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Ethnobotanical study of medicinal plants used to treat human diseases in Gura Damole District, Bale Zone, Southeast Ethiopia

BEHAILU ASSEFA[1], MOA MEGERSA[1,♥], TILAHUN TOLOSSA JIMA[2]

[1]Department of Biology, School of Natural Science, Maddawalabu University. P.O. Box 247, Robe, Ethiopia. ♥email: moamegersa78@gmail.com
[2]Department of Biology, College of Natural and Computational Sciences, Ambo University. P.O. Box 19, Ambo, Ethiopia

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Abstract. *Assefa B, Megersa M, Jima TT. 2021. Ethnobotanical study of medicinal plants used to treat human diseases in Gura Damole District, Bale Zone, Southeast Ethiopia. Asian J Ethnobiol 4: 42-52.* Many countries, including Ethiopia, use medicinal plants for their primary health care system. Plants have been used as a source of medicine to treat human diseases in Ethiopia. This study aimed to document medicinal plants to treat various human diseases in southeast Ethiopia's, the Gura Damole District of Oromia Regional State. Ethnobotanical survey of medicinal plants was carried out from August 05 to November 06, 2019. A total of 90 informants were selected to collect ethnobotanical information from 6 kebeles. Ethnobotanical data were collected using semi-structured interviews, focus group discussions with informants, and field observation. Various ethnobotanical ranking indices were used to analyze the importance of some plant species. A total of 30 medicinal plants belonging to 21 families were identified. These medicinal plants comprised shrubs (36.6%), trees (26.6%), herbs (23.3%), and lianas (13.3%). The plant families with the highest medicinal plants in the study area used for various diseases treatment were Asteraceae and Solanaceae (3 species each). Leaves (46.7%) were the dominant plant part used to prepare remedies, followed by roots (36.7%). Powdering (50%) and oral route of administration (59%) were commonly mentioned methods of preparation and administration, respectively. *Carissa spinarum* was the most preferred medicinal plant to treat evil eyes and is also ranked highest as the preferable medicinal plant for various purposes. Although the current study revealed the existence of indigenous knowledge of medicinal plants to treat human diseases, agricultural expansion became the primary threat to medicinal plants. Hence, different conservation methods should be applied to conserve those mostly preferred and frequently used medicinal plants for various purposes.

Keywords: Gura Damole, indigenous knowledge, medicinal plants, preparations, traditional medicine

INTRODUCTION

People in many parts of the world use medicinal plants as traditional treatments for various human ailments (Palombo 2011). According to the World Health Organization, between 65% and 80% of the world's population use medicinal plants as remedies (WHO 2011). The use of traditional medicine continues to expand rapidly across the globe (Kumar et al., 2013). According to the WHO, around 21,000 plant species can potentially be used as medicinal plants (Lucy and Edgar 1999).

In Africa, up to 80% of the population relies on medicinal plants for primary healthcare (WHO 2002). The population's dependence on traditional medicine is linked with poverty, inadequate health services, and a shortage of drugs (Birhan et al., 2011; Agbor and Nidoo, 2015). Local people of Ethiopia use traditional medicinal plants to get relief from numerous diseases. Nearly 80% of the Ethiopian population use traditional remedies, of which about 95% of the preparations are of plant origin (Abebe et al. 2001). To assess the medicinal values of these plants, various ethnobotanical studies have been conducted in Ethiopia. Most of the studies were carried out in the Oromia, South Nation and Nationalities of Peoples (SNNP), and Amhara regions (Alebie et al. 2017; Muluye and Ayicheh 2020). However, the reported medicinal plants are still minimal compared with Ethiopia's multi-cultural and floral diversity (Bekele and Reddy 2015; Chekole 2017). The ethnomedicinal knowledge varies even in the same ethnic group as various authors reported different medicinal plants and use. For instance, in the Oromo ethnic group of Ethiopia, other research groups said diverse use of medicinal plants to cure their ailments. Among the studies on medicinal plants used for human diseases treatment in the Oromia region include; Lulekal et al. (2008) in Mana Angetu district, Demie et al. (2018) in Dirre Sheik Hussen, Jima and Megersa (2018), Barbare district, Yineger and Yewhalaw (2007) in Sokoru district.

These studies reported a remarkable number of medicinal plants used by local communities for their primary healthcare. However, the disinterest of the young generation in indigenous knowledge, various threats, and minimal effort of conservation became significant concerns of medicinal plants (Yineger and Yewhalaw 2007; Jima and Megersa 2018). The knowledge of medicinal plants is transferred orally, and essential information on plants is discarded in the process (Kassa et al. 2020).

