, dosage, and factors that threaten medicinal plants.

#### 2.4 Data Analysis

The data was analyzed using simple descriptive statistics using Microsoft Excel 2010. The MS Excel Spreadsheet was also utilized for drawing bar graphs. Preference ranking was computed

according to Debela et al. [15]. Informant consensus factor (ICF) values were determined following [16]. To evaluate the consensus among traditional healers or to evaluate the reliability of the information provided by the informants.

$$ICF = \frac{Nur - Nt}{(Nur - 1)}$$

Where,

Nur: Number of use-reports for a particular use category

Nt: Number of taxa used for a particular use category by all informants.

The Pearson Correlation Test was calculated using SPSS v20. software package and employed to evaluate whether there is significant ( $p < 0.05$ ) correlation between i) the age of the traditional healers' and the number of medicinal plant species reported, and ii) the educational level of traditional healers' and the number of medicinal plant species reported. The informants who could not read and write were considered as illiterate while; those respondents attended formal education were considered educated.

The Fidelity Level (FL) index was calculated based on the formula recommended by Mirutse [17], which is used to quantify the importance of a given species for a particular purpose in a given cultural group or to determine the most preferred plants for a treatment of a particular disease was calculated as:

$$FL = \frac{Np}{N} \times 100$$

Where,

Np: Number of use-reports cited for a given species for a particular ailment

N: Total number of use-reports cited for any given species

## 2.5 Ranking of Threats to Medicinal Plants

Ranking of threats to medicinal plants that were reported by most of the informants in the study area was conducted using selected key respondents as described by Debela et al. [15] and Bayafers [18]. The informants were asked to give seven for the most threatening factor and one for the least threatening factor in the study area. Based on informants' six threats were

selected and the informants were asked to give seven for the most threatening factor and one for the least threatening factor in the study area. This information is used to determine the highest threats to traditional medicinal plants in the study area and helps to suggest the necessary appropriate conservation measures.

## 3. RESULTS AND DISCUSSION

### 3.1 Profiles of the Respondents

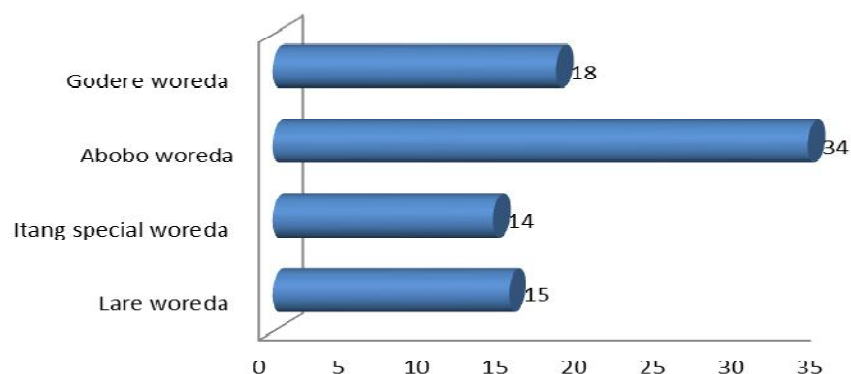
The gender distribution of traditional healers was 84 (84%) and 16 (16%) for males and females, respectively and 55% were illiterate. Most of traditional healers were married (65%) and 58% were older than 40 years (Table 1).

### 3.2 Human and Livestock Ailments Identified and Treated by Medicinal Plants

In the study area 25 diseases of humans and 16 diseases of animals are treated with a total of 81 plant types where one plant species can treat a single disease or a number of diseases. But, a study conducted by Gonfa et al. [6] showed that A total of 42 medicinal plants were identified that are used for the treatment of human and livestock diseases which is less than this finding. Similarly, one ailment can be treated with multiple plant species or a single plant species. For example, Bleeding is treated with 6 types of plants; retention of fetal membrane and stomach ache with 4 plants. This does not mean that they are necessarily used in combination; they could be used as alternative medicines for the same ailment. Ailments reported to be handled by traditional medical practitioners of the study areas are those disorders, which are not prevalent in the area. Although rabies is a common problem in the district, it is not indicated in the 2018/2019 report of the District's Health Office as prevalent. This could be attributed to the preference of herbal drugs over the modern ones by the public to treat the disease. Diarrhea and body wound ranked first with seven plants followed by drop of placenta and stop bleeding five plants each. Snake bite and diarrhea of calves ranked third with four plants each. This may indicate the presence of good therapeutic experience of the local people in treating livestock ailments. Perhaps this could be due to the fact that they are agro-pastoralists which helped them follow up and treat livestock and human in their day to day life activities.

