Journal of Medicinal Plants Studies
www.PlantsJournal.com

ISSN 2320-3862
JMPS 2015; 3(6): 01-11

Received: 01-09-2015
Accepted: 02-10-2015

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Ethnobotanical study of medicinal plants used by local communities of Minjar-Shenkora District, North Shewa Zone of Amhara Region, Ethiopia

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Abstract
Background: An ethnobothanical study was carried out between September 2009 and December 2010 in Minjar-Shenkora District, North Shewa Zone of Amhara Region, Ethiopia. The main objective of the study was to document plants species of medicinal value to the community in Minjar-Shenkora District and the associated knowledge on use, management, preparation and other aspects of the indigenous knowledge of the people in Minjar-Shenkora District.
Methods: A total of 80 informants (60 males and 20 females) were selected to collect information on medicinal plant use from twenty sampled kebeles. Out of these, 40 key informants were purposively selected based on recommendation from elders and local authorities. Other40 informants were selected randomly. Ethnobotanical data were collected using semi structured interview, guided field walk, group discussion, preference ranking, use diversity ranking and market survey.
Results: A total of 118 plant species distributed in 105 genera and 53 families were identified for their medicinal value. Out of the collected medicinal plants, about 48 (40.67%) plant species were shrubs, 46 (38.98%) were herbs and 16 (13.55%) were trees. Among the total traditional medicinal plants, 75 species were used against human ailments and 18 species were used for treatment of cattle diseases and 25 species for the treatment of both human and veterinary diseases. Ninety (76.27%) species of the medicinal plants were collected from the wild whereas 25 (21.18%) were from cultivated areas. Oral administration (54.21%) was found to be the dominant route of remedy administration. The medicinal plant species documented from the study area have also other uses including as firewood, construction and production of charcoal.
Conclusion: Thus, most of these plants are found under threats in the study area, which is one of the main reasons for the decline of the associated knowledge. Therefore, documentation of the indigenous knowledge associated with the medicinal plants and their uses before losing them forever. Verification of the medicinal values of the frequently reported species through phytochemical and pharmacological studies are urgently needed actions.

Keywords: Indigenous knowledge, Medicinal plants, Minjar-Shenkora

1. Introduction
The major role of medicinal plants in healthcare is demonstrated in the developing countries. It is estimated that about 80% of the people rely on traditional medicine for their primary healthcare [34]. Furthermore, many modern day drugs owe their origin to plants [8, 16]. Although traditional medicines involve the use of substances other than plants, plants form the backbone of these healthcare systems [15, 2]. However, information on the number of plants employed in traditional medicine and how they are used in traditional therapy is not exhaustively documented. Many countries lack complete inventories to their medicinal plant species [11, 35]. Yet such inventories are important in surveys undertaken to identify unique and valuable components and such inventories coupled with information from knowledgeable rural people, who have learnt through resource use, rather than formal training can be invaluable sources of information for plant utilization and conservation practices [13].
In Africa, the traditional knowledge on utilization of plants was undocumented. Most of the knowledge acquired by the local people has been passed on to them by a word of mouth from one generation to the other [21, 28]. Such orally preserved information is liable to loss if left undocumented. Thus, considering Ethiopia's varied flora and varied ethnomedicinal healing system with socio cultural diversity of the country, studies and research works are much needed on conservation, management, cultivation and ethnobotanical knowledge including that of medicinal plant species [3].

The Ethiopian indigenous medicinal plant knowledge, which is available in rural communities and perpetuated by word of mouth within families and the communities, consists of fragile traditional skills that are likely to be lost when communities emigrate to towns or to other regions with a different flora; and can also be lost by life style changes due to industrialization, rapid loss of natural habitats, drastic alteration of the local ecology. Anthropological events have major contributions to these changes [11, 12, 2]. Therefore, the need for ethnobotanical researches and documentation of medicinal plants and the associated indigenous knowledge has to be an urgent task and very important to preserve the knowledge and conserve the plants.

Despite their diverse role in treating various diseases in both humans and livestock, medicinal plants are also facing an increasing pressure from both natural and anthropogenic factors. Such studies are very important in order to identify the threatened medicinal plant species and to save the plant from further loss through conservation. Thus, this study was initiated to document the medicinal plants and the associated indigenous knowledge of the people and other aspects of the indigenous knowledge of the people in Minjar Shenkora District.

Materials and Methods

Study area and the people

The study area is located at about 135 km south east of Addis Ababa, in the North Shoa Zone of Amhara Regional State at 90º 6' and 90º 5' N and 39º 46' and 39º 26' East and has a total area of about 229,463 ha (Figure 1). The administrative town of Minjar-Shenkora District is Arerti. The altitude of the study area ranges from 1400-2400 m.a.s.l and the District falls within three major agroclimatic zones, Dega (high lands), Weinadega (mid lands) and Kola (low lands). Topography of the Wereda lands are characterized by diverse geomorphological features. Unpublished data from the Wereda agricultural office indicate that 20% of the land area is mountainous, followed by plain (65%) and gorge (10%) and 5% other topographic features.

The majority of people living in Minjar Shenkora District belong to the Amhara (93, 78%) ethnic descent, Oromo (3.11%), Argoba (2.65%), and all other ethnic groups constituted 0.46% of the total population [26]. Amharic is a widely spoken language (96.93%), followed by Afaan Oromo (2.79%), and the remaining (0.3%) ones speak other languages [26]. Based on figures by the Central Statistical Agency [10], the District has an estimated total population size of 128,741 of whom 66,843 were men and 61,895 women; 12,233 of the population are urban dwellers and the remaining 116,508 live in rural areas.

Meteorological data recorded at Modjo station taken from Addis Ababa National Meteorology Service Agency indicates that the area obtains high rainfall between June to August and low rain fall in March to May, and dry season extends from September to February. The highest mean annual rain fall of the study area within ten years was 1028mm, whereas the lowest mean total was 162.8mm. The lowest mean annual temperature over ten years was 7.3 °C whereas the highest was 20 °C (Figure 2).