Like other communities living in different parts of Ethiopia, local people living in Gura Damole District use many plant species in human disease treatments. However, the knowledge vanished before proper documentation, as various studies evidenced. Therefore, the first objective of this research was to document medicinal plants and associated indigenous knowledge of the local people of the

Gura Damole district. Second, the study aimed to assess threats to medicinal plants of the study area. The findings of this study may serve as a stepping stone for further phytochemical and pharmacological studies.

MATERIALS AND METHODS

Description of the study area

From August 5 to November 6, 2019, the study was conducted in Gura Damole District, Bale Zone, Oromia Regional State, Southeast Ethiopia. Gura Damole district (07°05' N and 40° 12'E) is located about 575 km from the capital city, Addis Ababa. The district possesses a total population of 38,125, of whom 19,479 are male and 18,646 female (CSA 2007). The altitude range is 900 to 2200 m a.s.l Gura Damole District Agricultural Office (GDDAO 2019). The annual mean temperature and rainfall are 22 °C, and 1600 mm, respectively. Gura Damole district possesses two major rainy seasons: autumn (‘Arfasa’) in Afaan Oromo, which extends from September to February, and winter (‘Genna’) from March to August, covering 60 and 40% respectively. The dominant vegetation types in the area are trees, shrubs, and herbaceous species. The predominant tree species include *Acacia abyssinica*, *Cordia Africana*, *Croton macrostachyus*, *Erythrina brucei*, *Hagenia abyssinica*, and *Juniperus procera*. The livelihood of the local people in the study area depends on mixed farming, but pastoralism predominates over crop production. The typical domestic animals are Camel, Cattle, Goat, and Donkey. The study was carried out in six kebeles selected from 15 rural kebeles of the district based on the availability of traditional healers, agro-climatic zone, recommendation from older people, and local authorities. The six kebeles selected were ‘Sado Werke, ‘Raytu, ‘ ‘Shabo Retebo, ‘ ‘Engoye ilani‘,‘Yedi‘ and ‘Jibri‘ (Figure 1).

Sampling methods and techniques for informants’ selection

A total of 90 respondents (72 male and 18 female) were selected using a random sampling technique from the six study sites. Out of 90 respondents, 12 key informants were systematically selected based on the recommendation of knowledgeable elders, local authorities, and developmental agents. Moreover, they were selected based on particular informants’ explanations during an interview. The ages of the informants were between 18 to 60 years.

Ethnobotanical data collection methods

The standard ethnobotanical data collection methods (Martin 1995; Alexiades 1996; Cotton 1996) were used to document medicinal plant knowledge of the local community. Various data collection tools were used for data collection. Semi structured interviews were undertaken based on the questions prepared in English and translated to the local language (Afaan Oromoo). The data were carefully documented during an interview with participants. The checklist includes medicinal plants, informants’ use to treat human diseases, the plant parts used, the preparation of the remedy, method of administration, and uses other than medicine.

Field observations were performed with the help of key informants on the habit and habitat of medicinal plants. Before the data collection, the consent letter was taken from Madda Walabu University. Before collecting any data, informants’ willingness was asked to participate in the study, and via their oral consent, all data were gathered.

Key informants checked the local names of the voucher specimens of medicinal plants. The pressed and collected specimens were identified by comparing them with already identified specimens in a mini herbarium of Madda Walabu University. Various volumes of the Flora of Ethiopia and Eritrea (Bekele-Tesemma 2007; Edwards et al. 1995; 1997; 2000; Fichtl and Admasu 1994; Hedberg and Edwards 1989, 1995; Hedberg et al. 2004, 2006) were also used in the identification of the collected specimens.

Data analysis

Descriptive statistical tools such as percentage and frequency were used to analyze and summarize data on medicinal plants, their uses, and other related information using MS Excel 2010. Moreover, these ethnobotanical data were analyzed using informant consensus, preference ranking, direct matrix ranking, and Jaccard’s similarity coefficient.

Preference ranking

Preference ranking was conducted for five important medicinal plants to treat evil eyes. The 12 key informants were participated in this exercise to identify the best preferred medicinal plants for the treatment of the evil eye following Martin’s (1995) procedures. The highest value was given to the medicinal plant thought to be the most effective in treating the evil eye (5), while the lowest was given to the least effective plant (1). The value of each species was summed up, and the rank was calculated for each species based on the total ranking.