**Table 1. Respondents profile**

Variables	Frequency (n=100)	Percentage (%)
<b>Sex</b>		
Male	84	84
Female	16	16
<b>Location</b>		
Lare woreda	25	25
Itang special woreda	25	25
Abobo woreda	25	25
Godere woreda	25	25
<b>Marital status</b>		
Single	13	13
Married	65	65
Divorced	12	12
Widowed	10	10
<b>Age categories</b>		
25-40 years	42	42
41-60 years	49	49
>60 years	9	9
<b>Educational status</b>		
Illiterate	55	55
Literate	45	45



**Fig. 3. Number of medicinal plants identified and used by people of the study area**

**3.3 Plant Habit and Part(s) used to Treat Diseases**

Of the total 81 medicinal plants collected from the study area, 30(37.03%) were shrub species followed by 26 (32.1%) trees, 15 (18.5%) climbers species, and 10 (12.3%) herbs (Fig. 2). In the same way high number of herbs and shrubs for medicinal purpose has also been reported previously by Sofowara [19].

**3.4 Plant Parts Used for Traditional Medicine Preparations**

The study revealed that 15.2% of the remedies are prepared from the root part of the medicinal plant followed by the leaf 13.6% which is different from

a study by Dawit [16]. In his finding most of the preparations were from leaves (27%) predominantly followed by roots (23%), fruits (10%), seeds (10%), stem barks (9%), whole plant (7%), latex (6%), root bark (4%), flower (3%) and gum (1%). The common use of leaf in the preparation of remedies could partly be due to the relative ease of finding this plant part. Leaves remain green and available in plenty for the most months of the years. The use of leaves in the preparation of remedies is also common elsewhere [17].

**3.5 Preparation Methods of Medicines, Route of Application and Dosage**

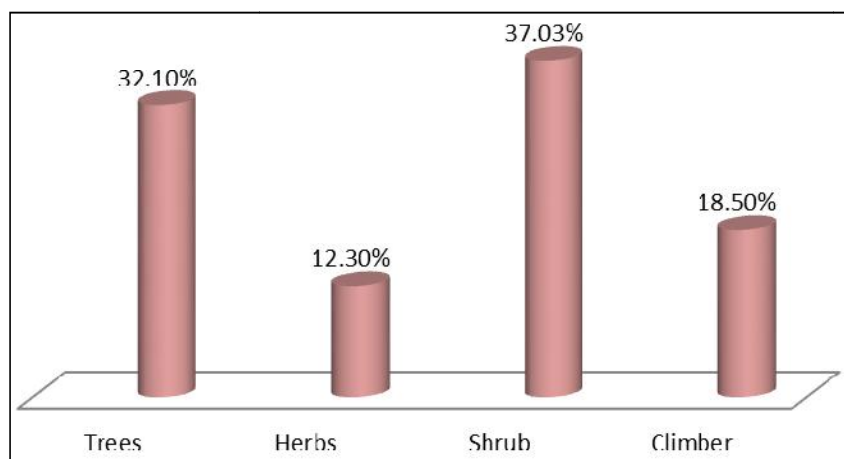
The study revealed that the main method of traditional medicine preparation was squeezing

