Journal of Medicinal Plants Studies
www.PlantsJournal.com

ISSN 2320-3862
JMPS 2017; 5(1): 364-371
© 2017 JMPS
Received: 16-11-2016
Accepted: 17-12-2016

Mulugeta Kebebew
Department of Biology, Arba Minch University, Arba Minch, Ethiopia

Ketema Dadi
Department of Biology, Wollega University, Wollega, Ethiopia.

Erchafo Mohammed
Department of Biology, Arba Minch University, Arba Minch, Ethiopia

Correspondence
Mulugeta Kebebew
Department of Biology, Arba Minch University, Arba Minch, Ethiopia

Diversity, Knowledge and Use of Traditional Medicinal Plants in Guduru District, Horo Guduru Wollega Zone, Oromia Region of Ethiopia

Mulugeta Kebebew, Ketema Dadi and Erchafo Mohammed

Abstract
Traditional medicine has remained as the most affordable and easily accessible source of treatment in the primary healthcare system of resource poor communities in Ethiopia. The local people have a long history of traditional plant usage for medicinal purposes. This study documents indigenous medicinal plant utilization, management and the threats affecting them. Ethnobotanical data were collected using semi structured interviews, field observations, preference and direct matrix ranking with traditional medicine practitioners. The data were analyzed using descriptive statistics; informant consensus factor and fidelity level using MS-Excel 2010. The ethno-medicinal use of 93 plant species belonging to 85 genera and 52 families were documented in the study area. The highest family in terms of species number is Fabaceae. Herbs were dominant (31.3%) flora followed by shrubs (30.1%). Most of the medicinal species (52.7%) were collected from the wild. Most of the plants (60.2%) were reportedly used to treat human diseases. The most frequently used plant parts were leaves (34.68%), followed by roots (23.39%). Fresh plant parts were used mostly (53.3%) followed by dried (29.3%) and the remaining (17.4%) either in fresh or dried. Among the preparations, pounding was the dominant (34.1%) form followed by powdering (13.29%). The remedial administration was mostly oral (54.91%) followed by dermal (30.64%). The highest (88.89%) Informant consensus factor was associated with *Ocimum urticfoluim* followed by *Allium sativum* (86.67%). The Fidelity level of *Allium sativum* was calculated irrespective of malaria treatment. Direct matrix analysis showed that *Carissa spinarum* was the most important species followed by *Syzygium guineense* indicating high utility value of these species for the local community. The principal threatening factors reported were deforestation followed by agricultural expansion.

Keywords: Ethno-medicine, ethnobotany, Guduru District, medicinal plants, traditional healers

1. Introduction
Researchers worldwide are beginning to recognize the potential of traditional medicinal plant contribution for prevention and treatment of diseases. Traditional medicine refers to the sum total of all the knowledge, beliefs and practices that are used in diagnosis, prevention and elimination of physical, mental or social imbalance and rely exclusively on practical experiences and observation handed down from generation to generation[33]. Medicinal plants have important contributions in the healthcare system of local communities as the main source of medicine for the majority of the rural population [32]. 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 [18]. The World Health Organization (WHO) estimates that up to 85% of world population uses herbal medicines for prevention and treatment of diseases, and the demand is increasing in developed and developing countries. In Ethiopia, plant remedies are still the most important and sometimes the only sources of therapeutics for nearly 80% of human and more than 90% in livestock population [32].
Indigenous knowledge refers to the knowledge, rules, standards, skills and mental sets generated by and kept in custody of local people in a particular area [31, 17]. It is the result of many generations and long years of experiences, careful observations and trial and error experiments [27, 17]. The ethnobotanical literature [7] underlines that both saving plant species and documenting and preserving indigenous knowledge associated with them are fundamental urgent concerns.

Ethiopia is endowed with a diverse biological resources including about 6, 500 to 7,000 species of higher plants, out of which more than 14% are said to have been used as traditional plant medicines to treat different human and livestock ailments while more than 1,000 species have been documented at the Ethiopian National Herbarium database [32, 17]. Documenting traditional medicinal plants and the related traditional medical knowledge is important in order to facilitate the discovery of new sources of drugs and promote sustainable use of natural resources in Ethiopia.

The local people, as in other parts of Ethiopia depend on traditional medicine, which mostly relies on medicinal plants, to fulfill their healthcare needs as pointed out by [32] and [34]. Despite this fact, as far as it can be ascertained there are no studies on ethno-medicinal plants, associated knowledge and the use in the Guduru district. However, this study provides sufficiently detailed information on the status of traditional botanical knowledge transfer from generation to generation based on age groups and educational levels as wells as on the ranking of most potential medicinal plants for specific disease treatment in the Guduru district, western Ethiopia. Hence, this study was framed with the aim of documenting the medicinal plants and the associated ethno-medicinal knowledge of people living in the study area.

