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**Mulugeta Kebebew**  
Department of Biology, College  
of Natural Sciences, Arba Minch  
University, Arba Minch,  
Ethiopia

**Erchafo Mohamed**  
Department of Biology, College  
of Natural Sciences, Arba Minch  
University, Arba Minch,  
Ethiopia

## Indigenous knowledge on use of medicinal plants by indigenous people of Lemo District, Hadiya Zone, Southern Ethiopia

**Mulugeta Kebebew and Erchafo Mohamed**

### Abstract

Traditional medicine is used throughout the world as it is dependent on locally available plants, which are easily accessible, simple to use and affordable. These medical systems are heavily dependent on various plant species and plant based products. Hence, the aim of this study is to documented different types of traditional medicinal plants used by the indigenous peoples in Lemo Woreda, Hadiya Zone southern Ethiopia. Sixty healers were used to collect data on use of medicinal plants using semi-structured questionnaires, group discussion, and field observation. The study was focused on identifying medicinal plants, disease treated, part of the plant used, methods of preparation, route of administration, ingredients added and preference ranking. In the current study, it was reported that 54 plant species belonging to 38 genera and 29 families were commonly used to treat various human and livestock ailments. Out of these 23 were cultivated where as 20 of them were wild and 11 were wild and cultivated plants. The most dominant plant part was leaf 22 (40.74%) followed by barks 7 (12.96%). The most common method of preparation is crushing about 27(43.55%) and the route of administration was oral administration about 39 (72.22%). The principal threatening factors reported were removal of medicinal plants for different purposes (e.g. firewood and charcoal production, building and construction, fencing materials, etc.), overgrazing/over browsing, human settlement, agricultural expansion, over harvesting and burning forests. Documenting the eroding plants and associated indigenous knowledge can be used as a basis for developing management plans for conservation and sustainable use of traditional medicinal plants in the area.

**Keywords:** Indigenous knowledge, Lemo district, medicinal plants, traditional healers

### 1. Introduction

Traditional medicine has remained as the most affordable and easily accessible source of treatment in the primary healthcare system of resource poor communities and the local therapy is the only means of medical treatment for such communities. Traditional medicine is used throughout the world as it is dependent on locally available plants, which are easily accessible, and capitalizes on traditional wisdom-repository of knowledge, simple to use and affordable. These medical systems are heavily dependent on various plant species and plant based products [1]. Ethiopia is endowed with a huge potential of medicinal plants which provides a wide range of treatment to human and livestock aliments. The current account of medicinal plants of the country estimated to be over 887 species [2].

Ethiopian plants have shown very effective medicinal value for some ailments of human and domestic animals thus medicinal plants and knowledge of their use provide a vital contribution to human and livestock health care needs throughout the country [3]. Various literature available show the significant role of medicinal plant in primary health care delivery in Ethiopia where 70% of human and 90% of livestock population depend on traditional medicine similar to many developing countries particularly that of Sub-Saharan African countries [3, 4]. The traditional health care is culturally deep rooted with oral and written pharmacopoeias.

In Ethiopia like many of the developing countries, medicinal plants have not been well studied, tested or documented. Similar to other region of Ethiopia, people living in Hadiya in general and in Lemo district in particular have traditional practices which they accumulated for centuries and has been transferred from generations to treat both human and livestock ailments [5]. Nonetheless, most of the information that is in the hands of traditional healers and local people is either lost or passed to generation by word of mouth. Moreover, in the Zone studied limited research works had been conducted on traditional medicinal plants utilization, management and threats in (Soro, Gombora, Gibe and Shashogo district [5]. This study believed to add up the communities' knowledge in the country's database of traditional

**Correspondence**  
**Mulugeta Kebebew**  
Department of Biology, College  
of Natural Sciences, Arba Minch  
University, Arba Minch,  
Ethiopia

knowledge on medicinal plant. In addition, the present study represents significant ethnobotanical information on medical plants which provides baseline data for future pharmacological and phytochemical studies. Thus the objectives of the present study are to document the knowledge and practices on use of medicinal plants by people of Lemo district, Southern Ethiopia. This paper, therefore, answers the questions (1) what kind of medicinal plants are used by the local people to treat diseases and ailments? (2) Which parts of the plants are used? (3) What types of diseases are common and treated by the plant species? (4) And how do the local people treat various ailments?

## 2. Materials and Methods

### 2.1. Description of the study area

Lemo is one of 11 districts in Hadiya zone, SNNP regional state. It is situated in the western margin of the Great Ethiopian Rift Valley and at the fringe of the Gurage mountains in the northern part of the region [5]. Its absolute location is roughly between  $7^{\circ}45' N$  and  $38^{\circ}28' E$ . Its capital, Hossana, is 232 km away from Addis Ababa, the capital of the Ethiopia and it is also 168kms and 200kms away from the capital of the SNNPR, Hawassa through Alaba- Danboya-Anegacha and Durame- Shenshicho, respectively. Hadiya zone is bordered in the south by Kembata-Tembaro Zone and Alaba Special District, on the west by the Omo River which separates it from Oromia Region and the Yem Special District, in the north by Gurage and Silite Zones, and in the east by the Oromia Region. Topography of the zone is sloppy (54%) and flat (46%) out of the total land [6]. The altitudinal variation between the average highest peak and the lowest point ranges from 3200m at Tulla in Misha district and 860m at Gortancho and Gibe valley in Soro district, respectively [7]. The district is categorized mainly into three agro-climatic zones; nearly two-thirds (64.7%) of the Zone lies in the Woyna Dega agro-climatic zone whereas 23.7% and 11.6% of the total land area of the zone lies in the Dega and Kolla agro-climatic nature respectively. According to the meteorological report obtained from the Agricultural and Rural Development Office of the District (ARDOD), the maximum and minimum mean annual temperature and rainfall are  $22.54^{\circ}C - 10.35^{\circ}C$  and 469.98 - 156.66 mm, respectively. According to the ARDOD, from the total area of the district, 69% is cultivated and used for growing different crops, 7% is grazing land, 6% bush and woodland, 8.78% used for nonagricultural activities, 2% cultivable and 7.22% not cultivable land.