**Table 2. Some of medicinal plants identified and used by people of the study area**

<b>Local name of the medicinal plant</b>	<b>Woreda found</b>	<b>Plant part used for medication</b>	<b>Used to treat</b>	<b>Uses of the remedy</b>	<b>Habitat of the plant</b>
Yong	Lare	Seed	Animals	Initiation of fertility/ pregnancy , avoid abortion	Wilde
Rep	Lare	Root	Human & Animals	Wound healing	Wilde
Kote	Lare	Seed	Animals	Wound healing	Wilde
Toar	Lare	Leaf	Animals	Start suckling of calf, improve temperment	Wilde
Jal	Lare	Root	Animals	For retained placenta	Wilde
Yagoy/kurkura	Goderea	Stem & leaf	Human	Stop bleeding	Wilde
Gizewa	Goderea	Leaf	Human	Bad sprit/evil eye	Wilde
Embaho	Goderea			To stop bleeding	Cultivated
Paak	Abobo&Lare	Root and leaf	Animals	For initiation of early pregnancy	Wilde
Eulaga	Goderea			For herpes virus	Cultivated
Kebericho	Goderea	Stem, Seed & leaf	Human	Abdomenal Colic	Cultivated
Tow	Abobo&Lare	Seed	Human	Abdomenal pain, skin disease, gastritis	Wilde
Makage	Lare	Leaf & seed	Animals	Malaria	Wilde
Tanglor	Lare&Abobo	Seed	Human &Animals	Bloat/ diarria/ wound healing	Wilde
Neem	Lare, Abobo, Itang	Root & stem	Human	Malaria	Cultivated
Lele	Itang &Lare	Root	Human & Animals	Increase production/ increase milk letdown, for snake bite	Wilde
Kolpew	Lare	Root	Animals	Trypanasomosis	Wilde
Tap	Lare& Itang	Leaf	Human & Animals	To stop nazal bleeding	Wilde
Misrot	Goderea	Leaf & Stem	Human	Hepatitis	Cultivated
Gursede	Goderea	Leaf	Human	Kidney disease	Wilde
Sheferaw	Goderea, Abobo, Itang	Leaf	Human	For many diseases, Blood pressure	Cultivated
Yewofmedihanit	Goderea	Root & leaf	Human	For the treatment of hepatitis	Wilde
Yemichmedihanit	Goderea&Abobo	Leaf	Human & Animals	Used for depression	Wilde
Dash merecha	Abobo	Leaf & stem	Human	For swollen body	Wilde
Guwaroo	Abobo	Leaf	Animals	Poultry disease	Wilde

<b>Local name of the medicinal plant</b>	<b>Woreda found</b>	<b>Plant part used for medication</b>	<b>Used to treat</b>	<b>Uses of the remedy</b>	<b>Habitat of the plant</b>
Chikir	Abobo	Leaf	Human	For malaria and increases appetite	Wilde
Artiya	Abobo	Root, leaf & stem	Human	Foe back pain	Wilde
Eutit	Abobo	Root, leaf & stem	Human & animals	For diarrhea	Wilde
Adekedo	Abobo	Leaf & root	Animals	Increase appetite	Wilde
Albeziya	Abobo	Leaf and stem	Human & animals	Abdominal distention	Wilde
Dejuye	Abobo	Root	Human & animals	For diarrhea	Wilde
Girawa	Goderea&Abobo	Leaf	Human & animals	Internal parasites	Wilde
Opat	Abobo	Root, leaf & stem	Human & animals	For diarrhea	Wilde
Jadereba	Abobo	Leaf	Human	Dysentery	Wilde
Olewo	Abobo	Leaf	Human	To avoid weakness	Wilde
Adeboch	Abobo	Root, leaf & stem	Human	For diarrhea	Wilde
Depgany	Lare	Stem	Animals	For bloating	Wilde





**Fig. 4. Plant habit and part(S) used to treat diseases**

**Table 3. Plant parts used for medicinal purpose**

Sn	Plant parts	Total Response	Proportion (%)
1	Root	19	15.2
2	Stem	12	9.6
3	Leaf	17	13.6
4	Bark	3	2.4
5	Seed	8	6.4
6	Leaf and root	6	4.8
7	Leaf and flower	3	2.4
9	Leaf and bark	10	8
10	Leaf and seed	12	9.6
11	Leaf and stem	12	9.6
12	Root and seed	4	3.2
13	Seed, leaf & stem	13	10.4
13	Whole part	6	4.8
Total		125	100%