2. Materials and Methods

2.1. Characteristic Features of the Study Area

The study was conducted in Guduru at Horo Guduru Wollega Zone, Oromia Region, South-western Ethiopia. Guduru district (2474 km^2) is the third largest district in East Wellega zone bordering West Shewa in the east, Jimma Horro and Abay Chomen in the west, Amhara Regional State in the north and West Shewa and Jimma Rare in the south. Kombolcha is the administrative center of the district. A sub-tropical (Wena Dega) Climate covers most of the district. The district has a latitude and longitude of 09°32′N 37°30′E with an altitude ranges from 880 to 2,430 meters above sea level. The highest peak is Habib Mountain with an altitude of 2430m. Rivers of the district are Abune, Boye, Asendabo, Gebete, Korke, Kersa, Imbabo and Dede wata. Most of them flow to Guder, Abay and Fincha'a rivers. The three types of soils are Nitosols, Eutric Cambisols and Arenosols. The district has no natural and man-made forests, except the bushes and shrubs in lowland areas of Abay and Guder valleys. The district had no parks, reserved areas or sanctuaries for wildlife conservation. The mean annual temperature and rainfall are 22 ^{0}C-27 ^{0}C and 510-1530 mm, respectively. The National Census (2007) reported a total population of the district, 98,084, of whom 48,848 were men and 49,236 were women. A survey of the land in this district shows that the cultivable land in Guduru district was 53.8% of the district, while grazing land and vegetation cover were 15.3% and 14.3% respectively. Niger seed, teff, maize, wheat, barley and bean are dominant crops grown in the area.

2.2. Reconnaissance survey and study site selection

A reconnaissance survey was conducted from September 2, 2014 to September 4, 2014. Before starting the ethnobotanical study, contacts were made with various offices (District administration, tourism and culture, agriculture and rural development, traditional healers' association and health affairs) to seek permission to carry out the study by informing them about the aims and significance of the study. In this way, full legal procedures were followed and the informed consent of interested participants was obtained. The study sites were selected based on the availability of practice of traditional medicine and on the recommendations of knowledgeable elders and local authorities. Relative distance and community forest interaction were taken as criteria after collecting information from kebele administrative offices and inhabitants of the area during the reconnaissance survey in order to compare the indigenous knowledge of the communities found nearest to the forest with those found relatively far away.

2.3. Informant selection

A total of 90 informants (70 males and 20 females) between the age of 18 and 80 were interviewed in this research. Purposive and random sampling techniques were employed to select traditional herbalists and general informants respectively. The Traditional Association leaders, members of the tourism and culture office, elderly people and religious leaders helped to identify the key informants. In addition, the identified traditional practitioners and members who had earlier been treated by the healers also helped to identify other traditional experts. The general informants were randomly picked (from the list of inhabitants) during field and house visits (15 in each study site) by checking their names from the list of residents obtained from kebele offices. All interviews were administered after obtaining voluntary consent of each informant and assuring them that the data will be used only for academic purposes.

2.4. Data collection

Ethnobotanical data collection was accomplished from September 2014 to August 2015 by living in close contact with the community in the study area, following standard methods [27, 6, 8]. Accordingly, semi-structured interviews, guided field walks, direct observations, market surveys 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 beforehand in English language and simultaneously translated into Afan Oromo. Interviews focused to informant's demographic features including sex, age, marital status, occupation, religion, educational background, and duration of time an informant lived in the study area, and indigenous ecological knowledge (traditional ways of classifying vegetation, plants, landscapes and the soils in the area). 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 effects 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. Further, the distribution (status) of medicinal plants, the interaction of healers with the district administration, threats and major problems, conservation methods, source of knowledge and ways of transfer and number of years of service as traditional healer were also the major interview points targeted, following the methods used by previous investigators [27, 4, 6].

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

[27]. 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. Informants were contacted two to three times and responses of an informant in harmony with each other were taken as relevant and used for data analysis. 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. Some of the traditional healers were genuine herbalists, well-known by the local community and owned traditional home pharmacies derived from plant remedies. They were asked to demonstrate their work at their homes and in the field, which was recorded in order to check the consistency in knowledge and practice on the preparation of remedies and their effectiveness. The patients encountered at healers' homes were also asked about the traditional plant medicines they have used and their effectiveness when applied by healers.

2.5. Plant collection and identification

Voucher specimens were collected for each plant species during guided field walk with the informants. At times,
the field activities included taking notes on plants and the associated indigenous knowledge with preliminary identification of the plants to family and sometimes to species levels. Photographic records were also taken in the field to capture the field sites, plants and other useful memories. The specimens were dried, deep-frozen, and determinations were made at the Ethiopian National Herbarium (ETH), Addis Ababa University, using taxonomic keys and descriptions given in the relevant volumes of the Flora of Ethiopia and Eritrea [12-14, 19-24] and by visual comparison with authenticated herbarium specimens. Finally, the accuracy of identifications was confirmed by a senior plant taxonomist and the voucher specimens with labels were deposited at the ETH.

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. Ethnobotanical ranking and scoring methods such as preference and direct matrix rankings as well as pair-wise comparisons and informant consensuses were employed to distinguish priority species and to check consistency. Preference/priority ranking activities were employed on five most preferred and widely used medicinal plant species for the treatment of diarrhea and the most threatened medicinal plants. Direct matrix ranking was employed for the seven most utilized multi-purpose plant species and for the eight factors considered most threatening to medicinal plants. Pair-wise comparison was made on five of the most preferred and commonly used medicinal plants against gonorrhoea. To do this, the number of possible pairs was determined by applying the formula n (n-1)/2, where n is the number of medicinal plant species being compared. For all the above ethnobotanical ranking and scoring techniques, the same ten key informants who had long time practical experience in traditional plant medicine preparation, administration and collection were engaged. The strength of knowledge of the key informants was evident to the first author who witnessed the clarity of explanations and accuracy of actions. The overall procedures for these activities were conducted following standard ethnobotany texts [27, 4, 6]. Informant consensus factor (ICF) for different ailment categories was calculated to test agreements of the informants on medicinal plant knowledge of each category by using the formula ICF = NurNu/Nur-1 where, nur is the number of uses reported in each category and Nu is the number of species reported in each category [25].