The leading human diseases in the study area were acute fever, wounds, malaria and urinary tract infections [27]. Likewise, the major livestock diseases reported in the study area are grouped under three main categories as bacterial (Blackleg, Anthrax), protozoan (Trypanosomiasis) and viral (sheep and goat pox) Infections. The District has one central veterinary clinic and three veterinary health workers.

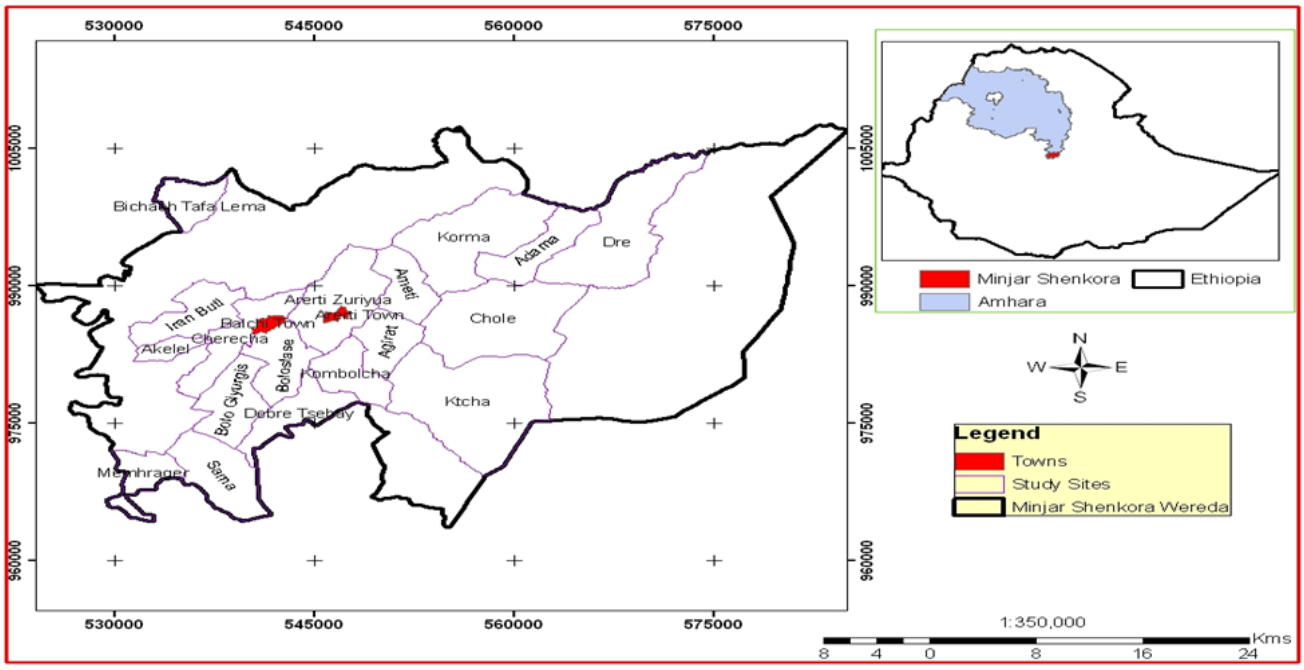

Fig 1: Location of Minjar-Shenkora District

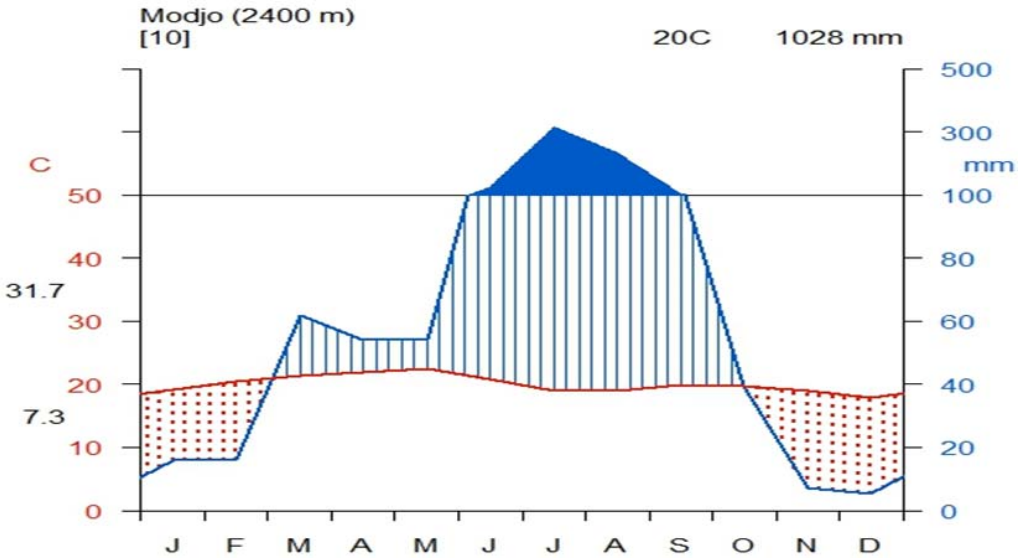

Fig 2: Climadiagram of the study area

Methods

A reconnaissance survey of the study area was conducted from September 16 to30, 2009 and determined to include 20 kebeles (lowest administrative unit in Ethiopia) as study sites out of the total of 29 kebeles. Thus, the study was carried out in three attitudinally varying sites areas with high altitude (1900-2400 m.a.s.l) (Eranbutie, Agirate, Balichi, Memhireager, Abatenehager, Kutereager, Sama, Debretshaye), located southeast of Arerti town, medium altitude areas (1700-1900 m.a.s.l) (Arerti zuria, Bologiorgis, Bolosilassie, Korma, Kombolcha), located in the northeast of Arerti and lower altitude areas (1400-1700 m.a.s.l) (Adama, Amite, Akelale, Bichashe, Cheli, Chercha, Deri) around west of Arerti town.