### 2.2. Selection of Survey Sites

Lemo district constituted 34 Kebeles. Among these, the 12 Kebeles were found in high altitude and the rest 22 Kebeles were situated in mid altitude areas. The study was conducted in four kebeles (farmers' associations) in Lemo Woreda, SNNPR for the survey purpose. Prior to ethnobotanical data collection, discussions were made with elders and local authorities to select the kebeles where traditional healers were found. The kebeles were selected based on availability of traditional healers, community-forest interactions, altitudinal differences, recommendations of elders and local authorities in the Lemo Woreda: "1<sup>st</sup> Omoshora", "2<sup>nd</sup> Omoshora", "Digba" and "Jewe".

### 2.3. Selection of Informants

Sixty informants (50 males and 10 females) aged 18 to 80 were interviewed in this research. Among these, 10 (7 males and 3 females) were key informants and the rest 50 were general informants. Purposive and random sampling

techniques were employed to select traditional herbalists and general informants respectively. The selection of respondents was based on their better knowledge on the area in the past and now, practical knowledge of medicinal plants and willingness guided by local administrators, individuals from the local community.

### 2.4. Ethnobotanical data collection

Ethnobotanical data collection was accomplished from September 1, 2015 to August 3, 2015 by living in close contact with the community in the study area, following standard methods [8, 9, 10]. Accordingly, semi-structured interview, guided field walk, direct observation and focus group discussions with key informants and other knowledgeable community members were applied and their knowledge on medicinal plants gathered. Interviews were held based on checklist of questions prepared before hand in English language and simultaneously translated into Hadiyisa. The major part of the interviews were focused on the local names of medicinal plants used, their habits and habitats, plant part/s used, remedy preparation methods, materials used during preparation, condition of preparation, additives/ingredients used during preparation and administration, dosages administered, and route of administration. Likewise, side effect of the medicine (if any), use of antidotes for adverse effects, the season, month, dates and time of collection and preparation of plant medicines, and market value were also included.

The semi-structured interviews held with informants usually started at their sitting places and further broadened into field walk with interviewed informants in order to see the plants mentioned in their habitats and voucher collections following Martin [9]. This activity further helped to record growth habits of medicinal plants. Focus group discussions were done with traditional medicinal plant association members, other herbalists, monks and general informants to obtain additional information and to check the reliability. At times, the preparation methods of the medicinal plants were said to be secret and were not included during discussion. Most field observations were conducted with a single informant in order to keep the knowledge top-secret as this was what the healers in particular preferred.

### 2.5. Plant specimens' identifications

The reported medicinal plants were collected from natural vegetation and home gardens during the field walks and trees, shrubs, herbs and climbers were listed. Voucher specimens were collected, pressed, dried, identified and deposited in the National Herbarium of Addis Ababa University (AAU). The plants identification was performed both in the field, and at the National Herbarium of AAU [11-19].

### 2.6. Data analysis

The ethnobotanical data were analyzed using Microsoft Office Excel spreadsheet (2010). The Excel was used to calculate sum, percentages, tabulate and draw graphs as well as preference ranking method, following Martin [9] and Cotton [8]. In the preference ranking key informants (10) were selected for the exercise. Accordingly, each of them ranked the selected five most popular medicinal plants based on their perceived effectiveness in treating malaria. A descriptive statistic procedure like percentage and frequency distribution were employed for analyzing plant habit, plant parts used & methods of preparation, dosages and route of administration.

### 3. Results and Discussions

#### 3.1. Medicinal Plant Diversity

The study area is endowed with diverse and rich sources of medicinal plants and these serve to the local communities as source of medicine, food, construction, forage, financial incomes and other values. Fifty four species distributed in 38 genera and 29 families were identified by local communities within the study area as traditional medicinal plants (Table 1). With respect to the diversity of the species gathered, the highest number of medicinal plants was recorded in the family *Fabaceae*, 5 species, followed by *Euphorbiaceae*, *Solanaceae* and *Rubiaceae* were represented by three species

each. *Asteraceae*, *Cucurbitaceae*, *Laminaceae*, *Musaceae*, *Myrtaceae*, *Rosaceae* and *Rutaceae* were represented by two species each. The rest of the families (18) were represented by one species each. This result showed that Lemo district is rich in medicinal plants as shown by the presence of 54 species exhibiting wide taxonomic diversity. The relative high number of medicinal plant in the study area may be due to the more intensive utilization of plants by the local communities. These numbers of diverse taxonomic groups of medicinal plants have been observed in different district of Ethiopia [20-24].

**Table 1:** Medicinal Plant species, Local names, Health problems treated, Parts used and Ways of applications for humans, live stocks or for both in selected District of Hadiya Zone.