Direct matrix ranking

Direct matrix ranking was employed following Cotton’s (1996) procedures to compare various importance of a particular plant species based on information gathered from key informants, several multipurpose species were selected out of the total medicinal plants, and use diversities of these plants were listed for eight randomly selected key informants to assign use values to each species. The usage values (5=best, 4=very good, 3=good, 2=less used, 1=least used, and 0= not used) were allocated to each selected vital informant. Then, the values for each species were summarized and ranked. Key informants chose these medicinal plants.

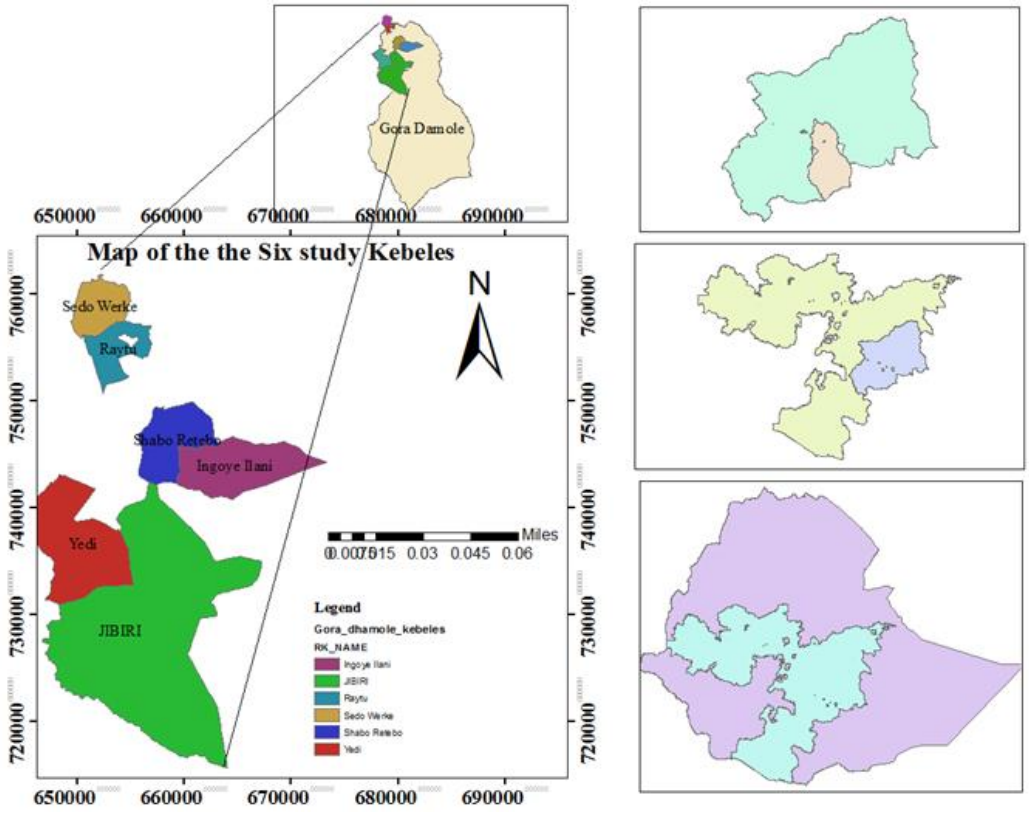

Figure 1. A map showing the study sites (kebeles) along with their District, Zone, Region in the Country, Ethiopia

Jaccard's coefficient of similarity (JCS)

JCS was measured to determine the composition of medicinal plant species and degrees of similarity between different areas. The similarity values were determined between the Gura Damole district and ethnobotanical studies conducted in other regions in different parts of Ethiopia. JCS expressed as follows: JCS = c/(a + b + c), where a is the number of species of sample a site, b the number of species of sample b site, and c is the number of species common to a and b sites (Kent and Coker 1992).

RESULTS AND DISCUSSION

Medicinal plants diversity of Gura Damole district

A total of 30 medicinal plant species belonging to 21 families were recorded in the study area (Table 1). Asteraceae and Solanaceae (3 species each) were the leading plant families, followed by Cucurbitaceae, Euphorbiaceae, Fabaceae, and Lamiaceae (two species each). In contrast, each of the remaining families was represented by one species. Among the reported medicinal plant species, *Olea europaea* subsp. *cuspidata*, *Solanum incanum*, and *Vernonia amygdalina* were used to treat more than one disease frequently. Among the most commonly used plants were: *Carissa spinarum* (cited by 20 informants), *Silene macrosolen* (12 informants), *Withania somnifera* (11 informants), *Embelia schimperi* (10 informants), and *Bidens pilosa (*8 informants) are some to mention.

The study also identified four growth forms of medicinal plants used to treat human diseases. These growth forms include shrubs (11 medicinal plants), trees (8 medicinal plants), herbs (7 medicinal plants), and 4 lianas (Figure 2).