Ethnobotanical data were collected by closely interacting with informants using semi-structured interview, guided field walk, group discussion, market survey, preference ranking, pair-wise comparisons and use diversity ranking/data matrix ranking. The language used most frequently with the informants was Amharic (common language of the wereda). Moreover, informants were asked about local names of medicinal and wild edible plants used, habitat of the species, distance to gathering sites, seasonality of species, marketability of species, degree of management (wild/cultivated), abundance, parts used, condition of plant part used (fresh/dried). Methods of remedy preparation, remedy storage, dosage prescriptions, routes of remedy administration, beliefs related to collection and use of plants, method of indigenous knowledge transfer, other uses of medicinal plant species, existing threats and traditional conservation practices. A market survey of medicinal plants of the Districts were conducted at two major markets i.e., namely, Cheli, Deri. Availability, price and unit of measurement of each marketable medicinal plant was documented and analyzed so as to identify extent of use and income generating potential of the respective medicinal plants.

Ethnobotanical data collection

Informants and the administration were formally approached to get permission to do the research and once permitted the consent of each informant was orally obtained to ensure that he/she gave the response willingly after understanding the value of the research. A total of 80 (60 males and 20 females) informants were selected as recommended by [23]; 40 randomly selected general informants and 40 were key informants taking two from each kebele selected based recommendation of elders, local authorities and development agents. Ethnobotanical data were collected using standard techniques as described by [23, 10]. Data were collected from November 2, 2009 to December 3, 2010. Interviews were carried out based on semi-structured checklist of questions prepared beforehand in English and translated to Amharic during interview administration.

During the course of the study, each informant was visited 2-3 times in order to confirm the reliability of the ethnobotanical information. Consequently, the responses of an informant that were not in harmony with each other were rejected since such responses were considered unreliable and then, no further questions made with such informants since they were irrelevant/unreliable. Thus, only the relevant ones were taken into account and statistically analyzed. This method was adopted from [4].

Specimen collection and identification

The collected plant specimens include the traditional medicinal plants of both humans and livestock. The local name, habit and associated information were recorded for each of the plant species along with the collected specimens, then, the plants were pressed, dried and taken to the National Herbarium of Ethiopia (Addis Ababa University). Identification of the plant specimens was done both in the field, and later at the National Herbarium using taxonomic keys and the Flora of Ethiopia and Eritrea. This was further verified by taxonomic experts and the specimen with labels were stored at the National Herbarium.

Ethnobotanical data analysis

A descriptive statistical methods including percentage and frequency were employed to analyze and summarize the data on medicinal plants. Preference ranking was conducted for evaluating the degree of preferences or levels of importance of certain selected plants or parts of plants following [23, 10] by using six of the key informants that were randomly identified and who were invited to rank five medicinal plant species that are used for the treatment of skin rash because it is frequently appearing disease in the study area and informed by several informants. Values of 0 to 5 were used in this ranking (0 = not used, 1 = least used, 2 = less used, 3= good, 4= very good, and 5= excellent) and the ranking were based on the informants' perceptions. Accordingly, each informant assigned the highest value which was 5 for the most preferred plant species, and the

lowest value (0) for the plant species that is not used.

Direct matrix ranking exercise was done following Martin (1995) in order to compare the multipurpose use of a given species and to relate this to the extent of its utilization versus its dominance. In the direct matrix ranking exercise, each key informant was asked to assign use values/5 = excellent, 4 = very good, 3 = good, 2 = less used, 1 = least used, 0 = not used, for each species. In order to evaluate their relative importance to the local people, eight multipurpose medicinal plant species were selected out of the total medicinal plants and the average value of use diversity for a species was taken and the values for use reports across the selected species were summed up and ranked. Priority ranking was computed on degree of threats to medicinal plants. Accordingly, eight key informants were selected in order to assign use values to each species and asked to give a value of or the plant not used and 5 to most destructive ones.

Informant consensus: In order to evaluate the reliability of information during the interview, informants were contacted at least two times for the same ideas and the validity of the information was proved and recorded. Consequently, if the idea of the informant deviates from the original information, it was rejected since it is considered as unreliable. Only the relevant ones were statistically analyzed. This method was adopted from [4].

The Informant Consensus Factor (ICF) is calculated for each category to identify the agreements of the informants on the reported cures for the group of ailments. The ICF were calculated as follows: number of use citations in each category (nur) minus the number of species used (nt), divided by the number of use citations in each category minus one [19]. The factor provides a range of 0 to 1, where a high value acts as a good indicator for a high rate of informant consensus.

$$ICF = \frac{n_{ur} - n_t}{n_{ur} - 1}$$

Where: ICF is informant Consensus Factor
nur is number of use citation
nt is number of species used

4. Result

Socio-demography of the Informants

Informants in the study area can be represented under two age groups the young (18-30), and elders greater than 30 years old. Eighty informants were used for the study purposes. Sixty (75%) male and twenty (25%) female informants were take part in this study. Out of 80 informants, twenty-five (31.25%) of the informants are found between the ages 18-30, fifty-five (68.75%) informants were greater than 30 years old. Much of knowledge of medicinal plants in the study area obtained from elder informants, when compared with the young people. This was evidence that informants greater than age 30 mentioned 90 (76.21%) medicinal plants out of the total medicinal plant species. Concerning educational status, majority of informants 55 (68.75%) were illiterate and 25 (31.25%) were literate.