No	Plant Local Name	Plant Scientific Name	Family Name	Habit	Habitat	Plant Part Used	Method of Preparation	Disease Treated	Route of Administration
1	Hailko	<i>Maringa stenopetala</i>	Mornigaceae	T	Cultivated	Leaf	Cooking	Typhoid and Malaria	Oral
2	Minantofa	<i>Ocimum lamiifollum</i>	Lamia ceae	H	Cultivated	Leaf	Crushed leaf with water	Sunstock	Nasal
3	Qobo	<i>Ricinus Communis</i>	Euphorbiaceae	T	Cuitivated	Leaf	Crushed leaf with water	Cattle tape worm	Oral
4	Messana	<i>Croton macrostachyus</i>	Euphorbiaceae	T	Wild	Leaf	Crushed leaf with water	Tape worm	Oral
5	Gora	<i>Rubusa ethiopis</i>	Rosacea	T	Wild	Leaf	Crushed leaf with water	Malaria and sun-stock	Oral
6	Kedal-barzafa	<i>Eucalyptus globules</i>	Myrtaceae	T	Wild	Leaf	Crushed leaf with water	Itch	Derma
7	Sena	<i>Calipurnia auria</i>	Fabaceae	T	Both	Leaf & Stem	Crushed leaf with water	To kill insect	Dermal
8	Zingibelo	<i>Zingiber officianale</i>	Zingiberaceae	H	Both	Rhizome	Crushed rhizome with boiled water	Common cold & Abdomin ache	Oral
9	Korch	<i>Erythrin abyssinica</i>	Fabaceae	T	Both	Leaf tip	Chewing leaf then oral	Tonsil	Oral
10	Lome	<i>Citrus aurantifolia</i>	Rutacea	T	Cultivated	Fruit	Squeezing	Common cold & Hypertson	Oral
11	Haluta	<i>Argemone mexicana</i>	Papaeraceae	H	Wild	Root	Crushing the leaf with water	Cattle abdominal pain	Oral
12	Chata	<i>Catha edulis</i>	Celastraceae	Sh	Both	Leaf	Dry/fresh roots crushed, boiled, filtered, cooled and drunk until recovery	Amoeba	Oral
13	Wedesha	<i>Cordia africana</i>	Boraginaceae	T	Cultivated	Bark	Fresh stem bark chewed	Teeth problem and sudden sickness	Oral
14	Qo'oma	<i>Cucurbita pepo</i>	Cucurbitaceae	Cl	Wild	Seeds	Dry seeds are cocked and eaten in the morning.	Tape worm and Ascaries	Oral
15	Machara	<i>Datura stramonium</i>	Solanaceae	H	Wild	Leaves	Fresh leaves pounded and parted on the head	Head infection	Dermal
16	Oda'a	<i>Ficus sur</i>	Moraceae	T	Wild	Bark	Dry fruits pounded, powdered and then mixed with honey and taken orally twice Dry fruits pounded, powdered and then parted on wound Fresh	Malaria, Wound Acute bleeding and Vomiting	Oral

							stem barks crushed, pounded, boiled, and cooled, then drunk twice as tea		
17	We'era	Olea europea	Oleaceae	T	Both	Leaves and Stem	Dry/fresh branches used as tooth brush and chewed Fresh leaves boiled and the infusion drunk in the morning	Teeth problem and Intestinal parasites	Oral
18	Digiba	Podocarpus falcatus	Podocarpaceae	T	Cultivated	Bark	Fresh stem barks boiled and filtered and then drunk in the middle of night for three days Dry stem bark crushed and pounded then parted on the wound	Jaundice	Oral
19	La'al hixe'e	Sesbania sesban	Fabaceae	Sh	Cultivated	Roots	Fresh/dry roots chewed and sprayed on the swollen part	Body swelling	Dermal
20	Lo'oro	Solanum incanum	Solanaceae	Sh	Wild	Fruit	Fresh leafs are rubbed and inserted in to nose Fresh fruits or leaves are rubbed on the part with the snake bite	Intestinal parasites, Amoeba Nasal bleeding and Snake bite	Oral
21	Barawa	Vernonia auriculifera	Asteraceae	Sh	Cultivated	Roots and Leaves	Fresh roots chewed and sprayed on swollen part Fresh leaves crushed and pounded, then dremed on the wound Dry/fresh leaves pounded and mixed with butter and pasted	Body swelling, Wound and Head infection	Dermal
22	Bunna	Coffea arabica	Rubiaceae	Sh	Cultivated	Seeds	Whole parts are burned and smoking Seeds are cocked and chewed and swallowed Dry Cocked seeds are pounded and given nasal	Malaria, Gastric illness, Headache, Sudden sickness	Nasal
23	Homma	Juniperus procera	Cupressaceae	T	Semi wild	Seeds	Dry seeds are a pounded and powdered then mixed with tea, and then drunk and smell through nasal Fresh leaves are crushed and pounded then mixed with butter given orally	Pneumonia, Nasal problem Asthma and Worantote dhiba (livestock)	Oral
24	Tamiba	Nicotiana tabacum	Solanaceae	Sh	Cultivated	Leaf	Dry leaves are Pounded and	Common cold	Nasal

							powdered then drunk for livestock or smelling through nose for human	(livestock) and Headache (human)	
25	Arara	<i>Prunus africana</i>	Rosaceae	T	Wild	Bark	Dry stem bark is crushed, pounded and powdered then put on	Wound (Human and livestock)	Dermal
26	Hebba'a	<i>Vernonia amygdalina</i>	Asteraceae	Sh	Wild	Leaves	Fresh leaves are pounded with water and filtered and drunk in the morning	Intestinal parasites (human) and Stomach problems (livestock)	Oral
27	Kashari shunkurutta	<i>Allium sativum</i>	Alliaceae	H	Cultivated	Leaf and Stem	Eat the parts with other food	Common cold, other infections in upper respiratory tract, fever, cough, asthma, malaria, hypertension	Oral
28	Chirontta	<i>Brucea antidyserterica</i>	Simaroubaceae	T	Wild	Root	Crushed and taken	Dysentery	Oral
29	Shanna	<i>Brassica carinata</i>	Brassicaceae	H	Cultivated	Fruit	Crushed concocted with <i>Piper capense</i> , <i>Lepidium sativum</i> and yoghurt	Constipation	Oral
30	Luxunixa	<i>Commelinina spp.</i>	Commelinaceae	H	Wild	Leaf	Chewed the part and applied to the infected skin with insect for three days	Skin infections	Dermal
31	Dabaqua	<i>Cucurbita moschata</i>	Cucurbitaceae	Cl	Cultivated	Seeds	Dried seed is coocked and given to eat empty stomach	Delayed placenta	Oral
32	Gunna	<i>Euclea divinorum</i>	Ebenaceae	Sh	Wild	Root	The root extracts and dried then powdered roots are taken orally	Toothache, cold	Oral
33	Kowada	<i>Maesa lanceolata</i>	Myrecenaceae	T	Wild	Bark	Crushed or powdered fresh mixed with water and taken	Ascaris	Oral
34	Wo'ora	<i>Erythrina brucei</i>	Fabaceae	T	Both	Leaves	Crushed or powdered fresh mixed with water and taken	Glandular swelling	Oral
35	Tumma	<i>Allium ursinum</i>		Sh	Cultivated	Corm	Fresh or dried bulb is mixed with honey then given to eat	Lung cancer, Wound, Dandruff	Oral
36	Kenetelam	<i>Ruta chalepensis</i>		H	Cultivated	Leaves	Fresh leafs and stems are chewed and swallowed in the morning	Stomach ache	Oral
37	Hanija	<i>Phytolacca dodecandra</i>	Phytolacaceae	Sh	C	Root	Crushed or powdered fresh mixed with water and taken	Abortion Anthrax Itchy	Oral
38	Damkase	<i>Lippia abyssinica</i>	Verbenaceae	Sh	Wild	Leaves	Fresh leaf is crushed and mixed with tea or coffee	Common cold	Oral
39	Tumuniga	<i>Justicia schimperiana</i>	Acanthaceae	Sh	Wild	Leaves	Crushed, washed, rubbed on the	Gonorrhea Malaria	Dermal and Oral