Medicinal plant parts used

According to the informants' report in the study area, leaves (46.7%) were the dominant part of preparing traditional medicine. The other plant parts used were roots (36.7%), seeds (10%), and stems (6.6%) (Figure 3).

Methods of preparation, conditions, and routes of administration

In the study area, the most common methods of preparation of traditional medicine from plant material were powdering (50%), followed by crushing (22%) **(**Figure 4A). Medicinal plants were administered through different ways, such as oral, dermal, optical, and nasal. The most commonly used way was oral (59%), followed by dermal (20.6%) (Figure 4B). Informants of the study area also reported that medicinal plants mainly harvested were fresh (60%), whereas the remaining (40%) were used in a dry form to treat human diseases.

Table 1. List of medicinal plants for treating human diseases in the study area, Gure Damole district, Ethiopia

Local name	Scientific name (Voucher number)	Family	Habit of the plant	Disease treated	Parts used	Method of preparation	Method of administration
Hagamsa	*Carissa spinarum* L. (BA 01)	Apocynaceae	Shrub	Evil spirit and eye	Root	Drying the bark of the root and grinding	Fumigating the smoke and rubbing the medicine on the body of the filled person
Hiddii	*Solanum incanum* L. (BA 11)	Solanaceae	Shrub	stop bleeding from cutting part of human organ	Leaf	Cutting and crushing the leaf	Put the crushed leaf on the bleeding part
				Sudden stomach ache	Root	Chewing the bark of the root	Chewing and swallowing the liquid
Hancotee	*Cucumis ficifolius* A. Rich. (BA 30)	Cucurbitaceae	Herb	Sudden stomach ache	Root	Drying and crushing the root	Mixing with water and drinking
Ulaagaa	*Ehretia cymosa* Thonn. (BA 07)	Boraginaceae	Tree	Fibril illness	Leaf	Cut the leaf	Rubbing the liquid of the leaf on the affected area
Maxxannee	*Bidens pilosa* L. (BA 27)	Asteraceae	Herb	Snake poison	Root, leaf	Chewing the leaf	Put on the bitten part
Hargiisaa	*Aloe pubescens* Reynolds (BA 15)	Aloaceae	Herb	Headache	Stem	Boiling the juice of the plant with milk	Simply drinking the liquid
Hanquu	*Embelia schimperi* Vatke. (BA 18)	Myrsinaceae	Liana	All stomach disease and parasite	Seed	Drying and grinding the seed, make powder and mix with water	Simply drinking
Unso	*Withania somnifera* (L.) Dun. (BA 04)	Solanaceae	Shrub	Evil eye and sprit	Root	Drying, grinding, making powder	Fumigate, washing the body with the prepared powder
Waggartii	*Silene macrosolen* Steud. ex A. Rich. (BA 16)	Caryophyllaceae	Herb	Evil eye and sprit	Root	Drying, grinding, and making powder	Fumigate, rub on the body, wash the body with the medicine
Ejersa	*Olea europaea* subsp. *cuspidata* L. (BA 22)	Oleaceae	Tree	Influenza and fibril illness	Leaf	Cutting the leaf	Simply chewing the leaf
Bakkanniisa	*Croton macrostachyus* Hochst. ex Del. (BA 21)	Euphorbiaceae	Tree	Gonorrhea	Root	Drying, grinding, and making powder and mix with water	Drinking
Roque	*Tamarindus indica* L. (BA 12)	Fabaceae	Tree	Stomach disease	Seed	Mixing the seed with water	Drinking the liquid part of the seed
Harmallaa	*Gomphocarpus integer* A. Rich. (BA 10)	Asclepiadaceae	Herb	Liver disease	Root	Drying, grinding	Boiling and drinking
Waatoo	*Osyris quadripartita* Salzm. ex Decne (BA 17)	Santalaceae	Shrub	Cold	Root, stem	Drying, grinding, making a powder	Fumigate to the filled person
Daboobeessaa	*Rhus vulgaris* Meikle (BA 03)	Anacardiaceae	Tree	Urination problem	Leaf	Cutting fresh leaf	Chewing the fresh leaf
Goraa	*Rubus steudneri* Schweinf. (BA 08)	Rosaceae	Shrub	Stomach disease	Root	Drying, grinding, make a powder, and mix with water	Boiling and drinking
Daamaakasee	*Ocimum gratissimum* L. (BA 29)	Lamiaceae	Shrub	Fibril illness	Leaf	Cut and crush the fresh leaf	Rubbing on the affected body
Tamboo	*Nicotiana tabaccum* L. (BA 19)	Solanaceae	Herb	Evil eye and sprit	Leaf	Drying, grinding, making a powder	Fire and fumigate
Raafuuosolee	*Solanecio angulatus* (Vahl) C. Jeffery (BA 06)	Asteraceae	Herb	Evil eye and sprit	All parts of the plant	Drying, grinding, making a powder	Boil with oil and drinking, rubbing on the body