Medicinal plant resources and associated indigenous knowledge

A total of 118 species distributed in 105 genera and 53 families were collected and documented. Among the families that contributed more medicinal species were Asteraceae, represented by 11 (9.3%) species, Lamiaceae with 10 (8.5%) species, Solanaceae with 7(6%) species, Euphorbiaceae 6 (5%) species and other 47 families contributing 75 (63.6%) of the species were represented by 1, 2 or 3 species. Of the 118 species of medicinal plants collected from the study area, shrubs constituted the highest proportion being represented by 48 (41%) species, while there were 46 (39%) herbs, 16 (13.5%) trees and 8 (7%) climbers.

Among the total traditional medicinal plants, 75 (63.55%) species were those said to be used against human aliments (Appendix 1), 18 (15.25%) to treat livestock ailments (Appendix 2) and 25 (21.18%) species were those used by the people to treat both human and livestock ailments (Appendix 3). Out of the total medicinal plants studied, 8 species were endemic and 5 were according to local perception categorized as rare species. Out of 118 medicinal plant species documented in the study area, 90 species (76.27%) were harvested from the wild/natural vegetation, 25 (21.18 %) were collected from cultivated fields and 3 (2.54%) were those the people harvested from both wild and cultivated areas. People of the study area mostly administer traditional medicine orally. This accounted for 54%, followed by dermal administration (29 %) and others (nasal, anal, ocular) accounting to 15%.

Plant parts used in the study area

Informants of the study area harvest different plant parts (e.g. leaves, roots, seeds, barks and fruit) for preparation of traditional drugs. In the study area, the informants reported that more species (54, 45.7%) of medicinal plants were harvested to use their leaves in medicine preparation, and these were followed by roots (17, 18.5%) and fruit parts accounted for 13.5%.

Regarding the plant, parts for veterinary uses leaves are widely used part for a range of preparations than the other parts. Leaves account for greatest preparations (9.40 %), followed by root (2.56 %), flower (1.70 %), fruit and others preparations are (0.85%).

Preparation of medicinal plants

The major forms of preparation of plant medicines in the study area included 50.60% liquid forms (liquid obtained after crushing the plant part), exudates (sap and drop form (9.03%), powdered forms (22.28%), smashed, juiced, boiled or filtered forms (12.04%) and (6.03%) as unprocessed plus other forms. Most of the medicinal plant preparations involved the use of single plant species or a single plant part (60.24%) while those mixing two plants or plant parts (28.3%) and three plants or plant parts (8.43%) were rarely encountered in the study area.

Marketability of medicinal plants

The survey conducted in two markets of the study area showed that most of the medicinal plants are not widely traded for medicinal purposes, but mostly for other different uses. Since the local people prefer either collecting these plants by themselves from the available areas (vegetations) in the district to prepare, the medicines or they prefer to go directly to the local healers to get treatments instead of buying the medicinal plants from the market. However, some of the medicinal plants (*Alliium sativium*, *Foeniculum vulgare*, *Artemisia absinthium*) are widely traded and used as spices and others (*Eucalyptus globulus*, *Olea europaea*) are used for firewood, construction, household tools and farming tools other than their medicinal uses (Table 4).

Importance of medicinal plants in the study area

Preference ranking of 5 medicinal plants that were reported to be effective for treating skin rash was conducted after selecting 6 key informants. The informants were asked to compare the given medicinal plants based on their efficacy. The results

showed that *Vernonia amygdalina* scored highest of all and ranked first indicating that it is the most effective plant in treating skin rash and this is followed by *Rhamnus perinoides.*

Use diversity of medicinal plants

A number of medicinal plants were reported for having multiple uses over and above their being medicinal. Key informants first identified eight medicinal plant species that were used by the community for additional purposes including for firewood, construction, charcoal making, fencing and fodder. Use diversity ranking of these species showed that *Olea europaea* was the best, followed by *Eucalyptus globuls* and *Clerodendrum myricoides* (Table 6).

Informant consensus

Based on the informants' consensus calculated from the interview data, certain species were independently cited by many of the informants for their medicinal uses against human and livestock ailments. Accordingly, *Solanecio gigas* with citation by 54 informants (67.5%) ranked first followed by *Vernonia amygdalina* (52 informants, 65%). *Clerodendrum myricoides* scored the third rank with 50 informants (62.5%) citations (Table 6).

Informant consensus factor (ICF) the diseases of the study area have grouped in to different categories based on the site of occurrence of the disease, condition of the disease as well as treatment resemblance of the disease to the local people. The informant consensus factors have been calculated for each category (Table 7). In this study, the informant consensus of medicinal plant usage resulted in ICF ranging from 0.88 to 0.973 per illness category. The factor provides a range of 0 to 1, where a high value acts as a good indicator for a high rate of informant consensus.

As the result shows Skin rash, scored the highest informant consensus factor of 0.973 followed by Wound (0.923), Malaria (0.916), Sudden sickness (0.909), Fibril illness (0.909), Tooth ache (0.909) and Cough (0.88) respectively (Table 7**)**. A high ICF value (0.973) indicates that the informants use relatively few taxa to manage specific disease conditions as well as consistency in the use of plant species, while a low value indicates that the informants disagree on the taxa to be used in the treatment within a category of illness. The lower informant consensus factor (0.88) in this study scored for the diseases Cough. This category may be indicative for lack of consistency in the use of plant species in the study area.

Threats to medicinal plants and conservation practices in the study area

Generally in connection to population growth Medicinal plants are at increasing risk from destruction of their habitats (agricultural activities, fire wood collection, collecting plants for construction, overgrazing by domestic animals, urbanization) and over-harvesting of known medicinal species the demand of woods, Agricultural expansion and urbanization are increased and thus have also significant effects for the threats to medicinal plants and associated knowledge of the study area.