3. Results and Discussion

3.1. Indigenous knowledge on health concept

In the study area, the local people call health ("Fayya" in Afan Oromo) which is taken as a special wealth provided by God ("Waaqayyo"). They believe or understand as ailments are the cause for health upset caused either with organisms ("ilbiisa") or can be sent from God as punishment ("Dheekkamsa Waaqayyoo") for wrong doings. They can also classify health problems, as those that can be treated and that cannot. For instance, the informants pointed that AIDs "dhibee baraa" and spiritual diseases "dhibee ayyanaa" are non-curable either traditionally or by modern treatment. From discussion made with elders several poems, proverbs and songs were recorded reflecting the values of health to the local people. To cite few of these: "Fayyan muka nyaata" meaning "healthy man does everything". "Dhibbi abbaan hin beekne fayyaa dha" meaning "a great wealth and gift is health". "Fayya xaba seete qayyaan laga ceete" meaning "health needs special care". These proverbs indicate that, health is considered as a great asset, which is assumed as a life engine for any aspects of life in the area.

3.2. Ethno-medicinal plant species used by people of the study area

The results obtained revealed that a total of 93 species of medicinal plants were gathered and documented from the study area. The species were represented 85 genera and 52 families. Family Fabaceae was represented by 10 species followed by 7 species of Asteraceae and 6 species of Lamiaceae. Rutaceae and Solanaceae were represented by 4 species each; Cucurbitaceae, Euphorbiaceae and Moraceae were represented by three species each. Nine families were represented by 2 species each (Acanthaceae, Araceae, Boraginaceae, Myrsinaceae, Myrtaceae, Polygonaceae, Ranunculaceae, Rosaceae and Verbenaceae) while the remaining families were represented by one species (Appendix 1). This result showed that Guduru district is rich in medicinal plants as shown by the presence of 93 species exhibiting wide taxonomic diversity. This number of diverse taxonomic groups of medicinal plants and associated ethno-medicinal knowledge has been observed in different regional state of Ethiopia [28, 16]. The existence and utilization of such a large number of medicinal plants by people in the study area indicates that the majority of the people used indigenous medicinal practices to take care of medication problems.

3.3. Sources of medicinal plants

Among the cited medicinal plant species of the study area, the majority 49 (52.7%) species were obtained from wild followed by 25 (26.9%) species and 19 (20.4%) species from home garden (cultivated and both cultivated and wild). This indicates that the practitioners depend on the wild source or the natural environment rather than home gardens to obtain the medicinal plants, and the activity of cultivating medicinal plants is very poor 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, [17, 16] where wild medicinal plants dominate. This and field observation during data collection clearly confirmed that some traditional healers do not have interest to grow in their home garden some plant species that are used to treat specific ailments in order to keep the secret of their medicinal value. This means that most of the medicinal plants found in the home gardens are those also known to have other uses particularly as food.

3.4. Growth form of plants used for medicine

The result of growth forms diversity analysis of medicinal plants reveals that herbs constitute the largest category (29 species, 31.3%) followed by shrubs (28 species, 30.1%). Trees amounted to (26 species, 27.9%). The others included climbers (7 species, 7.5%), epiphytes (2 species, 2.1%) and lianas (1species, 1.1%). Herbs and shrubs make up the highest proportion (57 species, 61.3%) of the medicinal plant species. This could be related to the fact that these species exhibit high level of abundance and easy to obtain them. Relatively high number of herbs and shrubs for medicinal purpose were also previously reported in Ethiopia [2, 17, 16].

3.5. Medicinal Plants and their main uses

Among the reported medicinal plants of the area, some plants were found to treat different health problems affecting the health of both humans and livestock. Out of 93 medicinal plant species in this study, 56 species (60.2%) were noted to treat only human ailments while 20 species (21.5%) are used to treat livestock ailments. Seventeen species (18.3%) are used to treat both livestock and human ailments. Informant consensus on these medicinal plants confirms their efficacy against some human and /or livestock ailments.

3.6. Parts of plants used for medicine

From the total plant parts used for remedy preparation, the leaves and the roots were the most commonly used plant parts in the preparation of remedies accounting for 34.68% (43 species) and 23.39% (29 species) of the total medicinal plants, respectively and lower values for other parts used to treat various health problems (Figure 1). The fear of destruction of medicinal plants due to plant parts collected for the purpose of medicine is minimal as leaves were the leading plant parts sought in the area. Sets of works that were carried out previously elsewhere in Ethiopia also revealed that leaves followed by roots were the common plant parts used to treat various health problems [29, 1, 2]. Herbal preparation that involves roots, rhizomes, bulbs, barks, stems or whole parts have effects on the survival of the mother plants but leaves generally have low impact on individual plants as compared to roots, rhizomes, bulbs, barks, stems or whole parts.

