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Ethnobotanical study on medicinal plants used by ethnic people of Gechi District, South West Oromia, Ethiopia

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Abstract. *Desalegn A, Egigu MC, Sasikumar JM. 2022. Ethnobotanical study on medicinal plants used by ethnic people of Gechi District, South West Oromia, Ethiopia. Nusantara Bioscience 14: 104-116.* This study recorded medicinal plants used by ethnic people of Gechi District, Buno Bedele zone of South West Oromia region, Ethiopia. Data were collected from 386 informants through semi-structured interviews, guided field observations, and focus group discussions. Descriptive statistics and quantitative ethnobotanical indices were used to analyze the data. Moreover, an independent t-test and one-way ANOVA were employed to investigate the effect of Sociodemographic traits on traditional medicinal knowledge. The study documented 70 medicinal plant species belonging to 61 genera and 36 families. Most plants (83.7%) were used to treat human ailments. Asteraceae (7 species) mainly represented the family. Most of the plants collected were shrubs (32.9 %), followed by herbs (25.7%). Leaves (42.3%) represented the highest part for remedy preparation. The dominant route of administration of remedies was oral (56%). Jaccard's similarity index (JI) showed a high degree of similarities (JI = 0.75-0.91) among three kebeles namely, Imboro, Koba, and Dike. The highest Informant consensus factor (ICF) value (0.73) was detected for the sensory organs category illnesses. *Juniperus procera* Hochst. Ex. Endl. was observed with the highest fidelity level (FL) index value (0.97) for the wound. The highest preference ranking (PR) was adjudged to be *Ruta chalepensis* L. for stomach ache. *Syzygium guineense* (Willd.) DC. was top-ranked as a multipurpose plant in direct matrix ranking (DR). It was observed that the Traditional Knowledge (TK) of medicinal plants was significantly ($P<0.05$) influenced by the gender, age, and educational level of the people. Therefore, our documentation of TK on medicinal plants possessed by the people of the studied area could help preserve their knowledge for extensive use.

Keywords: Ethnobotanical study, Gechi District, medicinal plants, traditional knowledge

INTRODUCTION

Indigenous people worldwide practice plant-based traditional medicine despite the massive growth of modern pharmacopeia and the advent of innumerable synthetic drugs. Traditional medicine of plant origin has endowed several current medications due to bioactive secondary metabolites. In addition, it will lead to the development of novel drugs for degenerative diseases (Cox and Balick 1994; Newman and Crag 2016). Among different regions of the world, the legacy of African people preferring traditional medicine to modern medicine for their health care is well known (Cunningham 1993; Sofowora 1996). Ethiopia is one of the cultural heritage nations in Africa, with diverse ethnic communities and a rich repository of floral diversity. Modern conventional drugs are widespread in Ethiopia, like in other countries, yet a majority of people in the country rely on traditional medicinal plants for their health care. That is mainly due to the low socio-economic status to afford modern medicine and the cultural acceptability of traditional medicine. However, studies on systematic documentation of traditional knowledge (TK) on medicinal plants are still needed in untapped territories of the country to explore the TK of diverse ethnic groups. Furthermore, the younger generation's unawareness of TK could cause the gradual depletion of biodiversity, which is a loss of TK. Also, the gradual migration of the population to urban areas of the country (Andarge et al. 2015; Jima and Megersa 2018). These factors necessitate ethnobotanical studies to explore the TK of the ethnic groups of Ethiopia.