The results of the present study showed that agricultural expansion, fuel wood (charcoal and firewood) collection were ranked 1st and 2nd factors respectively and these were followed by cutting for construction and urbanization in the 3rd and 4th places respectively as the major threats to the medicinal plants and by extension to the associated ethnomedicinal knowledge in the study area. The issue is being even more serious in the study area where such important information is not recorded in writing but passed on from one generation to the other by word of mouth.

Even though there are many problems facing medicinal plants, the local people of the study area know the importance of conserving the plants under both ex-situ and in-situ conservation methods, though the actual effort on the ground is minimal. For instance, some people and the District Agriculture Office have started conserving the plants by in-situ method (in their natural habitat), fence or in protected pasture lands, different places of worship (churches and mosques) in their farm fields or farm margins. Some local people are also conserving medicinal plants by ex-situ method by planting them in their home gardens. In the study area some cultural believes and traditional practices that associated with traditional medicines were found to contribute much to the conservation of medicinal plants in their natural habitat.

Discussion

Medicinal plant resources of the study area

The study area still maintains a good number (118) of medicinal plants and there are people who have the indigenous botanical and medicinal knowledge of the plants. The majority (85%) of these medicinal plants were reported for use in the treatment of human diseases while about 36% were used to treat livestock ailments. This is a good evidence to show that the local people of Minjar-Shenkora District, like local people in other parts of Ethiopia also use more medicinal plants to treat human diseases than those they have for treating livestock ailments. This is illustrated by the works of [37, 25, 29, 24].

Most of the medicinal plant species collected and identified in this study were also medicinally used in other parts of Ethiopia. For example, of the 118 medicinal plants collected from Minjar-Shenkora District 21 of them were reported by [14], 39 by [5] as medicinally important to cure human and livestock diseases. Such report on the use of these plants by different groups of societies in different areas could be attributed to different cultural groups which could validate the medicinal properties of these species. So, people of Ethiopia over wide area have the tendency to use the same medicinal plants as a result of the wider distribution of medicinal plants in the country and to a certain extent their efficacy.

Habitat of medicinal plants

Traditional medicinal plants harvested in the study area were from home gardens, crop field and in agricultural margin or field. Thus, the majority of medicinal plants are from wild vegetation. This result is in line with other studies [24] conducted in Ethiopia as well as in other countries [33] of the world.

Among the families that contributed more medicinal species were the Asteraceae, (9.3% of the total species) followed by Lamiaceae (8.5%) and Fabaceae (7.6%). This could be an indication that the study area consists of considerable diversity of plant species within these families in the same tone with the flora of the country where these families are among the few with the highest number of species that are widely distributed both in terms of their geographical and habitat spans. Research reports have also shown that these families have high contribution to the Ethiopian medicinal flora [6].

Growth forms of Medicinal plant

Plant categories grouped as shrubs came up with the highest (41%) and the most widely used growth form from which people of Minjar-Shenkora District prepare herbal remedies. This is in agreement with the studies of [30, 20, 7]. However, other findings [29, 24, 17] indicated that herbs were the most

frequently used plant categories based on data from their respective study areas.

Plant parts used, Preparation and route of administration of medicinal plants

Consistent with some other previous findings [24, 37, 18, 38], leaves were the most widely used plant parts for herbal medicine preparations. However, other findings [25, 4] reported different results which showed that that roots were the most frequently utilized plant parts in their respective research areas. According to [2], about 58.3% of traditional medicine is prepared from roots in Ethiopia. Utilization of leaves for drug preparation is important for conservation of medicinal plants since harvesting leaves may not cause detrimental effect on the plants compared to the root or whole plant collections [29, 24].

People of the study area prepare remedies, for human and livestock ailments, either from a single plant or plant part or by mixing them. The results of the present study showed that most of the medicinal plant preparations involved the use of a single plant species or a single plant part corresponding to each health problem. Similar findings were also reported for use of single plants or plant parts for a single health problem [24, 20, 1, 32]. This finding deviated from that reported by another researcher [29] who reported that 70% of the preparations of traditional medicine by indigenous people of Hawassa city were drawn from mixtures of different plants or plant parts and another work [36] also reported that local healers of Sokoru mostly used more than one plant species to prepare remedy for an ailment. Moreover, [24] indicated that healers used multiple plants in order to increase the strength and efficacy of the drug.

The medicinal plant preparations were applied through different routes of administration like oral, topical or dermal and nasal routes. Of these, oral application (54%) was the highest and most commonly used route of application followed by dermal application (29%). These results are consistent with the findings of various ethnobotanical researches in different areas of Ethiopia [37, 24, 20, 7, 17, 31]. Both the dominant routes of administration (oral and dermal) routes permit rapid physiological reaction of the prepared medicines with the pathogens and increase the curative power. This current finding fairly agrees with previous reports by [30, 7, 1]. In addition, informants reported that there are related restrictions to enhance rapid physiological reaction and to increase the curative powers of herbal remedies.

The predominant method of preparation in the study area reported to be used is the remedy preparation by crushing the plant parts. This finding agrees with the similar findings of [9, 32, 37, 24]. However, powdering was the most widely used method of preparation in Wonago Woreda as reported by [25].

Marketability of Minjar-Shenkora medicinal plants

Medicinal plants in the study area are not widely sold in the market for specific purpose of medicine. But there were medicinal plant species that mainly usually serve for the purposes of spicing foods, for firewood and construction. *Allium sativum* and *Olea europaea* ssp. cuspidate provide good evidence for this. Studies by [24, 32] had also reported similar findings.