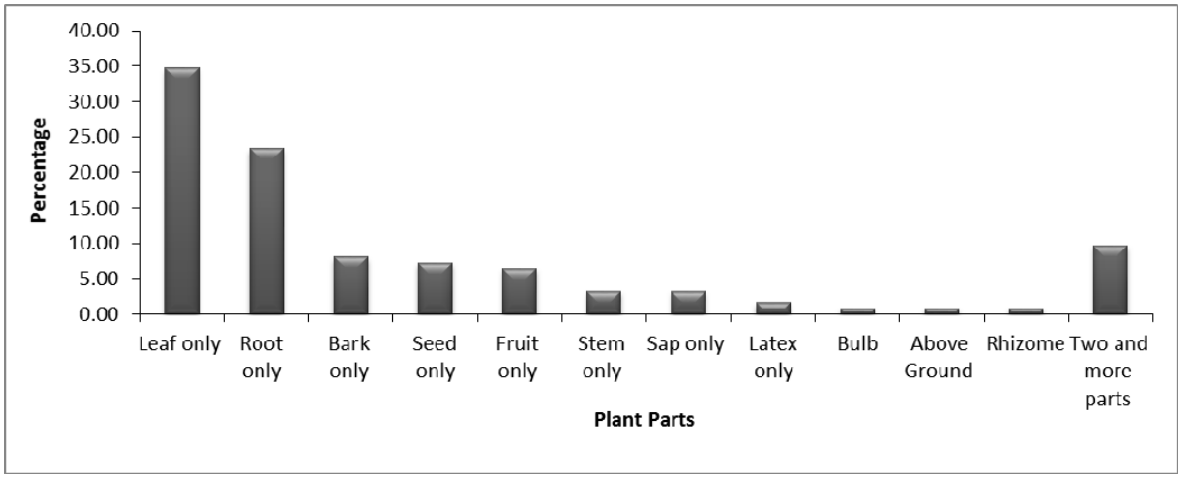

Fig 1: Parts of plants used for medicine preparations

3.7. Composition, condition and preparation methods of medicinal plants

In the collection of data concerning the preparation of medicine, informants have reported various skills associated with herbal preparation. These include plant composition (whether single or combined), condition of plant material used (fresh or dry) and methods of preparation. The result showed that most remedies were prepared from single plant species (61.5%) and preparation from combined plant species was about 38.5%. Local people depend on both dry and fresh remedies. In this case, 98 preparations (53.3%) are in fresh form, 54 (29.3%) are dried and 32(17.4%) are dried and fresh. 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 from all the other findings from other regions of Ethiopia [11, 26, 1]. The local healers employed several methods of preparation of traditional medicines from plants. The result showed that most remedies were prepared from single plant (61.5%) and preparation from combined plant species was about 38.5%. The result is in agreement with the findings of [9] and [11] in which the single plant preparation were reported to be high and disagrees with works of [30] and [5] in which the combined plant materials were reported to have high proportion in herbal preparation. The local people employ several methods of preparation of traditional medicines. The frequently used methods were pounding, powdering and smashing respectively. Pounding 59 (34.1%), powdering 23 (13.3%) and smashing 22 (12.7%) are the three main methods of preparation of medicine (Figure 2). The preparation and application methods vary based on the type of disease treated and the actual site of the ailment. The majority of the preparations are made from mixture of

different plant species with water and different additive substances like honey, sugar, butter, and salt and milk. These additive substances have different functions i.e. to reduce poisons, improve flavor and as antidotes during adverse affects such as vomiting and diarrhea [9]. 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. For instance, *Lepidium sativum* is added with a honey to improve its taste.