							skin and also taken through nose, powdered, and liquid filtered butter of a spoon given orally, crushed mixed with butter and rubbed on the part		
40	Bahet-heka	Rumex nervosus		Sh	Wild	Leaves	Stomach ache, chill	Gastritis	Oral
41	Qachabbaa	Ruta chaleensis	Rutaceae	H	Cultivated	Root and Leaves	Chewed orally or mixed with water	Stomach ache Cold	Oral
42	Shisho'o	Pavetta oliveriana	Rubiaceae	H	Wild	Leaf	Chopping the leaves and drinking one coffee cup at once or smelling the chopped leaves	Gonorrhoea,	Oral
43	Damakasse	Ocimum lamiifolium	Lamiaceae	H	Wild	Leaf	Crushed and mixed /concocted with coffee and taken	Common cold, wound	Dermal and Oral
44	Gimanja	Ocimum basilicum	Lamiaceae	H	Cultivated	Leaf	Crushed, pounded and given	Loss of appetite	Oral
45	Omorro'o	Hymenodictyon floribundum	Rubiaceae	Sh	Cultivated	Leaf	Choppong the leaves, squeezing it to get droplets of sap and put one droplets in each aye	Eye infection	Oral and Dermal
46	Genenno	Aloe monticola	Aloaceae	H	Wild	Leave	Taking the latex and drinking one coffee cup	Liver disease	Oral
47	Wokasha	Aframomum angustifolium	Zingiberaceae	H	Cultivated	Seed	The seeds are crushed and used as a spice	Stomachache	Oral
48	Hywona	Ensete ventricosum	Musaceae	Sh	Cultivated	Root	The root tied on neck	Bone fracture	Dermal
49	Dubana	Syzygium guineense	Myrtaceae	T	Wild	Bark	Crushed or powdered fresh mixed with water decocted and taken	Ascaris, stomach ache; abdominal pain	Oral
50	Aritimiza	Artemisia abyssinica	Asteraceae	H	Cultivated	All parts	Fresh leaf crushed and pounded with water, filtered and drunk until recovery made	Malaria	Oral
51	Maxxoo	Euphorbia tirucalli	Euphorbiaceae	Sh	Wild	Shoot	Decocted and taken	swelling of stomach	Oral
52	Shuunfa	Lepidium sativum	Brassicaceae	H	Cultivated	Seed	Crushed and mixed butter and taken	abdominal pain and Intestinal problem	Oral
53	Abokado	Persea americana	Lauraceae	T	Cultivated	Bark	Crushed/decocted bark taken	Colic pain	Oral
54	Kosso	Hagenia abyssinica		T	Cultivated	Seed	Crush and mixed with water	Top warm	Oral

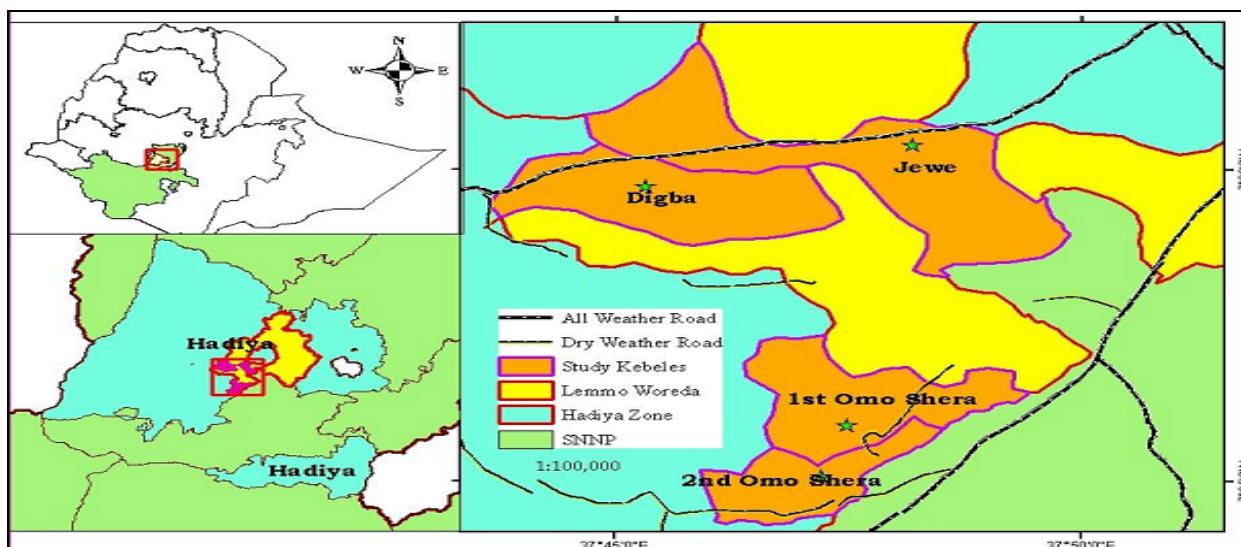
### 3.2. Growth habit of the medicinal plants