Threats to medicinal plants

The indigenous people of the study area reported that medicinal plants were highly threatened by agricultural expansion and firewood collection. [17] reported that medicinal plants used by Zay people in the central rift valley of Ethiopia were highly threatened by deforestation for agricultural expansion. Generally, in connection to population growth the demand for wood material, agricultural expansion and urbanization are increased and thus have effects in threatening the medicinal plants and associated indigenous knowledge of the study area. The threats on the medicinal plant are among the major causes for the loss of the medicinal plant and ethnomedicinal knowledge. The other reason for the loss of the knowledge on medicinal plant is modernization and refusal to practice or inherit the knowledge by new generation. As reported by the informants, the expansion of modern health institutions, schools some environmental and cultural modifications were among the reasons for the loss of the knowledge on medicinal plants of the area. The study exposed that Minjar-Shenkora District is rich in medicinal plant diversity and associated indigenous knowledge. However, anthropogenic factors coupled with acculturation and very poor conservation efforts threaten medicinal plant survival in the area. Promoting a complementary in situ and ex situ conservation strategy for medicinal plants of the District is highly recommended.

Table 1: Medicinal plants used to treat Human diseases in Minjar-Shenkora District

Scientific name	Local name	Family	Hb	Ha	Part used	Preparation	Route	Disease Treated	V. No.
Achyranthes aspera L.	TELENGE	Amaranthaceae	H	W	L and S	Pounded, mixed in water and drunk and rubbed	Oral/Dermal	Sudden sickness	GA4
						Creamed on wounded part	Dermal	Wounds	
						powdered and applied on the affected part	Dermal	Skin rash (chiffe)	
Acmella caulirhizea Del.	YEMIDER BERBRIE	Asteraceae	H	W	L and F	Smashed and rubbed	Oral	Tonsillitis	GA68
Allium sativium L.	NECHSHINK URT	Alliaceae	H	C	Bu	Eat with Injera	Oral	Malaria	GA131
Aloe debrana Christian	ERET	Aloaceae	H	W	Sa	Cover the affected area	Anal	Hemorrhoids	GA129
						Creamed on affected part	Dermal	Ringworms	
Artemisia absinthium L.	ARITI	Asteraceae	H	C	WP	Powdered, mixed in water and drunk	Oral	Syphilis	GA130
Balanites	JEMO	Balanitaceae	Sh	W	R	Pounded and held	Oral	Toothache	GA32

aegyptiaca (L.) Del.						on teeth			
Calotropis procera (Ait) Ait. f.	KINBO	Asclepiadaceae	Sh	W	Sa	Drop on affected part	Anal	Hemorrhoid	GA59
Calpurina aurea (Ait). Benth.	DIGTA	Fabaceae	Sh	W	Fr	Crushed, Pounded and drunk	Oral	Diarrhea	GA12
Carica papaya L.	PAPAYA	Caricaceae	T	C	L	Powdered, boiled and taken with honey	Oral	Malaria	GA42
Catha edulis (Vahl) Forssk.ex Endl.	CHATE	Celactraceae	Sh	C	L	Crashed, boiled in water and the solution drunk	Oral	Intestinal parasite	GA45
Clematis hirsuta Perr.	YAZOHAREG	Ranunculaceae	Cl	W	L	Powdered and tied on affected part	Dermal	Swellings	GA138
Cymbopogon citratus (DC. ex)	TEJESAR	Poaceae	H	C	WP	Smashed, boiled in water and drunk	Oral	Stomachache	GA104
Cynoglossum geometrica Bak.	CHIGOGOTE	Boraginaceae	H	W	L	Crushed, powdered and applied on affected part	Dermal	Skin rush	GA43
Ehretia cymosa Thonn.	GAMIE	Boraginaceae	Sh	W	R and L	Powdered and put affected part or smoked as a cigarette	Oral	Tooth ache and Head ache	GA29
Eucalyptus globulus (Labill.)	NECHBAHIRZAF	Myrtaceae	T	C	L	Chopped, boiled and inhale the vapor	Nasal	Influenza	GA25
						Boiled and inhaled	Nasal	Fibril illness	
Foniculum vulgare Mill.	ENSILALE	Apiaceae	H	C	Wp	Powdered, boiled and drunk	Oral	Kidney disease	GA28
Kalanchoe Shimperiana A. Rich.	ENDAHAHULA	Crassulaceae	H	W	L	Heated and put on affected part	Dermal	Body swelling	GA36
Kanahia laniflora (Forssk.)	TIFERNDO	Asclepidaceae	H	W	Sa	Applied on affected part	Dermal	Ring worms	GA37
Lippia adoensis Hochst. ex. Walp.	KESSI	Lamiaceae	Sh	W	L and S	Powdered, mixed in coffee and drunk	Oral	Fibril illness and headache	GA88
Osyris quadripartita	KERET	Santalaceae	Sh	W	L	Powdered, mixed in water	Oral	Intestinal parasite	GA67
Ruta chalepensis L.	TENADAME	Rutaceae	Sh	C	L	Crushed, powdered and sniffed	Nasal	Evil eye	GA27
					Wp	Smashed, boiled in water and drunk	Oral	Tonsillitis	
					L	Powdered, mixed with coffee and drunk	Oral	Cough	
Rosa abyssinica	KEGA	Rosaceae	Sh	W	Fr	Powdered, mixed with water and drunk	Oral	Hypertension	
Rhus retinorrhoea Krauss	TLEM	Ancardaceae	Sh	W	R and L	Powdered, mixed in water and drunk the filtrate	Oral	Liver disease	GA86
Rumex nepalensis Spreng.	YEBERA MILASE	Polygonaceae	H	W	L	Powdered and put on affected part	Dermal	Wound	GA126
Salvia nilotica Jacq.	HULEGEB	Lamiaceae	H	W	L	Powdered and drunk	Oral	Fibril illness	GA22
Thymus schimperi Ronniger	TOSIGN	Lamiaceae	H	W	L	Powdered, mix with water and drunk	Oral	Cough	GA77
Urtica simensis Steudel	SAMA	Urticaceae	H	W	R and L	Powdered, mixed in water and drunk the filtrate	Oral	Gonorrhea	GA116
					Sa	Drunk the sap	Oral	Acute stomachache	
					Sa	Heated and put on	Dermal	Body	

						affected part		Swelling	
Zehneria scabra (L.f.) sand	HAREGRESA	Cucurbitaceae	Cl	W	L	Ground, powdered and drunk	Oral	Mitch	GA58
						Chewed and swallowed	Oral	Mich	