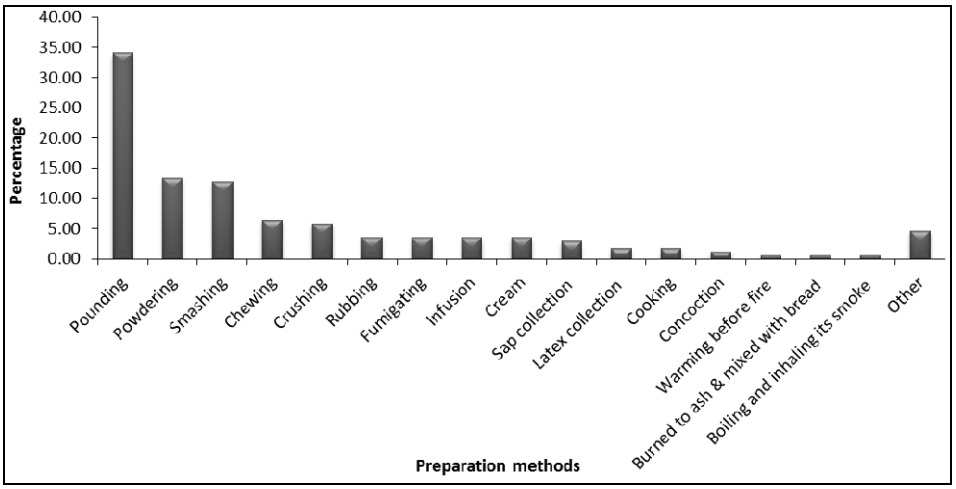

Fig 2: Preparation methods of medicinal plants

3.8. Route of remedy administration and dosage determination

There are various routes of administration of traditional medicinal plants prepared products by the local community. The major routes of administration in the study area are oral, dermal, nasal, anal and optical. Oral administration is the dominant route (54.91%), followed by dermal route (30.64%) (Figure 3). Both oral and dermal routes permit rapid physiological reaction of the prepared medicines with the pathogens and increase its curative power. This fact has been documented by different authors in the other part of Ethiopia [1, 2, 17]. In addition, informants reported that there are related restrictions to enhance rapid physiological reaction and to increase its curative power of remedies. For example, a patient who takes remedy against tapeworm should not take any food six hours before and after administration of the medicine. People of the study area used various units of measurement and the duration of administration to determine the dosage. Local units such as finger length (e.g., for bark, root, stem,), pinch (e.g., for powdered plant medicine) and numbers (e.g., for leaves, seeds, fruits, bulbs, rhizomes, flowers and latex) were used to estimate and fix the amount of medicine. Recovery from the disease, disappearance of the symptoms of the diseases, fading out of the disease sign and judgment of the healer to stop the treatment were some of the criteria used in determining duration in the administration of the dosage. However, from the interview made during the study, it was found that there was disagreement among the healers concerning the dosage system used. For example, some informants suggested that four or five drops of the latex from *Euphorbia candelabrum* is used to treat Ascariasis or gonorrhea, while some suggested that only one drop is enough for the same problem. Still some others suggested that they apply the latex randomly without such measuring system. Although the full dose determination is varying from healer to healer, the dose given depends on age, physical strength and heath conditions. This finding is significantly agreed with other findings from other regions of Ethiopia [10, 1]. The healers never administer treatments that are taken internally to pregnant women.

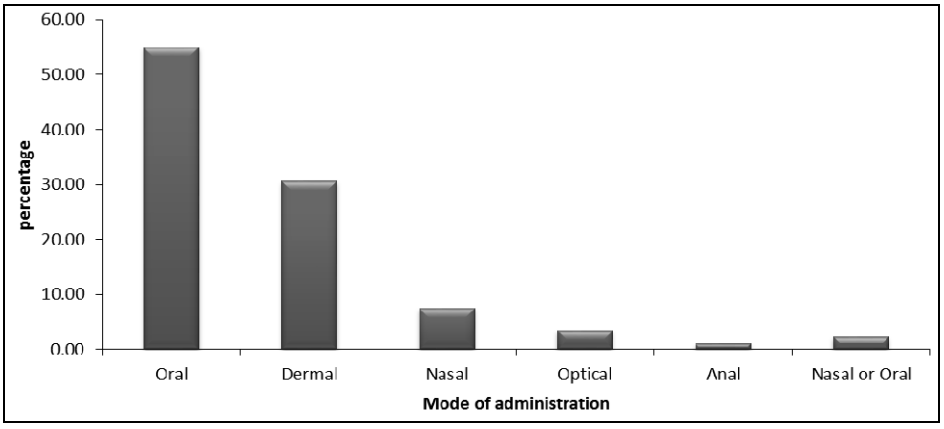

Fig 3: Mode of administration of the plant remedies

3.9. Informant consensus

The results of the study showed that some medicinal plants are popular than the others, in view of that, *Ocimum urticfoluim* (Hancabbii adii) took the lead where it was cited by 80 informants for its medicinal value for treating fibril illness. *Allium sativum, Citrus limon* and *Echinops kerebicho are* cited by 78, 72 and 68 informants ranking 2nd, 3rd and 4th respectively (Table 2). The latter three species are used for

treating a series of different health problems. The action of plant extracts on different health problems may explain the broad- spectrum nature of plants, while their action on a particular problem explains their narrow spectrum nature. Popularity of these medicinal plants according to key informants is due to their wide range of diseases they treat or due to the abundance of the plant in the area for easy access. The case of *Ocimum urticfoluim* and *Allium sativum* can be cited for their abundant distribution in the area. With this, other medicinal plants mentioned by four or more, scoring percentage greater than 50 and those frequently used ones for treatment of more than two ailments are given in Table 2.

Table 1: The top 15 medicinal plants and the corresponding informants

Scientific name	No. of informants	% total	Scientific name	No. of informants	% total
Ocimum urticifolium	80	88.89	*Lepidium sativum*	41	45.56
Allium sativum	78	86.67	*Croton macrostachyus*	39	43.33
Citrus limon	72	80	*Rhamnu sprinoides*	38	42.22
Echinops kerebicho	68	75.56	*Otostegia tomentosa*	36	40
Nicotiana tabacum	61	67.78	*Carica papaya*	35	38.89
Ruta chalepensis	50	55.56	*Asparagus africanus*	34	37.78
Ricinus communis	43	47.78	*Eucalyptus globulus*	34	37.78

3.10. Preference ranking

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 diarrhea, 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 diarrhea and the lowest number (1) for the least effective plant in treating diarrhea. Preference ranking for seven medicinal plants used to treat gonorrhoea (Table 3) shown that *Lepidium sativum* ranked first and hence is the most effective medicinal plant to cure diarrhea. The second and third most preferred medicinal plants against this disease are *Thalictrum rhynchocarpum* and *Amaranthus caudatus* while, the least preferred species compared to the other five species are *Phragmanlhera macrosolen* and *Amorphophallus abyssinicus* according to informants.