Qadiidaa	*Rhamnus staddo* A.Rich. (BA 20)	Rhamnaceae	Shrub	Hepatitis	Leaf	Drying, grinding, making a powder	Boil with water and drinking
Birbirsa	*Podocarpus falcatus* L. (BA 25)	Podocarpaceae	Tree	Eye infection	Leaf, bark	Powdering	Mixing with water and drinking
Qobboo	*Ricinus communis* L. (BA 13)	Euphorbiaceae	Shrub	Rabies	Seed and Leaf	Drying, grinding, making a powder	Mixing with water and drinking
Urgeessaa	*Premna schimperi* Engl. (BA 23)	Lamiaceae	Shrub	Teeth infection	Leaf	Cut and crush Fresh leaf	Put the medicine on the infected teeth
Baargamoo	*Eucalyptus globulus* Labill. (BA 24)	Myrtaceae	Tree	Stomach diseases	Leaf	Drying, grinding makes a powder	Mixing with water and drinking
Gaaleexaruu	*Coccinia grandis* (L.) Voigt (BA 09)	Cucurbitaceae	Liana	All disease problems inside the	Root	Drying, grinding, making a powder	Mixing with water and drinking
Ebicha	*Vernonia amygdalina* Del. (BA 14)	Asteraceae	Tree	Headache and eye disease	Leaf	Drying, grinding, making a powder	Fumigate the smoke within the mouth and nose
Ittacha	*Dodonaea angustifolia* (L. Fil.) J.G.West (BA 28)	Sapindaceae	Shrub	Eye disease	Leaf	Cut and crush a fresh leaf	Drop the liquid of the leaf on the infected eye
Handoodee	*Phytolacca dodecandra* L'Her. (BA 26)	Phytolacaceae	Liana	Stomach disease problem	Root	Cutting fresh root	Chewing the root
Laaleessaa	*Rubia cordifolia* L. (BA 05)	Rubiaceae	Liana	Sex problem in males	Root	Drying, grinding, making powder, and mixing with water	Drinking
Ceekataa	*Calpurnia aurea* (Aith.)Benth. (BA 02)	Fabaceae	Shrub	Stomach disease and Amoeba	Leaf	Cut and crush the fresh leaf and squeeze the liquid	Drinking the leaf juice

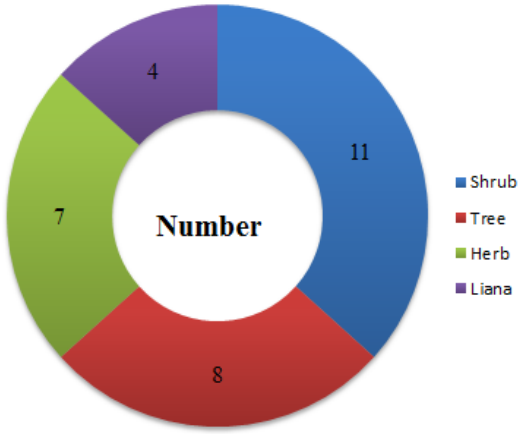

Figure 2. Growth forms of reported medicinal plants

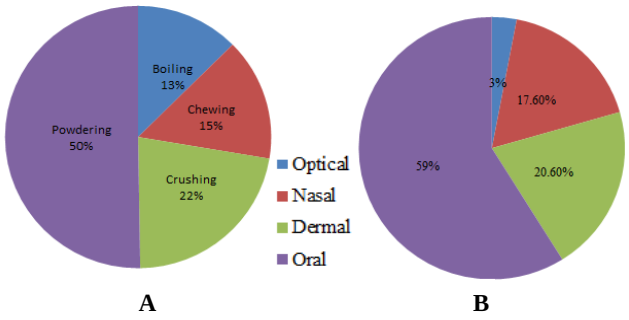

Figure 4. Medicinal plants of Gura Damole district. A: Method of remedy preparation, B: Route of administration.