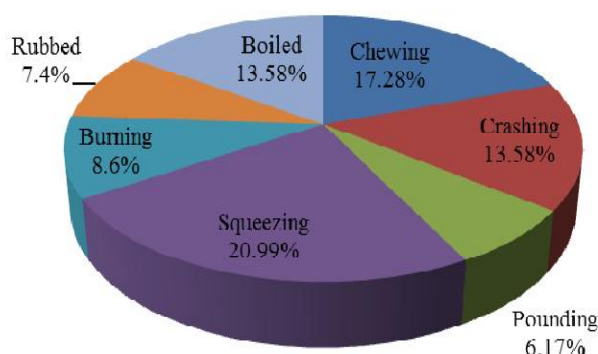
17(20.99%) followed by chewing 14(17.28%), crushing 11 (13.58%), pounding 5 (6.17%), and burning 7(8.6%), rubbed/creamed 6(7.4%) and boiled 11(13.58%). But similar study by Alebie et al. [1] showed that Powdering and pounding were the most frequently used methods of traditional medicine preparation by Oromo People.

Concerning the preparation of traditional medicine, the local people employ various methods of preparation of traditional medicines for different types of ailments. The preparations vary based on the type of disease treated and the actual site of the ailment. The principal method of traditional medicine preparation reported was crushing (pounding or pulverizing). This may be due to the possibility of effective extraction of plant ingredients when crushed/powdered so that its curative potential

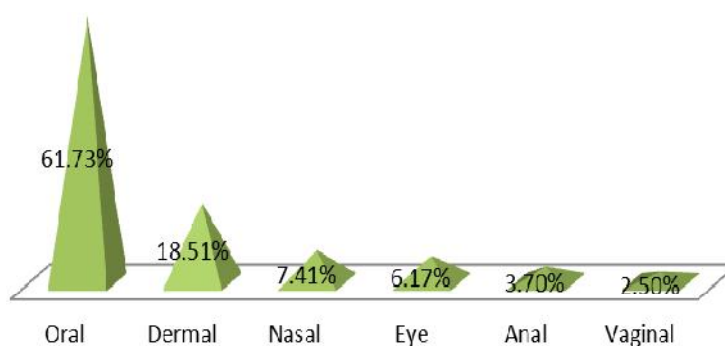
would increase. Preparations may involve using a single plant part or mixtures of different organs of the same plant or mixture of organs from different plants.

In this study, the local people also use some other products as additives in their preparations. For example, coffee, sugar, tea, hot pepper, alcohol, salt, lemon juice, milk, honey, etc. are some of the additives that the local people reported to be used to improve the flavor and reduce adverse effects such as vomiting and diarrhea so that the efficacy of the traditional medicine would be maintained or increased. Such additives were also reported by some previous researchers.

As regards to route of administration, medicines are applied internally or externally. Internal application include through oral, through the



**Fig. 5. Preparation methods of traditional medicines**



**Fig. 6. Rout of administration of traditional medicines**



**Fig. 7. Ways of medicine preparation and dosage determination**

eyes, nasal, anal, vaginal or through the ear canal. External application involves dermal treatment. The major routes of administration of remedies was reported to be oral 50 (61.73%) followed by dermal 15 (18.51%), nasal 6 (7.41%), through eye 5(6.17%), anal 3(3.7%) and vaginal 2(2.5%). This finding is in agreement with studies by Bayafers et al. [18] which showed that the Methods of administration of traditional medicinal plants prepared products by the local healers/community. The major routes of administration in the study area were reported to

be oral, dermal, nasal, anal, auricular and optical. Oral administration was the most cited route (63.9%), followed by dermal route (23%) and nasal (10%). Both oral and nasal routes (4%) permit rapid physiological reaction of the prepared medicines with the pathogens and increase its curative power.

The informants' responses indicated that there were variations in dosages of remedies, unit of measurement of remedies, duration and time that were prescribed for the same kind of health

problems. Herbal remedy dosage was basically determined by edibility of the plant parts used. In case of remedies prepared from non-edible plants/parts, dose was prescribed based on age, physical fitness, stage of illness, pregnancy and presence or absence of any disease other than the disease to be treated. [3,4] have also discussed lack of precision and standardization as a drawback of the traditional health care system. However, full dosage determination varied from healer to healer. Variations were noted in the measurement units used for dose estimation, and in the frequency and duration of herbal treatment prescribed. Dose of herbal preparations was usually estimated using different locally available materials/means, including plastic/ glass/steel cups (could be coffee-cup, teacup, water-cup) or gourd utensils, number of drops for liquid materials; teaspoons for powders; counting the number of units for seeds, leaves and fruits; index finger estimation of root size. Generally, recommendation was made to administer the herbal remedies twice or three times per day for one, two or three consecutive days to many months or until recovery. The finding is also supported by Alebie et al. [1].