The study area, Gechi District, Buno Bedele zone (Illu Aba Bora), also encounters the challenges mentioned above that urged the authors to tap the TK of the ethnic community dwelling in the area. The *Oromo* ethnic group inhabits the study site with strong TK on the uses of plants for curing various ailments. According to the District Health Office, for 19 *Kebele*s (*Kebele* is the lowest administration unit), only a few health facilities, viz. four health centers, three veterinary health clinics, and 17 health posts, serve the entire people and livestock. Thus, people in the study area still depend on medicinal plants to treat human and livestock diseases. Therefore, documentation of the study area's medicinal plants and associated TK is essential. The Gechi District is situated in the Southwest part of the *Oromia* regional state. Although some studies have been reported from other parts of the Southwest *Oromia* region, Ethiopia (Awas and Demissew 2009; Abera 2014; Chemeda and Mosisa 2017; Siraj et al. 2020), no ethnobotanical report was found from the Gechi District. Thus, we undertake a study to document medicinal plants and associated traditional knowledge of the ethnic

people to treat human and livestock ailments in ethnobotanically unexplored *Kebele*s of Gechi District, Buno Bedele zone, *Oromia* region, Ethiopia.

MATERIALS AND METHODS

Description of the study area

Gechi District, Buno Bedele zone of Oromia region, Ethiopia, is situated between 8°10'-8°30' N and 36°20'-36°40' E latitude and longitude, respectively (Figure 1). The district is subdivided into 19 *Kebele*s, of which three are urban, and the rest are rural. The elevation of the study area is about 1,787 meters above sea level. The district's total population was 70,478, of which 35,307 were men and 35,171 were women (CSA 2007). Islam followers (87.7%) dominate the total population, followed by Ethiopian Orthodox Christians (10.58%) and Protestants (1.66%). Most people (97.16%) speak *Affan Oromo*, and *Amharic* is spoken only by 2.09% of the population.

Selection of *Kebeles* and sampling

Before collecting data, a reconnaissance survey was performed from July 2017 to August 2017 to select *the district's Kebeles (study sites)* based on vegetation cover, traditional medicine use history, availability of medicinal plants, and traditional medicine practitioners. Accordingly, three *Kebele*s, Imboro, Koba, and Dike, were selected for the ethnobotanical survey out of 19 Kebeles. The survey was conducted between September 2017 and July 2018. A total of 386 participants (age ≥25) were interviewed for data elicitation. Of this, 366 respondents were non-traditional medicinal practitioners selected randomly. In addition, based on the information from the ordinary people of the study area, experienced and highly knowledgeable key informants (20) were selected purposively. For the interviews, the respondents were divided into three age ranges (25-40, 41-60, >60) and three levels of educational status (illiterate, elementary, and secondary schools completed (Megersa and Woldetsadik 2022).

The sample size of the selected *Kebele*s was calculated based on the total population size (11,128) of the three selected *Kebele*s by adapting the formula of Cochran (1977) used by (Eshete and Molla 2021) as follows:

$$n = \frac{N}{1 + N(e)^2}$$

Where n = sample size for a survey; *N* = the total number of populations in the three *Kebeles* (11,128); *e* = maximum variability or margin of error 5% (0.05); and 1= the probability of an event occurring.

Thus, the required sample size was:

$$\frac{11{,}128}{1+ 11{,}128(0.0025)} = 386$$

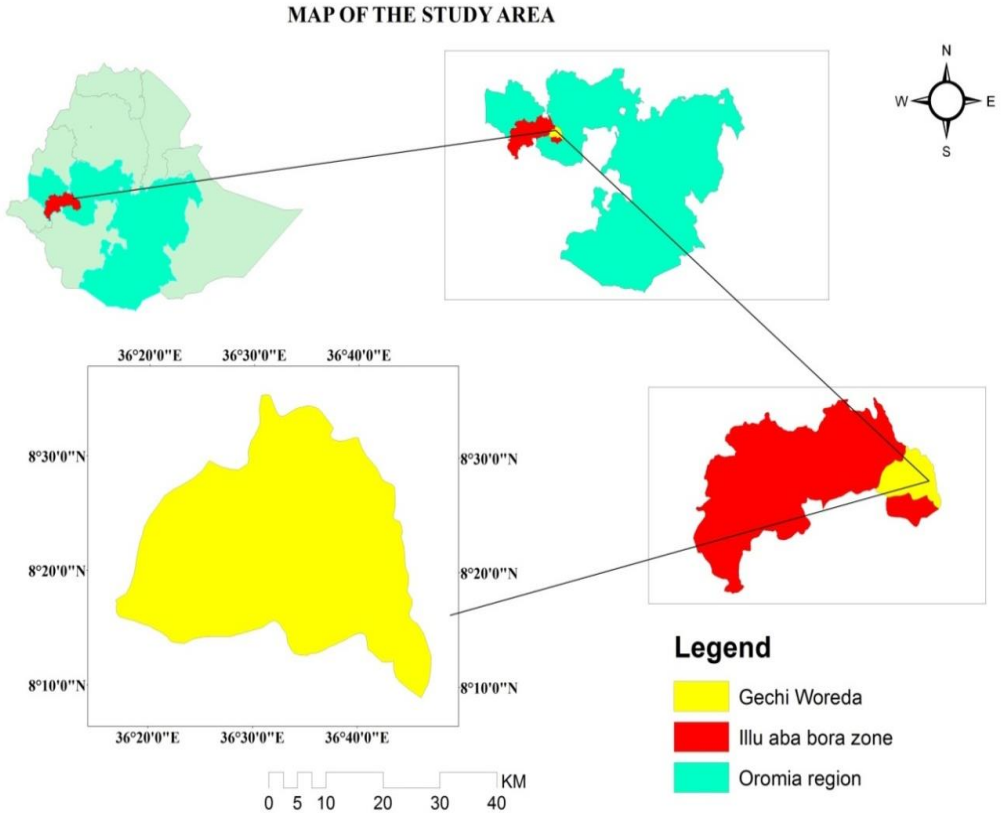

Figure 1. Location of Gechi District, Buno Bedele zone of Oromia region, Ethiopia

Field surveys for TK data collection

During the field trips, data were gathered using methodologies viz. semi-structured interviews, focus group discussion, and direct guided field walks, ethnobotanically and social-demographically. The data on ethnobotany included vernacular names of the medicinal plants, ailments treated, habits, habitat, plant part(s) used, methods of preparation of plant remedies, administration routes, dosage, etc. The socio-ethnographic data encompassed gender, age, educational level, marital status, religion, and occupation. Interviews were made in *Affan Oromo* (the language of the local ethnic group) from the questions prepared in English. Women were interviewed in their ambient vegetation after the purpose of the survey was explained to the family's elders. The ethnomedicinal plants were collected, and the voucher specimens were pressed, dried, and mounted. The identification of the plants was achieved by using Flora of Ethiopia and Eritrea (Friis 2009) and by comparing it with the authentic herbarium specimens at Haramaya University. The scientific names of the medicinal plants were verified by consulting 'the plants of the world online' (https://powo.science.kew.org/). The identified plants were deposited in Haramaya University Herbarium, Ethiopia, for future reference.

Data analysis and comparison of traditional knowledge

The data on TK gathered were statistically analyzed using descriptive statistical methods. In addition, for quantification of TK on medicinal plants, Jaccard's similarity index (JI), Informant consensus factor (ICF), fidelity level (FL), preference ranking (PR), and direct matrix ranking (DR) were computed. Furthermore, to compare TK discrepancies between the informants of different gender, age, and education status. Independent T-test and one-way ANOVA were performed in SPSS version 20. There were two categories in gender (Male vs. Female); the age category was divided into three groups (25-40, 41-60, >60), and educational status had three levels (informants with no formal education, elementary and secondary school completed). Differences were considered statistically significant at $P<0.05$.

Jaccard's similarity index (JI)

Furthermore, to compare the similarity of TK on medicinal plants among the *Kebele*s, the Jaccard's similarity index was calculated using the following formula:

$$JI = \frac{c}{a+b+c}$$

Where JI is the Jaccard similarity index, 'c' is the number of species shared by the study sites, 'a' is the number of species in study site A only, and 'b' is the number of species in study site B only. The JI values range between 0 and 1, whereby a value of 1 indicates complete similarity.