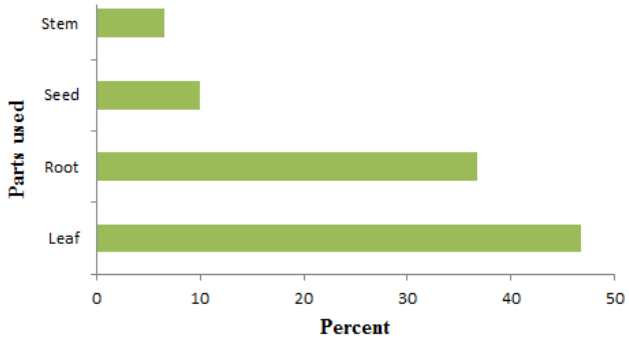

Figure 3. Plant parts used for human ailments treatment in Gura Damole district, Ethiopia

Common human diseases treated by medicinal plants in the study area

About 16 diseases were identified from the study area that medicinal plants locally treated. Moreover, this study determined that a single illness could be cured by more than one medicinal plant, and a single medicinal plant could be utilized to cure more than one disease. For instance, stomachache is a significant disease and can be treated by 8 medicinal plants (Table 2).

Preference ranking

Twelve key informants were asked to compare five medicinal plants based on their knowledge of medicinal plants to treat evil eyes. A score of 5 was assigned to the most effective medicinal plants and one to the least effective medicinal plants. *Carissa sapinarum* was ranked as the preferable medicinal plant for evil eye treatment, followed by *Solanecio angulatus* (Table 3).

Direct matrix ranking

Among the medicinal plants reported by the informants, medicinal plant species have multipurpose use. Key informants first identified six medicinal plants used by the local people for different purposes, including firewood, charcoal production, construction, and food. Application of direct matrix ranking to these species showed that *Carissa spinarum* was the best, followed by *Eucalyptus globulus* and *Croton macrostachyus* (Table 4).

Jaccard's similarity index

The highest similarity between the Gura Damole district and Barbare and Gindeberet district (14%) was noticed in the composition of medicinal plants. In contrast, the degree of similarity was lower with Yalo district (3.7%) (Table 5).

Threats to medicinal plants

Based on the discussion with informants, various factors were reported as primary threats to medicinal plants. Accordingly, the significant factors reported according to their severity were agricultural expansion, charcoal, firewood collection, drought, overgrazing, and recurrent fire.

Table 3. Preference ranking values of nine medicinal plants used to treat evil eye in the study area

Scientific name	Key informants labeled A to L												Total	Rank
	A	B	C	D	E	F	G	H	I	J	K	L		
Carissa spinarum	2	5	1	3	1	1	2	4	2	2	1	0	24	1
Nicotiana tabaccum	3	1	3	2	1	2	0	1	5	3	0	0	21	3
Silene macrosolen	4	2	0	1	2	0	2	2	0	0	2	0	15	4
Solanecio angulatus	5	3	3	4	0	2	1	0	1	1	0	2	22	2
Withania somnifera	2	0	2	2	0	0	2	1	0	1	2	1	13	5

Table 4. Direct matrix ranking of eight multipurpose medicinal plants (Average score of 8 key informants)

Plant species	Respondents (n = 8)					Total	Rank
	A	B	C	D	E		
Carissa spinarum	5	3	2	0	4	14	1
Croton macrostachyus	3	4	3	2	0	12	3
Embelia schimperi	2	0	0	1	5	8	4
Ehretia cymosa	1	1	1	2	1	6	6
Rubus steudneri	2	2	0	0	3	7	5
Eucalyptus globulus	3	4	1	5	0	13	2

Note: A: Medicine, B: Firewood, C: Charcoal, D: Construction, E: Food

Table 2. Human ailments that medicinal plants in Gura Damolthe e district can treat

Ailments treated	No. of medicinal plants
Stomachache	8
Evil spirit	5
Eye infection	4
'Mitch'	3
Headache	2
Hepatitis	2
Bleeding	1
Toothache	1
Amoeba	1
Gonorrhea	1
Influenza	1
Sexual impotence	1
Flu	1
Rabies	1
Urine problem	1
Snake poison	1

Discussions

In the present study, 30 medicinal plant species were identified to treat human diseases, distributed across 21 families. From the 21 plant families, Asteraceae and Solanaceae (10% each) were the major contributing species, followed by Cucurbitaceae, Euphorbiaceae, Fabaceae, and Lamiaceae (6.6% each). Similar to our findings, various studies in Ethiopia (Yohannis et al. 2018; Tesfaye et al. 2020; Teka et al. 2020) and elsewhere globally (Hachlafi et al. 2020) have reported Asteraceae as the most dominant medicinal plant family. In contrast, other studies found that Fabaceae (Kidane et al. 2018; Tefera and Kim 2019), Euphorbiaceae (Jima and Megersa 2018), and Lamiaceae (Kefalew et al. 2015; Tamene et al. 2020) were dominant over others.