Of the recorded traditional medicinal plants in the study area, trees were the highest life forms with 19 species, followed by shrubs with 16 species and herb with 15 species from the total medicinal plants. On the other hand, climbers were the least life forms with 2 species. Trees and shrubs make up the

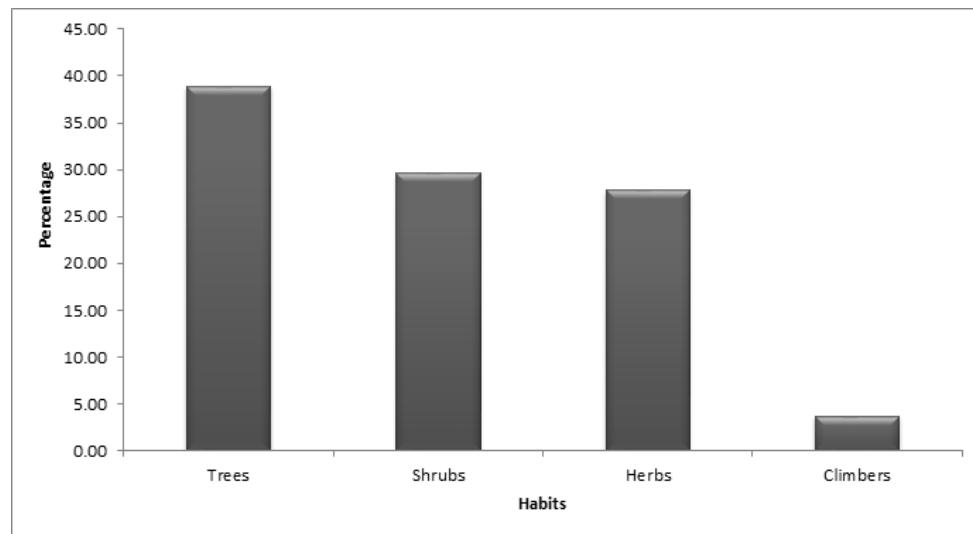
highest proportion (35) of the medicinal plant species (Figure 2). This could be related to the fact that they are often harvested from a variety of habitats ranging from deciduous bush land and Thicket, riverine forest, forests and grass land distantly located from resident areas. The finding agrees with the general pattern of dominance of trees species seen in most

medicinal plant inventories in Ethiopia and other countries [<sup>5, 25-28]</sup>. With the current effect of climate change, tree and shrub species of medicinal plants could play a significant role among poor people to alleviate the problem of healthcare

system. Since the medicinal plants have adapted to the area, they have greater ability to cope with the extreme climate change and adverse effects.



**Fig 1:** Map of the study area



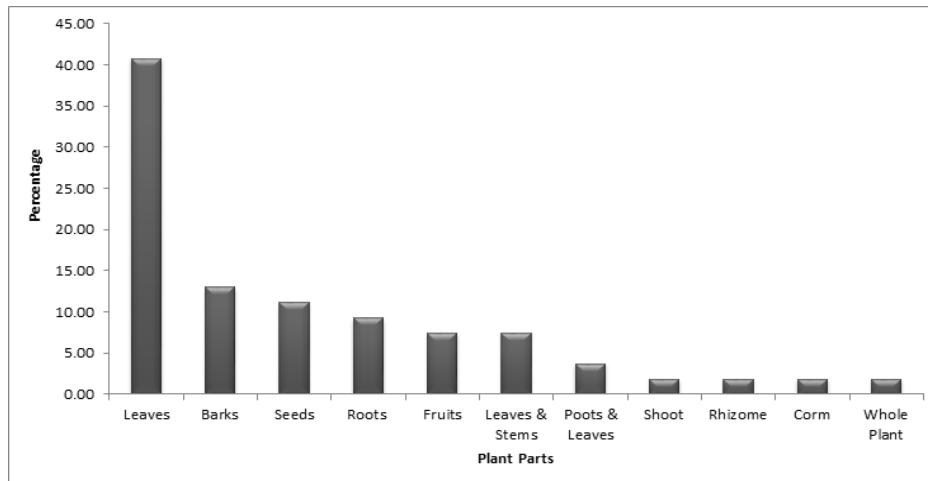
**Fig 2:** Frequency of medicinal plant taxa arranged by life forms

### 3.3. Source of medicinal plants

In various parts of the world, medicinal plants are mostly harvested from the wild sources either for local use or trade purposes. In this study plants were collected from various habitats including remnant forest, riverbanks, hill slopes, bush-land, roadsides, farm borders, home-garden and church compounds. About 23 of the plants were located in home-gardens. Twenty from the wild and the rest, 11 species form both wild and homo-garden. This indicates that the practitioners depend on the home-garden source or cultivated rather than wild or natural environment to obtain the medicinal plants, and the activity of cultivating medicinal plants is very high in the study area. It also indicates that the natural forest of the study area is being over exploited by traditional practitioners for its medicinal plants composition. This finding is similar to the general pattern seen in most medicinal inventories (for example, [<sup>26</sup>] where home-garden medicinal plants dominate.