Table 2: Preference ranking of medicinal plants used to treat Diarrhea

Medicinal plants	Informants labeled R1 to R10											
	R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**	**Total score**	**Rank**
Amaranthus caudatus	3	4	5	3	4	2	2	1	1	3	28	3
Amorphophallus abyssinicus	2	1	1	2	1	4	5	3	4	1	24	5
Lepidium sativum	5	5	3	4	2	5	4	4	3	5	40	1
Phragmanlhera macrosolen	1	2	4	1	5	3	1	5	2	2	26	4
Thalictrum rhynchocarpum	4	3	2	5	3	1	3	2	5	4	32	2

3.11. Paired comparison

For medicinal plants that were identified by the informants to be used in treating gonorrhea, a paired comparison was made among five of them using ten informants to know their rank (Table 4). *Carissa spinarum, Phytolacca dodecandra, Justica schimperiana* and *Flacourtia indica* were ranked 1st, 2nd, 3rd and 4th respectively. *Euphorbia condelabrum* are less preferred and less efficacious compared to the other four species.

Table 3: Paired comparisons of six medicinal plants used to treat gonorrhoea

Medicinal plants	Informants labeled R1 to R10											
	R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**	**Total score**	**Rank**
Justica schimperiana	3	2	5	2	4	3	2	2	5	3	**31**	**3**
Carissa spinarum	4	5	4	5	5	5	3	4	4	5	**44**	**1**
Euphorbia condelabrum	1	3	1	1	2	4	1	1	2	1	**17**	**5**
Flacourtia indica	2	1	2	3	1	1	4	3	1	2	**20**	**4**
Phytolacca dodecandra	5	4	3	4	3	2	5	5	3	4	**38**	**2**

3.12. Direct matrix ranking

In this study, a number of medicinal plants were found to be multipurpose species being utilized for a variety of uses. The common uses include medicinal, fodder, food, firewood, construction, charcoal, fencing and furniture making. Seven commonly reported multipurpose species and eight use-categories were involved in direct matrix ranking exercise in order to evaluate their relative importance to the local people and the extent of the existing threats related to their use values (Table 5). The results show that the local people harvest seven multipurpose species mainly for firewood, fencing, medicine, charcoal, construction and furniture with the rank of 1st, 2nd, 3rd, 4th, 5th, 6th and 7 th respectively. Thus, the long-term survival of the top- ranked species are under question, as the daily demand of the local society is usual and continuous with lesser rate of re-plantation, except for *Eucalyptus globulus*. This is evidenced by the high rate of loss of *Carissa spinarum, Syzygium guineense* and *Croton macrostachyus* in the area.

Table 4: Direct matrix ranking for multiple uses of medicinal plants

Medicinal plants species	Multiple use of medicinal plants									
	Fire wood	**Forage**	**Construction**	**Furniture**	**Food**	**Charcoal**	**Fencing**	**Medicine**	**Total score**	**Rank**
Acacia abyssinica	3	6	2	2	0	7	5	3	28	6

Cordia africana	2	5	1	7	5	3	2	4	29	5
Carissa spinarum	7	7	4	1	6	2	7	6	40	1
Croton macrostachyus	6	2	3	3	0	6	6	7	33	3
Eucalyptus globulus	4	1	7	6	0	4	4	5	31	4
Syzygium guineense	5	4	5	5	7	5	3	1	35	2
Olea europaea	1	3	6	4	0	1	1	2	18	7

3.13. Fidelity level index

Confirmation or consensus could not be taken as a single measure of the potential efficacy of any medicinal plant in fidelity level index. Thus, efficacy is not the only factor that influences the informant choice but abundance of a given plant and prevalence of disease in the area can affect informants choices. As malaria is one of the frequently reported diseases in low land areas (Fincha Sukuar project and Sementegna camp area) and less frequent in high land areas (Achane, Kolobo, Gengi Ketela and Jare). Different number of informants from the two areas for malaria case reported the use of *Allium sativum* as a remedy. The fidelity level index was calculated for *Allium sativum* for the two ecological areas. A total of 13, 17 specific and general use for *Allium sativum* were reported by informants from Achane, Kolobo, Gengi Ketela and Jare. While 17, 18 specific and general uses for *Allium sativum* were reported by informants from Fincha Sukuar project and Sementegna camp area. Use reports of informants from Achane, Kolobo, Gengi Ketela and Jare were compared with informants from Fincha Sukuar project and Sementegna camp area to assess the fidelity level of *Allium sativum (*FL=IP/IU*).* From the comparison, it was found that the fidelity level of *Allium sativum* for malaria treatment by Achane, Kolobo, Gengi Ketela and Jare informants was 76.4%, while for Fincha Sukuar project and Sementegna camp area was 94.4%. Thus, the medicinal value of *Allium sativum* is high in *Kola* areas compared to *Woinadega* zones.