This study shows that the most represented life forms of medicinal plants in the study area were shrubs followed by trees. Similar results were also indicated in the earlier ethnobotanical studies conducted in Ethiopia. For instance, the survey conducted by Hunde et al. (2006) in the Boosat subdistrict reported 46% shrubs and 25% herbs, whereas; the study conducted by Yineger and Yewhalaw (2007) in Sekoru district documented 37% of shrubs. The more recent studies conducted by Demie et al. (2018), Jima and Megersa (2018) also reported the dominance of shrubs for the preparation of traditional medicines. However, other findings (Tefera and Kim 2019; Kassa et al. 2020, Pradhan et al. 2020) indicated that herbs were the most frequently used plant categories. The dominance of shrubs and herbs for medicinal plant preparation could be explained in two ways. In one way, the supremacy of shrubs for human diseases treatment could be due to their availability throughout the year and their relative capability of resisting drought that could aid in extensive uses (Maroyi 2011). In another way, the dominance of herbaceous species could be related to the fact that they are easily accessible in nearby areas than trees and shrubs (Lulekal et al., 2013).

The present study results showed that the local people of the Gura Damole district use different parts of medicinal plants to prepare remedies. Leaves were the most widely used part to treat human ailments in the study area. Either roots or leaves are reported as the dominant plant parts used to prepare traditional medicine in Ethiopia and elsewhere in the world. On the one hand, the leaves were a widely used medicinal plant part used to treat human ailments in Ethiopia (Tesfaye et al. 2020; Kassa et al. 2020) and other countries (Wet et al. 2010; Hachlafi et al. 2020; Pradhan et al. 2020; Wanjohi et al. 2020). On the other hand, (Mesfin et al. (2009) and Kefalew et al. (2015) reported that the roots were widely used plant parts. Various authors stressed that using roots for traditional medicine preparation could have a detrimental impact on plant species. A study by Kassa et al. (2020) revealed that *Echinops kebericho*, whose root is highly marketable in local markets of the Sheka zone, is affected.

Most of the medicines (60%) were prepared in the study area from fresh plant materials. Similar findings were also recorded in different studies from other parts of Ethiopia (Jima and Megersa 2018; Tefera and Kim 2019; Kassa et al. 2020). The preference for fresh plant parts is related to the efficacy of medicinal plants in treating diseases compared with dried parts (Kassa et al. 2020). The utilization of fresh plants or plant parts could have a detrimental impact on plants through systematic collection compared to dried pieces. Once the plant part is collected and dried, it can be used for later use; however, local people made minimal efforts in storing dried plant material for later use, as reported in the results of Kassa et al. (2020).

About 59% of the medicines in the area were administered orally. In similar studies, other researchers reported oral administration of medicine as the leading route of application (Demie et al. 2018; Kassa et al. 2020). This finding could indicate internal ailments are common

in the study area. However, researchers recommend that care be given while taking the remedy, as overdosage could cause severe internal problems (Chekole 2017; Kassa et al. 2020). Dermal application of traditional medicine as the dominant way was also reported by Giday et al. (2009) and Tesfaye et al. (2020).

Jaccard's similarity index indicated some similarity in the composition of medicinal plants between the study area and the Gindeberet district (Zerabruk and Yirga 2012) and Barbare district Jima and Megersa (2018). In contrast, less similarity was found between Yalo district (Teklehaymanot 2017) and Jigjiga town (Alebie and Mohamed 2016). The similarity and dissimilarity between the present study and other districts could be due to cultural and agroclimatic conditions, as Tefera and Kim (2019) stated.

According to the responses from informants, the leading causes of the loss of medicinal plants in the study area were agricultural expansion, charcoal, firewood collection, drought, overgrazing, and recurrent fire. Similar to the present finding, other studies on threats to medicinal plants in Hawassa Zuria district, Tefera and Kim (2019), indicated agricultural expansion is the primary threat to medicinal plants.

Comparison with previous ethnobotanical studies conducted in Ethiopia

Medicinal plant species used most frequently to treat human diseases in this study were searched in Ethiopia's published similar research works (Amsalu et al. 2018; Tefera and Kim 2019, Tamene et al. 2020). From this review, medicinal plant species used by communities of the Gura Damole district are likely to be found in other parts of Ethiopia. Medicinal plants such as *Carissa spinarum*, *Cucumis ficifolius*, *Withania somnifera*, *Embelia schimperi*, *Ehretia cymose*, and *Ocimum gratissimum* had similar uses with other studies, and *Croton macrostachyus*, *Bidens pilosa*, *Solanum incanum*, and *Gomphocarpus integer* had different functions (Table 6).