Informant consensus factor (ICF)

The ICF was employed to analyze the agreements among informants on using plant species in various ailment categories and was computed by applying the formula used earlier (Gazzaneo et al. 2005).

$$\text{ICF} = \frac{n_{ur\_}n_t}{n_{ur\_}1}$$

Where, the number of use citations for each ailment (nur) minus the number of species used (nt) for that ailment is divided by the number of use citations for each ailment minus one.

Fidelity level (FL)

The FL, the percentage of respondents claiming a specific plant for the same primary purpose, was calculated for the most frequently reported ailment category using the following equation (Teklehaymanot and Gidey 2007).

$$\text{FL}(\%) = \frac{NP}{N} x100$$

Where Np is the number of informants that claim the use of a plant species to treat a particular disease, and N is the number of informants that use the plants as a medicine to treat any given disease.

Preference ranking (PR)

The PR was calculated using the method of Martin (1995). More frequently mentioned medicinal plants (10 species) for treating stomachaches were selected for PR analysis. In the ranking analysis, randomly selected key informants (10) were enquired to rank the plant species based on their perceived efficacy in curing the disease by giving the highest value (10) for the most effective plant and the lowest value (1) for the least effective plant.

Direct matrix ranking (DR)

The DR was performed using 14 plants claimed by informants for eight use diversities following Martin's (1995) and Cotton's (1996) methods. First, ten key informants were asked to assign use-values viz., 5=best, 4=very good, 3=good, 2=less used, 1= least used, and 0=not used for each plant corresponding to each use-value. Then, the average value of use diversity given by informants for each species was taken, and the values were totaled and ranked.

RESULTS AND DISCUSSION

Traditional medicinal plants documented

The ethnobotanical survey in three *Kebele*s of Buno Bedele Zone, Gechi District, documented 70 medicinal plant species used for various ailments in this ethnic. The medicinal plant species belong to 61 genera and 36 families. About 84% of the plants were used to remedy human ailments, and 12% were utilized against livestock ailments. An insufficient number of species (4%) was used for human and livestock ailments (Table 1). The informants cited some plants for specific ailments among the medicinal plants documented. For example, *Allium sativum* was cited by 47 informants for treating malaria, the common cold, and dental disease, followed by *Datura stramonium* (38 informants) as a remedy for dandruff, wart, and toothache.