### 3.4. Medicinal plant parts used as medicine

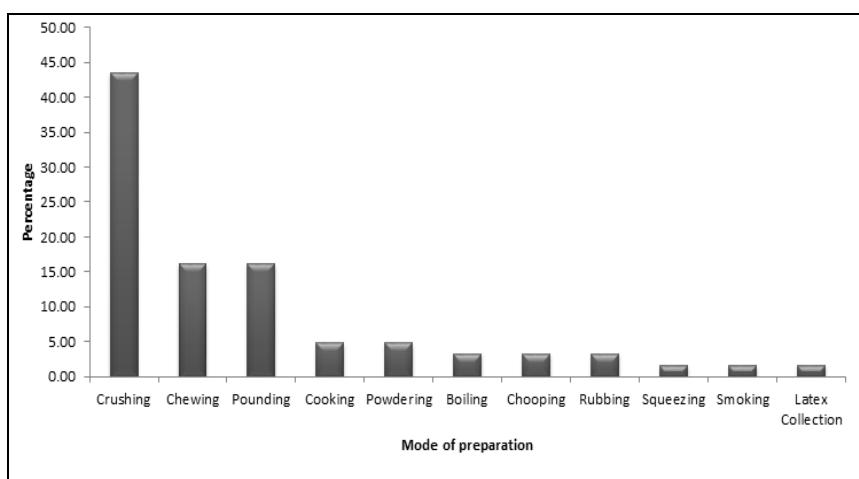
The study showed that a total of 10 medicine parts were recorded from 54 medicinal plant species implying that more than one parts of a species are used by the traditional healers to treat different types of human and livestock ailments. The most commonly used plant parts for remedy preparations were leaves (22), followed by bark (7) (Figure 3). Similar trend has been reported in most medicinal plant inventories in Ethiopia and other countries [<sup>5, 25, 27, 29, 30</sup>]. Such wide harvesting of leaves for traditional medicine compared to roots, seeds, fruits and whole plant are important for survival of plants has a less negative influence on the survival and continuity of useful medicinal plants and hence does not affect sustainable utilization of the plants. However, in the study area bark was the second most part. Comparatively utilization of whole plant, root, seed and fruit part highly affects the survival and ecological aspect of the plant.

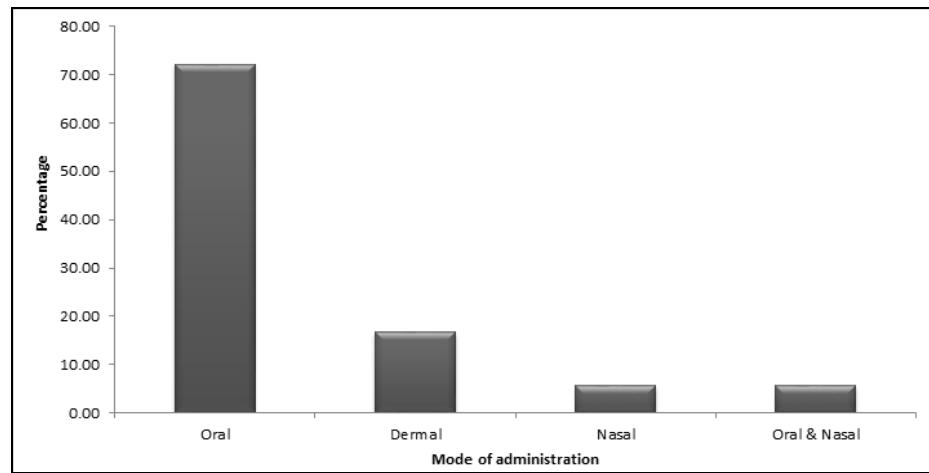
**Fig 3:** Parts of plants used for medicine preparations by the local people

### 3.5. Preparation and mode of administration

In the collection of data concerning the preparation of medicine, informants have reported various skills associated with herbal preparation (composition, condition of plant material used and methods of preparation). The result showed that most remedies were prepared from single plant species (81.8%) and preparation from combined plant species was about 18.2%. Information from most informants indicated that the plant parts used condition for medicinal preparation depended on the availability of the species. For example, for commonly available plants, they used fresh specimens to prepare remedies for their patients. But, for rare and seasonally available plant species, they stored and used dried specimens. Local people depend on both dry and fresh remedies. In this case, 41 preparations (75.5%) are used in fresh form, 8 (14.81%) in dried and 8(9.26%) in dried and fresh form. The dependency of local people on fresh materials put the plants under serious threat than the dried form, as fresh materials are harvested directly and used soon with its extra deterioration with no chance of preservation i.e. not stored for later use. However, local people argue that fresh materials are effective in treatment as the contents are not lost before use compared to the dried forms. The livelihood of most traditional healers relies on fresh materials that have aggravated the decline of rare medicinal plants from the study area according to the informants. Traditional practitioners are collecting medicinal plants with less attention than would be preferred from viewpoint of conservation of plant resource.

This finding is significantly similar to all the other findings from other regions of Ethiopia [20, 24, 31]. The preparation and application methods vary based on the type of disease treated and the actual site of the ailment. Some of the medicinal plants were added different ingredients but around 41.5% of the plants were not adding any ingredient to treat human and livestock ailments. The healers responded that Coffee, Garlic, Water, Butter, Tella, Honey, Salt and Sugar were some of the ingredients added to the medicinal plants in different mode of preparation. These additive substances have different functions i.e. to reduce poisons, improve flavor and as antidotes during adverse affects such as vomiting and diarrhea. Dawit [32] has also identified the additive substances in herbal remedy preparations with their possible benefits. It was also reported that some medicinal plants are mixed with food and drinks in such manner that, they change their flavor and simple to take. The frequently used methods were pounding, powdering and smashing respectively. The local people employ several methods of preparation of traditional medicines. Crushing 27 (43.55%), Chewing 10 (16.13%) and Pounding 10 (16.13%) are the three main methods of preparation of medicine (Figure 4). The major routes of administration in the study area are oral, dermal and nasal. Oral administration is the dominant route 39 (72.22%), followed by dermal route 9 (16.67%), nasal 3 (5.56%) and oral and dermal 3 (5.56%) (Figure 5). Both oral and dermal routes permit rapid physiological reaction of the prepared medicines with the pathogens and increase its curative power.

**Fig 4:** Preparation methods of medicinal plants

**Fig 5:** Mode of administration of the plant remedies

### 3.6. Preference ranking of medicinal plants used to treat Malaria

When there are different species prescribed for the same health problem, people show preference of one over the other. Preference ranking of 5 medicinal plants that were reported as effective for treating malaria was conducted after selecting 10 key informants. The informants were asked to compare the given medicinal plants based on their efficacy, and to give the highest number (5) for the medicinal plant which they thought

most effective in treating malaria and the lowest number (1) for the least effective plant in treating malaria. Preference ranking for five medicinal plants used to treat malaria (Table 2) shown that *Artemisia abyssinica* ranked first and hence is the most effective medicinal plant to cure malaria. The second and third most preferred medicinal plants against this disease are *Rubusa ethiopis* and *Maringa stenopetala* while, the least preferred species compared to the other five species are *Coffea arabica* and *Ficus sur* according to informants.