### 3.6 Conditions of Preparation for Medicines

Local people depend on both fresh and dry remedies. In this case remedy preparation for 40 plant species was reported in fresh form, whereas 27 in dry form, and 14 of them were prepared and dry and fresh forms. The fact that fresh preparations dominates dry one is because of the belief that the local people have curative potential over that of dry form.

A study by Gonfa et al. [6] showed that about 92% of the medicinal plants were prepared in fresh form and 2% in dried forms while the remaining 6% were prepared either in fresh or in dry forms. Preparation of traditional medicines

from fresh materials has exposed the species to serious threat in comparison to dried forms, which can be stored for longer periods of time, and preservation of remedies from either form was not reported. Similar findings were also reported by other researchers in Ethiopia [6,9] who reported that the majority of the remedy preparations were in fresh form.

### 3.7 Informant Consensus Factor (ICF)

In this study, all cited human and livestock diseases were grouped into 7 categories (Table 4). Urine retention and Placental retention had high ICF value followed by Evil eye and depression, Swelling, Wound, hemorrhage and Hemorrhoid; Tape worms and Ascariasis; Problems of the sensorial system; Swelling, Wound and Hemorrhoid; Diarrhea, Gastritis, GIT parasites and Stomach ache and Problems of the sensory system. Those disease categories having high ICF value (e.g., > 0.8) may be the ones that commonly occur in the study area so that more number of people communicates on their remedy. According to Yirga [11] medicinal plants that are presumed to be effective in treating a certain disease have higher ICF values. A high ICF value (value close to 1) indicates that the informants rely most on the same taxa to manage specific disease conditions, while a low value (close to 0) indicates that the informants disagree on the taxa to be used in the treatment of a given ailments.

### 3.8 Fidelity Level Index (FL) of Medicinal Plants

Fidelity level values were calculated for some commonly used medicinal plants against some commonly reported ailments (Table 5). Medicinal plants that are widely used by the local people to treat one or very few ailments will have higher FL values than those that are less popular [19]. In this study, *sheferaw* was cited by many

**Table 3. Informant Consensus Factor (ICF)**

Disease categories	Nt	Nur	ICF
Urine retention, Placental retention and milk letdown	3	50	0.96
Febrile illness, Cough and Common cold	6	30	0.83
Evil eye and depression	3	40	0.95
Problems of the sensory system	11	65	0.83
Swelling, Wound, hemorrhage and Hemorrhoid	6	52	0.94
Diarrhea, Gastritis, GIT parasites and Stomach ache	8	75	0.91
Snake bite, Spider poison and Rabies	4	12	0.73

**Table 4. Fidelity levels of some common medicinal plants in the study areas**

Local name	Disease treated	NP	N	FL	FL%
Misrot	Hepatitis	16	25	0.64	64
Leele	To drop placenta	23	25	0.92	92
Kot	Wound healing	18	25	0.72	72
Tow	Abdominal pain	10	25	0.4	40
Sheferaw	Many diseases	25	25	1	100
Rep	Wound healing	17	25	0.68	68
Jal	To drop placenta	12	25	0.48	48
Kolpew	Internal parasites	16	25	0.64	64
Tanglor	Constipation	8	25	0.32	32
Qebericho	Colic	15	25	0.6	60
Oulaga	Anti-emetics	19	25	0.76	76
Embaho	Stop bleeding	12	25	0.48	48
Gizawa	Evil eye	17	25	0.68	68
Yagoye	Stop bleeding	22	25	0.88	88

informants to treat many diseases and hence had 100% FL followed by *leele* cited to drop placenta and increase milk letdown 92% FL, *yagoye* to treat wound 88% FL. High FL may indicate the efficiency of the reported plant to cure specific ailment.

$$FL = \frac{NP}{N} \times 100$$

Where; NP= the number of informants that claim the use of a plant species to treat a particular disease, N = the number of informants that use the plants as a medicine to treat any given disease. And FL= fidelity level.