Table 1. Traditional medicinal plants documented

Scientific name (habit)	Family	Common name	Habitat	Disease treated	Treatment for	Part(s) used and mode of preparation	Route
Acacia abyssinica Hochst. ex Benth. (Tree)	Fabaceae	*Laaftoo* (O)	F	Tonsillitis	H	Root: Fresh root bark is chewed	O
				Eye disease	H	Leaf: Young leaves are squeezed, and the extract is directly applied to the infected eye	E
Allium sativum L. (Herb)	Alliaceae	*Qullubbi adii* (O)	HG	Malaria	H	Bulb: Bulb of *Allium sativum* and rhizome of *Ginger officinale* are pounded and eaten with honey	O
				Common cold	H	Bulb: Bulb is inserted into the nostrils to sniff	N
				Tooth disease	H	Bulb: Bulb is held on the tooth	O
Artemisia abyssinica Sch., Bip. ex A.Rich. (Herb)	Asteraceae	*Qoddoo* (O)	HG	Malaria	H	Leaf: Fresh leaf and *Allium sativum* bulbs are pounded and consumed	O
Asplenium monanthes L. (Epiphyte)	Aspleniaceae	*Digaluu bakkannisaa* (O)	OT	Headache	H	Leaf: Leaf is pounded with the leaf of *Cussonia ostinii* and drunk with a cup of tea	O
Bersama abyssinica Fresen. (Tree)	Melianthaceae	*Lolchiisaa* (O)	F	Plague	L	Root: Root is crushed and mixed with water to wash the cattle's body	D
				Stomach ache	H	Leaf: Leaf is smashed, mixed with water, and drunk	O
Beta vulgaris L. (Herb)	Chenopodiaceae	*Qosta* (O)	HG	Dehydration	H	Leaf: The fresh leaves are cooked with oil and salt, then after eaten	O
Bidens biternata (Lour.) Merr. & Sherff (Herb)	Asteraceae	*Cogoogitii gurraattii*	RS	Febrile illness	H	Leaf: Leaf is pounded together with the leaf of *Croton macrostachyus* and rubbed against the body	O
Bidens pilosa L. (Herb)	Asteraceae	*Maxanne* (O)	GL	Nasal bleeding	H	Leaf: Freshly squeezed leaves are sniffed	N
Calpurnia aurea (Aiton) Benth. (Shrub)	Fabaceae	*Ceekaa* (O)	AR	Wound	H	Leaf: The leaf is smashed, and the solution is added to the wounded part	D
				Scabies	L	Leaf: Leaf is pounded and mixed with water to wash the body of the animal	D
Capparis cartilaginea Decne. (Climber)	Capparidaceae	*Gooraa* (O)	RS	Toothache	H	Root: Root is chewed and held onto the teeth	O
Carissa spinarum L. (Shrub)	Apocynaceae	*Hagamsa* (O)	F	Gonorrhea and Stomachache	H	Root: Fresh root is pounded and mixed with local alcohol such as "Tella" and drunk	O
				Stomachache	H	Leaf: Pounded leaf of *Carissa spinarum* is mixed with honey and taken in a small amount every morning	O
				Headache	H	Leaf: Dry pounded leaf is smoked	N
Capparis tomentosa Lam. (Shrub)	Capparidaceae	*Harangamaa* (O)	F	Headache	H	Root: Dried root is powdered, and one spoon of the powder is mixed with alcohol and drunk	O
				Diarrhea	H	Leaf: Dried and powdered leaves are mixed with water and consumed	O
Citrus limon (L.) Burm. f. (Shrub)	Rutaceae	*Loomii* (O)	HG	Common cold	H	Fruit: Juice is drunk with tea	O
				Nasal bleeding	H	Fruit: Fruit is sniffed	N
				Tinea versicolor	H	Fruit: Juice is rubbed on the skin	D
Clausena anisata (Willd.) Hook.f. ex Benth. (Shrub)	Rutaceae	*Ulumaayii* (O)	RS	Skin infection	H	Leaf: Leaves of *Clausena anisata, Solanecio gigas,* and *Justicia schimperiana* are pounded together and creamed on the skin	D