3.14. Threats to medicinal plants and conservation practices

In Guduru district various factors that were considered as main threats for medicinal plants were recorded by interviewing the informants. The major factors claimed were deforestation (1), agricultural expansion (2), overgrazing and browsing (3), trading charcoal and firewood (4), construction material (5), drought (6), fire (7) and medicinal plant trade (8) (Table 6). These results are consistent with the findings of various ethnobotanical researches elsewhere in Ethiopia, such as that of [3, 15] and [17] indicates some similar investigation. The effort to conserve medicinal plants in the district was observed to be very poor. Some traditional practitioners have started to conserve medicinal plants by cultivating at home gardens, though the effort was minimal. Traditional beliefs in the area also have their own unintentional role in conservation and sustainable utilization of medicinal plants. However, giving conservation priority for identified threatened medicinal plants, promoting *in-situ* and *ex-situ* conservation of medicinal plants in Guduru area as well as supporting the district's Traditional Healers Association, by providing funds, land for cultivating medicinal plants and assisting their activities with professional guidance helps to conserve the fast eroding medicinal plants of the study area.

Table 6: Threats to medicinal plants

Factors	Respondents											
	R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**	**Total score**	**Rank**
Deforestation	8	7	8	8	7	6	8	8	7	8	75	1
Agricultural expansion	6	8	7	6	8	8	6	7	8	7	71	2
Overgrazing and browsing	7	5	5	7	6	7	7	6	6	6	62	3
Charcoal and firewood	4	6	6	5	4	5	5	5	5	5	50	4
Construction material	5	4	3	4	5	3	4	4	4	4	40	5
Extended dry time	2	3	4	2	3	4	3	3	2	3	29	6
Fire	3	2	2	3	2	2	2	2	3	2	23	7
Medicinal plant trade	1	1	1	1	1	1	1	1	1	1	10	8

4. Conclusion

The results of the present study showed that Guduru district a high diversity of medicinal useful plants and the people living in the area have a long history of plant use, and that of medicinal plants is exceptionally notable and culturally rooted in the area. Despite the gradual socio-cultural transformation, the inhabitants have retained remarkable knowledge of the plants and their uses. Difficulties in knowledge transfer and the resulting generation gap in knowledge are threatening the continuity of the medicinal plants and the indigenous knowledge on them. On the other hand, the study provided evidence that medicinal plants will continue to play an important role in the healthcare system in the study area, given support through conservation and education. Knowledge and herbal medical practices for the treatment of various ailments among both rural and urban people are major parts of their
livelihoods and culture. The traditional knowledge of the use and conservation of these plants is still being transferred from generation to generation, but appeared to be aging. The problem of transfer of knowledge from the elders to the young generation probably arose following the introduction of modern education, religious, spiritual and culture-related factors. Therefore, it is not only essential to conserve such a wealth of information hidden among the local people but also to apply modern science and technology to meet the ever increasing requirements of humankind. Furthermore, conservation of these biological resources is very important because their sustainable use can generate higher levels of employment and income.

References

1. Abiyu E, Zemede A, Ensermu K, Raja N. Ethnobotanical Study of Traditional Medicinal Plants in and Around Fiche District, Central Ethiopia. Curr. Res. J Biol. Sci. 2014; 6(4):154-167
2. Balcha A. Medicinal plants used in traditional medicine by Oromo people, Ghimbi District, Southwest Ethiopia.