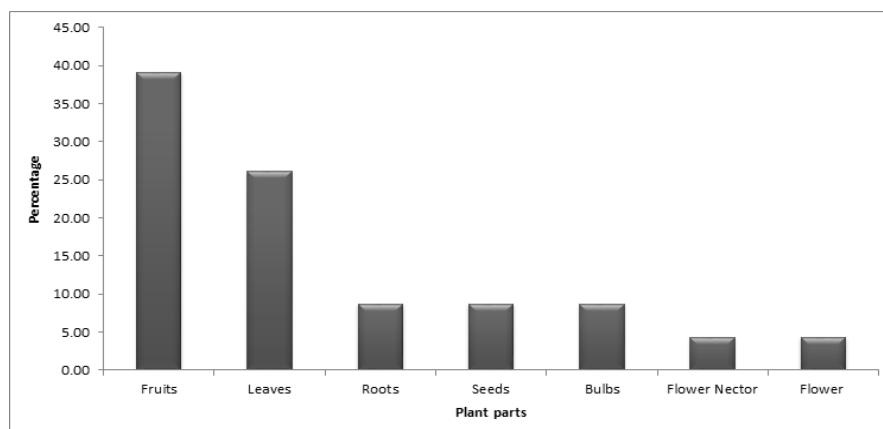
**Table 2:** Paired comparisons of six medicinal plants used to treat malaria

Medicinal plants	Informants labeled R1 to R10										Rank
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	
<i>Maringa stenopetala</i>	3	5	4	2	4	3	2	3	5	3	34
<i>Rubusa ethiopis</i>	4	3	2	3	5	4	5	4	3	4	37
<i>Ficus sur</i>	1	2	1	1	2	2	1	1	2	1	14
<i>Coffea arabica</i>	2	1	3	4	1	1	2	2	1	2	19
<i>Artemisia abyssinica</i>	5	4	5	5	3	5	4	5	4	5	45

### 3.7. Traditional wild edible medicinal plants

Of the recorded medicinal plants in the study area, 22 species serve the local community both as sources of food and as traditional medicine. The study showed that a total of 7 edible parts were recorded from 22 wild edible plant species implying that more than one parts of a species are consumed by humans. From the part of the wild edible plants, about 9 (39.13%) were fruits, 6 (26.09%) were leaves and 2 were roots, seeds and bulbs each while the rest 2 were flower and flower nectar (Figure 6). This may show how simple is that to collect and use wild edible plant fruits and green leafy

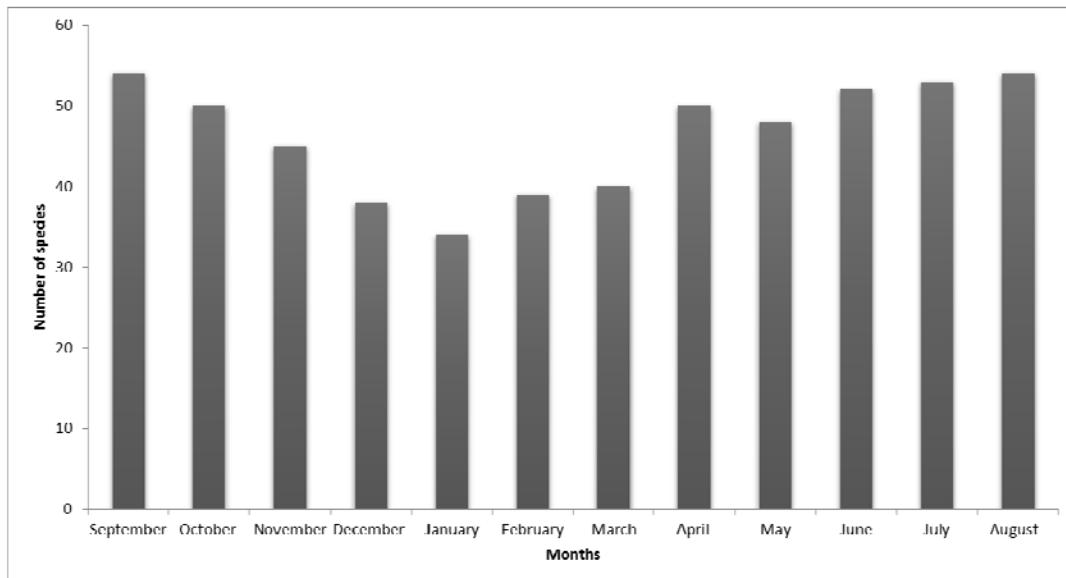
vegetables as compared to cultivation of domestic food crops. The increased use of wild fruits compared to other part of the plant indicates that the plants are used more during season of food shortage since eating fruit do not take much time to prepare. Those who feel hungry harvest from the natural growing environment and eat without waiting for cooking or preparation. This further explains why the communities have much knowledge about the increased number of wild fruit plants. Similar trend has been reported in Amhara National Regional State [33], Derashe and Kucha Districts, South Ethiopia [34], Chelia District of Ethiopia [35].

**Fig 6:** Traditional wild edible medicinal plants

### 3.8. Seasonal availability of medicinal plants

The time of harvesting varies from plant to plant depending on its availability, and from place to place due to ecological and climatic conditions. The annual pattern of rainfall in the region is bimodal, with a long rain season during June to September, and a short rain season during February to April. Because of their seasonal availability, the majority of medicinal plant part(s) are gathered from June to September and February to April. While, the smallest number of medicinal plants was gathered in October to January as the amount of rain fall decreases during this time (Figure 7). Some medicinal plant species grow at narrow ranges of time and others stay longer. As a result of this, some medicinal plants are available almost throughout the year as compared

to other seasonal medicinal plants. During group discussion most informants indicated that the plant parts used condition for medicinal preparation depended on the availability of the species. For example, for commonly available plants, they used fresh specimens to prepare remedies for their patients. But, for rare and seasonally available plant species, they stored and used dried specimens. This result is in agreement with earlier studies by Habtamu *et al.*<sup>[5]</sup> in Hadiya Zone, Ethiopia. This indicates that the year round availability of a series of different medicinal plants within and across the study area provides opportunities for medicinal supplement. This situation could motivate local people to conserve medicinal plant resource and encourage domestication.