### 3.9 Threats to Medicinal Plants and Indigenous Knowledge

Rural people need plants in their livelihood for different aspects. From the interview with informants various factors were recorded as the main threats to medicinal plants in the study areas. Agricultural encroachment, firewood collection, charcoal production, plant use for house and fence construction, overgrazing, and urbanization were reported to be factors for the dwindling of natural vegetation in general and medicinal plants in particular. As a result, informants require long distance of travelling to fetch medicinal plants.

The ethnobotanical knowledge on uses of some medicinal plants is secrete and transferred from one generation to the next orally. From discussion with informants, it was observed that the forefathers tell information only to one or few family members to use in secrecy. They disclose their knowledge on medicinal plants at old age by

the time when they most probably die before teaching the details of medicinal plants or when they are too old to walk to the field to show the plants in their habitat. Modernization and facility to modern medication has also contributing to the loss of indigenous knowledge as new generations give less attention to traditional medicinal plants. As a result the indigenous knowledge seems to be vanishing from the study area.

### 4. CONCLUSION AND RECOMMENDATIONS

The findings of this study revealed that several plant species are used as traditional medicine in the study area. About 81 medicinal plant species were collected which have a great value to treat a wide spectrum of human and livestock diseases. Out of the total collected plant species, 35 were used to treat 25 human ailments, 30 species to treat 16 livestock ailments and the rest to treat ailments of both. Traditional medicine preparation mostly involves single plant species and the mode of administration is mainly internal in which oral administration is the common route. This enables the traditional health care system to cover more than 59% of human and 54% of livestock health services in the study area. This in turn gives hint to believe that the traditional medicinal practices using native medicinal plants exist well-functioning in the study area. The local people use traditional medicines for primary health care due to the belief in its effectiveness, lack of modern medicines and medication as well as poor economic status of the people. The Gambella people are rich with indigenous knowledge in using, conserving and managing plant resources in general and medicinal plants

in particular. They have a wide knowledge in using plants for various purposes such as for medicine, food, household utensils, fodder, fuel, construction, etc. This knowledge is transferred from elders to youngsters entirely through oral traditions and personal experiences. But this way of knowledge transmission will lead to distortion of the original knowledge or total disappearance of the practice. Human induced and natural factors are the major threats to plant species in general and to the medicinal plants in particular in the study area. As suggested by informants, the human induced threats include farming land expansion, overgrazing, deforestation, uncontrolled burning, and multipurpose usage of plant species and natural factors such as extended dry time are cited to be major threats for reduction of medicinal plants. Based on the results of the study the following recommendations are used to conserve the natural resources as well as indigenous knowledge of the study area:

The majority of the reported medicinal plant species were wild. These indicated that the local people harvest more medicinal plant species from the wild than from home gardens. Many medicinal plant species were also reported to be rare. These need an urgent attention to conserve such resources in order to optimize their use in the primary health care system.

Traditional medicine had minimal adverse effects with exception of vomiting and inflammations, since the dosage not fixed (in most cases unknown). Therefore, there is need for traditional healers to undergo training in basic health care delivery.

Traditional healers should be encouraged to transfer their knowledge to interested persons in their communities and attention should be given to the usage of traditional medicine and indigenous knowledge of traditional practitioners.

Awareness raising activities need to be undertaken so that traditional healers get organized in managing and controlling different human and livestock ailments and in ensuring the sustainable utilization of medicinal plant resources in the study area. This could be achieved through; Establishment of healers association at least at the kebele and if possible at the woreda level; Protecting, advising, licensing and encouraging their association and indigenous skills to use this traditional practice properly in controlling and managing both human and livestock diseases of the study area.

Adjusting conditions for close discussion and cooperation of traditional healers and modern health care system officials about the preparation and applications of remedies properly and effectively. This can be carried out through providing basic training to the healers with the objective of adding values to their traditional skills, especially related to dosage and sanitation.

The healers did not have certificates for their medicines and they did not work in cooperation with therapeutic professionals for the preparation of their medicine. This implies that the majority of plants of medical importance were not yet identified and cultivated by traditional healers.

Detailed Further research on the analysis of the ingredients of those identified plants is strongly advised.

## CONSENT AND ETHICAL APPROVAL

As per university standard guideline participant consent and ethical approval has been collected and preserved by the authors.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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