The present study documented 30 medicinal plants and their uses for human ailments treatment. Medicinal plants could treat Sixteen human ailments of the Gura Damole district, where a single medicinal plant was reported to treat more than one ailment. On the other hand, a single disease could be treated by more than one medicinal plant, as evidenced in the study. Shrubs were found to be the dominant growth form of medicinal plants used to prepare traditional remedies and followed by Trees. Leaves were the most frequently used plant parts of preparing traditional remedies. The study also indicated that local communities preferred medicinal plants over others, probably due to their efficacy. In this regard, *Carissa spinarum* is considered the best selected medicinal plant to treat evil eyes. The therapeutic activity of some medicinal plants reported in the study area also had a similar function with other study areas. Hence, future phytochemical and pharmaceutical investigations could consider such plants in fighting against human ailments, including emerging and pandemic diseases.

Table 5. Jaccard Index of similarity of the present study area across different districts inside Ethiopia

Study areas (districts)	Species no. (a or b)	Common species (c)	Jaccard index	References
Gura Damole district	30	-	-	*This study*
Barbare district	70	14	14	Jima and Megersa (2018)
Sekoru district	27	5	8.7	Yineger and Yewhalaw (2007)
Gindeberet district	26	8	14.2	Zerabruk and Yirga (2012)
Dirre Sheik Hussen	78	11	10.2	Demie et al. (2018)
Mana Angetu district	208	22	9.2	Lulekal et al. (2008)
Dhera town	73	12	11.6	Wondimu et al. (2007)
Gubalafto district	135	17	10.3	Chekole (2017)
Gozamin district	91	14	11.5	Amsalu et al. (2018)
Dega Damot	60	9	10	Wubetu et al. (2017)
Dek island	60	9	10	Teklehaymanot (2009)
Yalo district	103	5	3.7	Teklehaymanot (2017)
Bench community	35	3	4.6	Giday et al. (2009)
Hawassa Zuria district	97	14	11	Tefera and Kim (2019)
Meinit ethnic	51	8	9.8	Giday et al. (2009)
Amaro district	56	8	9.3	Mesfin et al. (2014)
Boricha district	38	5	7.3	Tamene et al. (2020)
Asgede Tsimbila district	65	9	9.5	Zenebe et al. (2012)
Alamata district	25	3	5.4	Yirga (2010)
Jigjiga town	46	3	4	Alebie and Mohamed (2016)
Mandura district	60	5	5.5	Mengesha (2016)
Berta ethnic	40	4	5.7	Flatie et al. (2009)

Table 6. Diseases treated by medicinal plants in this study and other study areas

Rank	Medicinal plants	Diseases treated	References
1	*Carissa spinarum* L.	Evil spirit	*This study*
		Wound, evil spirit	Tefera and Kim 2019
2	*Croton macrostachyus* Hochst. ex Del.	Gonorrhea	*This study*
		Hook worm, tinea cor.	Demie et al. 2018
		Malaria	Chekole 2017
		Stomachache, malaria	Amsalu et al. 2018
3	*Withania somnifera* (L.) Dun.	Evil spirit	*This study*
		Typhoid, evil spirit	Teklehaymanot 2017
		Fibril illness, evil spirit	Wondimu et al. 2007
		Fibril illness, an evil spirit	Mesfin et al. 2014
4	*Embelia schimperi* Vatke.	Internal parasites	Study area
		Tape worm	Demie et al. 2018
5	*Bidens pilosa* L.	Snake poison	*This study*
		Evil spirit	Chekole 2017
6	*Solanum incanum* L.	Bleeding	*This study*
		Hemorrhage, toothache	Alebie and Mehamed 2016
		Stomachache, swelling	Zenebe et al. 2012
		Headache, impotence	Lulekal et al. 2008
	Cucumis ficifolius A. Rich.	Stomachache	*This study*
		Rabies, stomachache	Teklehaymanot 2009
7	*Gomphocarpus integer* A. Rich.	Liver diseases	*This study*
		Evil spirit	Wondimu et al. 2007
		Gastritis, gonorrhea	Lulekal et al. 2008
8	*Ehretia cymosa* Thonn.	Fibril illness	*This study*
			Tamene et al. 2020
		Stomachache	Demie et al. 2018
		Cancer	Tefera and Kim 2019
9	*Ocimum gratissimum* L.	Fibril illness	*This study*
			Demie et al. 2018
			Lulekal et al. 2008
		Malaria, cancer	Tefera and Kim 2019
		Eye diseases	Lulekal et al. 2008

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