**Fig 7:** Seasonal availability of medicinal plants

### 3.9. Multipurpose use of medicinal plants

Apart from their food and medicinal value, most of the medicinal plants identified in the study area are used by the community for different purposes. They are commonly used as firewood, construction material, for furniture, fencing, charcoal, agricultural tools and as fodder to animals. This practice was actually observed by the researchers in the study areas where some of the medicinal plants were sold at local market. As a result nine plant species that are used for different purposes were identified by the community. Direct matrix ranking was undertaken in order to evaluate these multipurpose tree species and their relative importance to the local people and the extent of the existing threats related to their use values (Table 3). The result of use diversity indicates that *Eucalyptus globulus*, *Cordia africana* and *Syzygium guineense* ranked 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> respectively because they are

used for different purposes in the study area. This shows that the local people harvest the medicinal plants not only for medicine but mostly for construction, firewood, and furniture. This might be a reason for the scarcity and rarity of some of the medicinal plants especially outside of the study area. Such a problem was similarly described in other parts of Ethiopia [36, 37]. The utilization of these plants for the top ranked uses (construction, fuel wood, food and furniture) linked with the daily life activities of the community. In order to have a sustainable utilization of these plants, the best practical solution is to launch conservation measures. This could be done by encouraging the plantation of other trees (non-edible plants and non medicinal plants) using agro-forestry practices in degraded areas along roadsides, home garden and agricultural fields.

**Table 3:** Average score for direct matrix ranking of the 9 medicinal plant species on eight use criteria

Medicinal plants species	Multiple use of medicinal plants										
	Fire wood	Forage	Constr-uction	Furnit-ure	Food	Char-coal	Fencing	Medic-ine	Shade	Total score	Rank
<i>Cordia africana</i>	3	6	3	8	6	5	2	5	5	43	2
<i>Croton macrostachyus</i>	4	1	2	1	0	8	4	7	2	29	8
<i>Eucalyptus globulus</i>	8	0	7	4	1	6	7	6	7	46	1
<i>Ficus sur</i>	1	8	1	5	7	1	0	4	6	33	7
<i>Hagenia abyssinica</i>	0	5	0	0	2	0	1	8	1	17	9
<i>Juniperus procera</i>	5	2	5	6	4	4	6	1	4	37	6
<i>Olea europaea</i>	2	3	8	2	3	2	8	2	8	38	5
<i>Podocarpus falcatus</i>	7	4	6	7	5	3	5	0	3	40	4
<i>Syzygium guineense</i>	6	7	4	3	8	7	3	3	0	41	3

### 3.10. Threats to medicinal plants

Since the local communities have an intimate relationship towards their natural environment, they are familiar with the threats on medicinal plants. Therefore, during both group and individual discussions, key informants identified the major threats to medicinal plants. This is attributed mainly to human population pressure and its associated effects. Accordingly, removal of medicinal plants for different purposes (e.g. firewood and charcoal production, building and construction, fencing materials, etc.), overgrazing/over browsing, human settlement, agricultural expansion, over harvesting and burning forests were the major threats. Some or most of the above results are also reported in different areas of Ethiopia [34, 37, 38, 39]. Due to these reasons, plant species such as *Cordia africana* and *Ficus sp.* are identified as threatened and near-threatened species respectively in the study area.

### 3.11. Conservation of medicinal plants and associated knowledge

The local communities in the study area have various indigenous management strategies of medicinal plants conservation. For example, many medicinal plants are left to widely grow in farmlands, farm boundaries watershed areas, homesteads as live fence, shade, along road sides and degraded areas. This practice was actually observed by the researchers in the study areas. For example, *Cordia africana*, *Eucalyptus globulus* and *Hagenia abyssinica* were widely grow in farmlands, farm boundaries and watershed areas and others frequently appear around homesteads as live fence (*Justicia schimperiana*, *Calipurnia auria*, *Podocarpus falcatus* and *Juniperus procera*), shade (*Olea europaea*, *Eucalyptus globulus* and *Ficus sur*) and along road sides and degraded areas. Similar trend has been reported in the Indigenous communities in and the buffer area of Awash National Park [37]. Besides, personal observation and communication revealed that children and livestock herders bring the seeds after consuming the fruits back to homes and cultivate them around homesteads and fence the seedlings saved from livestock foraging. This gives some hint for the possibility of conservation and domestication of wild edible medicinal plants. These are sustainable modes of resource use that need to be encouraged and applied by blending them with standard modern management practices.

### 3.12. Transfer of indigenous knowledge of medicinal plant species

The study showed that the indigenous knowledge associated with medicine of medicinal plants is generally in the public domain with both direct and indirect ways of transfer. The knowledge flow from elders to children and its enrichment thereafter is directly conveyed through observation, imitation, free flow of information, oral history, and myths among community members. Riddles in local languages are the indirect way of transferring indigenous knowledge in the community. The knowledge is used to identify the medicinal plant parts, treatments, and preference for utilization. All rounded description of the medicinal plants including their nomenclature, morphology, habit, and usage during traditional ceremonies, diversity, and preference are mostly transferred through folklore. In this study folklore was also used as means of gathering edibility information. Some examples of conveying knowledge associated with medicinal plant species through folklore include, habitat, treatment, side effect to utilize the plant.

### 4. Conclusion

In the present study, fifty four plant species of medicinal importance were recorded and documented. The majority of the reported medicinal plant species were wild. The results of the present study provide evidence that medicinal plants continue to play an important role in the healthcare system of this urban community. They still continue to depend on medicinal plants for the treatment of healthcare problems. Furthermore, the documented medicinal plants can be used as a basis for further studies on the regions medicinal plants knowledge and for future phytochemical and pharmacological studies.

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