J. Ethnobiol. Ethnomed. 2014; 10(40):1-15.
3. Balemie K, Kelbessa E, Asfaw Z. Indigenous medicinal plant utilization, management and threats in Fentalle area, Eastern Shewa, Ethiopia. Ethiop. J Bio. Sci. 2004; 3:37-58.
4. Balick MJ, Cox PA. Plants, People and Culture: Science of Ethnobotany. Scientific American Library, New York, USA, 1996.
5. Bayafers T. A floristic analysis and ethnobotanical study of the semi-wetland of Cheffa area, South Welo, Ethiopia. M.Sc. Thesis. Addis Ababa University, 2000.
6. Cotton CM. Ethnobotany: Principles and Applications. Chichester: John Wiley and Sons Ltd, New York, 1996.
7. Cunningham AB. People, Park and Plants use Recommendations for Multiple use Zones and Development Alternatives around Bwindi: Impenetrable National Park Uganda. In People and Plants: Paris: UNESCO Working Paper 1996; 4:18-25.
8. Cunningham AB. Applied Ethnobotany: People, Wild Plant use and Conservation. People and Plant Conservation Manual. Earthscans Publication Ltd, London, 2001.
9. Dawit A. Traditional medicine in Ethiopia. The attempt being made to promote it for effective and better utilization. SINET: Ethiop. J Sci., 1986; 9:61-69.
10. Dawit A, Ahadu A. Medicinal plants and enigmatic health practice of north Ethiopia. Berhanina Selam Printing Enterprise, Addis Ababa, Ethiopia, 1993.
11. Debela H. Use and Management of Traditional Medicinal Plants by Indigenous People of Bosat Woreda, Wolenchiti area: An ethnobotanical approach. M.Sc. Thesis, Addis Ababa, Ethiopia, 2001.
12. Edwards S, Demissew S, Hedberg I. (Eds) Flora of Ethiopia and Eritrea. Hydrocharitaceae to Arecaceae Volume 6. Ethiopia: Department of Systematic Botany, Uppsala University, Sweden and The National Herbarium, Addis Ababa University, 1997.
13. Edwards S, Tadesse M, Demissew S, Hedberg I. (Eds) Flora of Ethiopia and Eritrea. Magnoliaceae to Flacourtiaceae Ethiopia: Department of Systematic Botany, Uppsala University, Sweden and the National Herbarium, Addis Ababa University, 2000; 2(1).
14. Edwards S, Tadesse M, Hedberg I. (Eds) Flora of Ethiopia and Eritrea. Canellaceae to Euphorbiaceae Ethiopia: Department of Systematic Botany, Uppsala University, Sweden and The National Herbarium, Addis Ababa University, 1995; 2(2).
15. Ermias L, Ensermu K, Tamrat B, Haile Y. An ethnobotanical study of medicinal plants in Mana Angetu District, southeastern Ethiopia. J. Ethnobiol. Ethnomed. 2008; 4(10):1-10.
16. Getaneh GM. Ethnobotanical survey of medicinal plants used in treating human and livestock health problems in Mandura Woreda of Benishangul Gumuz, Ethiopia. Adv. Med. Plant Res. 2016; 4(1):11-26.
17. Getnet C, Zemede A, Ensermu K. Ethnobotanical study of medicinal plants in the environs of Tara-gedam and Amba remnant forests of Libo Kemkem District, northwest Ethiopia. J Ethnobiol. Ethnomed. 2015; 11(4):1-38
18. Haile Y, Delensaw Y. Traditional medicinal plant knowledge and use by local healers in Sekoru District, Jimma Zone, South western Ethiopia. J. Ethnobiol. Ethnomed. 2007; 3:3-24.
19. Hedberg I, Edwards S. (Eds) Flora of Ethiopia and Eritrea. Pittosporaceae to Araliaceae Ethiopia: Department of Systematic Botany, Uppsala University, Sweden and The National Herbarium, Addis Ababa University, 1989, 3.
20. Hedberg I, Edwards S. (Eds) Flora of Ethiopia and Eritrea. Poaceae (Graminae) Ethiopia: Department of Systematic Botany, Uppsala University, Sweden and The National Herbarium, Addis Ababa University, 1995, 7.
21. Hedberg I, Edwards S, Nemomissa S. (Eds) Flora of Ethiopia and Eritrea. Apiaceae to Dipsacaceae Ethiopia: Department of Systematic Botany, Uppsala University, Sweden and The National Herbarium, Addis Ababa University, 2003; 4(1).
22. Hedberg I, Friis I, Edwards S. (Eds) Flora of Ethiopia and Eritrea. Asteraceae Ethiopia: Department of Systematic Botany, Uppsala University, Sweden and The National Herbarium, Addis Ababa University. 2004; 2(4).
23. Hedberg I, Kelbessa E, Edwards S, Demissew S, Persson E. (Eds) Flora of Ethiopia and Eritrea. Plantaginaceae Ethiopia: Department of Systematic Botany, Uppsala University, Sweden and The National Herbarium, Addis Ababa University, 2006, 5.
24. Hedberg I, Friis I, Person E. (Eds) Flora of Ethiopia and Eritrea. Lycopodiaceae to Pinaceae. Ethiopia: Department of Systematic Botany, Uppsala University, Sweden and the National Herbarium, Addis Ababa University. 2009, 1.
25. Heinrich M. Ethnobotany and its role in drug development. Phytother Res. 2000; 14:479-488.
26. Kebu B, Ensermu K, Zemede A. Indigenous medicinal utilization, management and threats in Fentale area, Eastern Shewa, Ethiopia. Ethiop. J Biol. Sci. 2004; 3:1-7.
27. Martin GJ. Ethnobotany: A Method Manual. London: Chapman and Hall, London: 1995, 1-151.
28. Meaza G, Tadesse B, Maria AS, Piero B, Gidey Y. Traditional medicinal plants used by Kunama ethnic group in Northern Ethiopia. J Med. Plants Res. 2015; 9(15): 494-509.
29. Mirutse G, Gobana A. An Ethnobotanical Survey on Plants of Veterinary Importance in Two Woredas of Southern Tigray, Northern Ethiopia. SINET: Ethiop. J. Sci. 2003; 26(2):123-136.
30. Mirutse G. An Ethnobotanical study of medicinal plants used by the Zay People in Ethiopia. M.Sc. Thesis. Uppsala, Sweden, 1999.
31. Quanash N. Bicultural diversity and integrated healthcare in Madagascar. Nat. Res. 1998; 30:18-22.
32. Tadesse B, Dereje A, Eyasu E. Ethnobotanical Study of Medicinal Plants in Selected Horro Gudurru Woredas, Western Ethiopia. Journal of Biology, Agriculture and Healthcare. 2015; 5(1):83-93.
33. World Health Organization (WHO) Regulatory situation of herbal medicines. A worldwide Review, Geneva. 1998, 1-13
34. Zegeye H, Teketay D, Kelbessa E. Diversity and regeneration status of woody species in Tara-gedam and Abebaye forests, Northwestern Ethiopia. J Forestry Res. 2011; 22:315-328.