Hb=Habit, T=Tree, Sh=Shrub, H=Herb, Cl=Climber, Ha=Habitat, W=Wild, C=Cultivated, L=Leaves, R=Roots, Fr= Fruit, WP=Whole plant, S=Seed, Sa, Sap, V. No, Voucher Number

Table 2: Medicinal plants used to treat Livestock ailments in Minjar-Shenkora District

Scientific name	Local name	Family	Hb	Ha	Part used	Preparation	Route	Disease Treated	V. No.
Acokanthera schimperi (DC) Benth.	MERENZE	Apocynaceae	Sh	W	R	Pounded, mix in water and drunk	Oral	Rabies	GA66
Capparis cartilaginea Decne.	ANKORSA	Capparidaceae	Sh	W	L	Crushed, powdered and mixed with water	Oral	Cough of donkey	GA76
Euclea divinorum Hiern.	DEDEHO	Ebenaceae	Sh	W	L	Mix the powder in water and drunk	Oral	Sudden disease	GA61
Gladiolus candidus (Rendle)	MILAS GOALGULE	Iradaceae	Cl	W	R and L	Smashed and mix in water	Oral	Anthrax	GA125
Gossypium barbadense L.	TITE	Malvaceae	H	C	L	Powdered and mixed with water	Oral	Diarrhea	GA115
Inula confertiflora A. Rich.	WOJNAGIFT	Asteraceae	Sh	W	L	Powdered and mixed with water and applied oneye	Optical	Eye disease	GA93
Lagenaria siceraria (Molina) Standl	QEL	Cucurbitaceae	Cl	W and C	Fr	Mix with powder of teff and given	Oral	Rabies	GA83
Leucas abyssinica (Benth.)	ASHALE	Lamiaceae	Sh	W	L	Powdered and applied on affected part	Optical	Eye disease	GA52
Nicotina tabaccum L.	TINBAHO	Solanaceae	H	W and C	L	Powdered and smoked	Nasal	Cough	GA97
Premna shimperi Engle.	CHOCHO	Lamiaceae	Sh	W	L	Powdered, mixed in water and applied on affected part	Optical	Eye disease	GA94
Tragia cinerea (Fax.)	ALLEBLABIT	Euphorbiaceae	H	W	L	Powdered and mixed with water	Oral	Sudden disease	GA47

Hb=Habit, T=Tree, Sh=Shrub, H=Herb, Cl=Climber, Ha=Habitat, W=Wild, C=Cultivated, L=Leaves, R=Roots, Fr= Fruit, WP=Whole plant, S=Seed, Sa, Sap, V. No, Voucher Number

Table 3: Medicinal plants used to treat both human and livestock diseases in Minjar-Shenkora District

Scientific name	Local name	Family	Hb	Ha	Part used	Preparation	Route	DiseaseTreated	V. No.
Cicer arietinum L.	SHIMBRA	Fabaceae	H	C	Wp	Powdered, boiled and drunk	Oral	Malaria	GA64
						Smashed, mix in water and given for cattle	Oral	Leeches	
Croton macrostachyus Hochst	BISANA	Euphorbiaceae	Tr	W	Sa	Creamed on affected part	Dermal	Ringworms	GA7
Cynodon dactylon (L.)Pers.	SERDO	Poaceae	H	W	Wp	Crushed and rubbed on affected part	Dermal	Wound	GA114
Leonotis neptitolia (L.) R. Br.	RASKIMIRE	Lamiaceae	H	W	R and L	Powdered and tied on affected part	Dermal	Body swelling	GA71
						Pounded, mix in water and drunk	Oral	Fibril illness	
Lepidium sativum L.	FETTO	Brassicaceae	H	C	S	Mix the powder in water and drunk	Oral	Diarrhea and cough	GA31
					Fr	Crush, mix in	Dermal	Ringworms	

						water and put on affected part			
					L	Mix in water and drink the filtrate	Oral	Gonorrhea and syphilis	
					L	Grounded, mix in water and cream on wound	Dermal	Wound	
Steganotaenia araliacea Hochst.	YEJIB MIRKUZE	Apiaceae	Sh	W	L	Powdered and applied on wound	Dermal	Wound	GA135

Hb=Habit, T=Tree, Sh=Shrub, H=Herb, Cl=Climber, Ha=Habitat, W=Wild, C=Cultivated, L=Leaves, R=Roots, Fr= Fruit, WP=Whole plant, S=Seed, Sa, Sap, V. No, Voucher Number

Table 4: Medicinal plants traded in the local markets (many of them used primarily for non-medicinal purposes)

Scientific name	Local Name	Use
Allium sativum	NECH SHINKURT	Spice and food
Artemisia absinthium	ARITI	Spice
Brassica carinata	GOMENZER	Food
Brassica nigra	SENAFICH	Food
Catha edulis	CHAT	Stimulant
Capsicum annuum	KARIA	Spice
Cicer arietinum	SHIMBERA	Food
Citrus aurantifolium	LOMI	Food
Citrus sinensis	BIRTUKAN	Food
Coffea arabica	BUNA	Stimulant
Croton macrostachyus	BISANA	Fre wood
Cymbopogon citratus	TEJESARE	Fragrance
Echinops kebericho	KEBERCHO	Fragrance
Eucalyptus globulus	NECH BAHERZAFE	Construction, Firewood
Foeniculum vulgare	ENSILAL	Spice
Lepidium sativum	FETOO	Food
Linum usitatissimum	TELBA	Food
Lycopersicon esculentum	TIMATIME	Food
Nicotiana tobacum	TEMBAHO	Stimulant
Ocimum basilicum	BESOBLA	Spice
Olea europaea	WEYRA	Firewood, Construction
Rhamnus prinoides	GESHO	Beverage
Ruta chalepensis	TENADAME	Spice
Vicia faba	BAKELA	Food
Ziziphus mucronata	QURQURA	Food

Table 5: Total scores and ranks for direct matrix ranking of eight medicinal plant species

Plant species	Use categories								Total	Rank
	Medicine	Fence	Firewood	Construction	Shade	Tool	Charcoal	Fodder		
Clerodendrum myricoides	4	3	5	5	2	0	4	0	23	3rd
Croton macrostachyus	4	1	4	2	4	4	2	0	21	4th
Eucalyptus globuls	4	3	5	5	2	4	5	0	28	2nd
Hagenia abyssinica	1	2	3	4	3	5	1	0	19	5th
Olea europaea	3	2	3	5	4	5	4	5	31	1st
Phytolacca dodecandra	4	0	2	3	1	0	5	0	15	6th
Pterolobium stellatum	1	0	4	4	2	0	3	0	14	7th
Ziziphus abyssinica	4	1	4	0	2	0	3	0	14	7th

Table 6: List of medicinal plants and the corresponding informants' citations

Scientific name	Local name	Citation	Percentage
Solanecio gigas	SHEKOKO GOMEN	54	67.50
Vernonia amygdalina	GIRAWA	52	65.00
Clerodendrum myricoides	MISIRCH	50	62.50
Cucumis ficifolius	YEMEDER EMBWAYE	49	61.25
Calpurnia aurea	DIGETA	48	60.00
Croton macrostachyus	BISANA	45	53.75
Solanium incanum	ZERECH EMBOYE	42	52.50
Ocimium lamifolium	DAMAKESSIE	40	50.00
Calotropis procera	KINBO/TOBIAW	39	48.75
Achyranthes aspera	TELENGE	38	47.50
Salvia nilotica	HULGEB	33	41.25

Allium sativum	NECH SHINKURT	32	40.00
Asparagus africanus	YESET KESTE	31	38.75
Phytolacca dodecandra	ENDODE	27	38.00
Eucalyptus globule	NECHBAHER ZAFE	29	36.25
Datura stramonium	ASTENAGIR	28	35.00
Ruta chalepensis	TENADAM	26	32.50
Acokanthera schimperi	MERENZE	24	30.00

Table 7: Results of Informants consensus factors (ICF) values for more prevalent health problems of the District (emic-etic categories)

Category	List of plant species used and number of citation in the bracket	Total number of species	Total no. of citation	ICF
Wound	*Achyranthes aspera* (12), *Rumex nepalensis* (8), *Steganotaenia araliacea* (11), *Lepidium sativum* (14), *Cynodon dactylon* (6)	5	53	0.923
Sudden sickness	*Euclea divinorum* (8), *Achyranthes aspera* (15), *Kalanchoe Shimperiana* (9), *Urtica simensis* (8), *Tragia cinerea* (5)	5	45	0.909
Fibril illness	*Eucalyptus globulus* (10), *Lippia adoensis* (8), *Salvia nilotica* (8), *Leonotis neptitolia (*8)	4	34	0.909
Malaria	*Allium sativium* (10), *Carica papaya* (11), *Cicer arietinum* (4)	3	25	0.916
Cough	*Capparis cartilaginea* (5), *Ruta chalepensis* (9), *Thymus schimperi* (3), *Nicotiana tabaccum* (9)	4	26	0.880
Skin rash	*Cynoglossumn geometricum* (15), *Achyranthes aspera* (24)	2	39	0.973
Tooth ache	*Balanites aegyptiaca* (8), *Ehretia cymosa* (4)	2	12	0.909

Conclusion

Minjar-Shenkora District is relatively rich in medicinal plant diversity. IK is found to be distributed unevenly both within the communities and in the study areas as a whole. Only few of them are specialists, and majority of the local people are generalists. Localities far from the main road/modern healthcare are highly dependent on use of traditional medicine. Ninety (76.27%) species of the medicinal plants were collected from the wild whereas 25(21.18%) were from cultivated areas. Oral administration (54.21%) was found to be the dominant route of remedy administration. The medicinal plant species documented from the study area have also other uses including as firewood, construction and production of charcoal. Plant categories grouped as shrubs came up with the highest (41%) and the most widely used growth form from which people of Minjar-Shenkora District prepare herbal remedies. Leaves were the most widely used plant parts for herbal medicine preparations. Traditional medicine preparation mostly involves single plant; the mode of administration is mainly internal in which oral administration is the common route.

Most of these plants are found under threats in the study area, which is one of the main reasons for the decline of the associated knowledge. The main threat for medicinal plants in the area arises from agricultural expansion, firewood, charcoal production, urbanization and construction. Threat comes to medicinal plants due to the utilization of these plants for medicinal purpose is negligible. Whereas threats that erode indigenous knowledge emanate from secrecy, oral based knowledge transfer, and reluctance of young generation to gain the knowledge, the expansion of modern health institutions, influence of modern education and awareness factors are the major ones. Therefore, awareness rising should be made among the healers to avoid erosion of the indigenous knowledge and to ensure its sustainable use. Further biological studies should also be conducted on the reported medicinal plant species of the study area so as to utilize them in drug development.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

All the Authors made substantive intellectual contributions to this study in data collection, identification of plants, preparation and editing of the manuscript and proof reading.

Acknowledgments

We are very much grateful to Minjar-Shenkora District administration, agriculture department and development agents for their cooperation in allowing us to carry out the study. Our special gratitude goes to informants of the study area for their willingness to supply relevant responses to the questions. We are very much grateful to Etenesh Kinfe for typing the paper. We also gratefully acknowledge the financial support provided by Addis Ababa University.

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