Clematis simensis Fresen. (Climber)	Ranunculaceae	*Hidda feetii* (O)	F	Dandruff	H	Leaf: Leaves are pounded and placed on the head	D
				Tonsillitis	H	Leaf: Leaf is crushed, pressed, rolled in a clean cloth, and tied to the neck	D
				Elephantiasis	H	Leaf: Leaf of *Clematis simensis* and *Lagera aleta* are crushed, smashed, and tied to the affected part of the leg	D
Clerodendrum myricoides (Hochst.) R.Br. ex Vatke (Shrub)	Lamiaceae	*Maraasisaa* (O)	RS	Toothache	H	Leaf: Leaves are chewed directly or leaf powder mixed with butter and put on the affected tooth	O
				Toothache	H	Stem: Stem is used as a toothbrush	O
Coccinia abyssinica (Lam.) Cogn. (Climber)	Cucurbitaceae	*Ancootee* (O)	HG	Broken Bone	H	Root: The root is cooked and eaten with oat bread	O
Coffea arabica L. (Tree)	Rubiaceae	*Buna* (O)	HG	Diarrhea	H	Seed: Roasted and pounded seeds are mixed with honey and eaten	O
				Stomachache	H	Leaf: Tea made of leaves is drunk	
Croton macrostachyus Hochst. ex Delile (Tree)	Euphorbiaceae	*Bakkannisa* (O)	F	Wound	H	Sap: Sap is rubbed against the affected body part	D
				Ring Worm	H	Leaf: The leaf is crushed, and the extract is creamed on the infected area	D
Cucumis ficifolius A.Rich. (Climber)	Cucurbitaceae	*Yemidir Embuay* (A)	AR	Stomachache	H	Root: Fresh or dried root powder is mixed with water and drunk	O
				Diarrhea	B	Whole plant: Whole fresh plant is used to prepare a decoction with water and drunk by humans and cattle	O
				Ascariasis	L	Whole plant: Whole dried plant is powdered, mixed with water, and drunk	O
Cucurbita pepo L. (Herb)	Cucurbitaceae	*Buqqee* (O)	HG	Gonorrhea	H	Seed: Seed powder is mixed with water and drunk	O
Cupressus lusitanica Mill. (Tree)	Cupressaceae	*Yeferenji Tid* (A)	HG	Diarrhea (animal)	L	Leaf: Leaves are crushed, mixed with water, and given to cattle to drink	O
Cynodon dactylon (L.) Pers. Herb	Poaceae	*Coqorsa* (O)	GL	Wound	H	Above ground: Above-ground parts of *Cynodon dactylon* are crushed and rubbed on the affected skin for a week with butter	D
Datura stramonium L. (Shrub)	Solanaceae	*Asaangira* (O)	AR	Dandruff	H	Leaf: Fresh leaf is smashed, and its solution is creamed on the affected part of the skin	D
				Wart	H	Stem: Leafy stem is squeezed, and its drop is mixed with butter and creamed on the affected body part	D
Dodonaea angustifolia L.f. (Shrub)	Sapindaceae	*Kitkita* (A)	F	Wounds and eczema	H	Leaf: Fresh leaf paste is mixed with butter and applied to the affected part	D
Echinops kebericho Mesfin (Herb)	Asteraceae	*Qarabichoo* (O)	HG	Wound	H	Root: Dried root is smoked	N
Echinops macrochaetus Fresen. (Shrub)	Asteraceae	*Kusheshile* (A)	F	Toothache	H	Root: Fresh root paste is orally given with water	O
				Febrile illness	H	Root: Dried root decoction is orally given	O
Ehretia cymosa Willd. ex Roem & Schult. (Tree)	Boraginaceae	*Ulaaga* (O)	F	Stomach ache or stabbing pain	H	Leaf: The leaf is smashed, and the human takes the sap	O
Embelia schimperi Vatke. (Shrub)	Myrsinaceae	*Haanquu* (O)	RS	Taeniasis	H	Seed: Seed powder is mixed with water and drunk	O
				Hookworms	H	Seed: Seed powder is mixed with water and drunk to eliminate hookworm	O
Eucalyptus globulus Labill. (Tree)	Myrtaceae	*Bargamoo adii* (O)	HG	Stomach ache	H	Fruit: Top part of the fruit is chewed	O
				Fever	H	Leaf: Leaves are rubbed on the skin to reduce fever	D
				Common cold	H	Leaf: Leaves are boiled in water and inhaled	N

Euphorbia lathyris Georgi (Tree)	Euphorbiaceae	*Adaamii* (O)	F	Heartburn	H	Stem: Stem is chopped and boiled to fumigate ulcerated breast	D
				Rabies	P	Root: One spoon of root powder is mixed with a cup of fresh milk and given to the dog to drink	O
Ficus palmata Forssk. (Shrub)	Moraceae	*Luugoo* (O)	HG	Skin infection	H	Latex: Latex is rubbed on the skin	D
Ficus sur Forssk. (Tree)	Moraceae	*Harbuu* (O)	F	Ringworm	H	Sap: Sap is creamed on the affected skin	D
Ficus sycomorus L. (Tree)	Moraceae	*Odaa* (O)	F	Hepatitis	H	Sap: Sap is collected from the bark surface of *Ficus sycomorus* and creamed on the skin	D
Foeniculum vulgare Mill. (Herb)	Apiaceae	*Ensilal* (A)	RS	Urine retention	H	Whole plant: The whole part is pounded, mixed with water, and drunk	O
Guizotia abyssinica (L.f.) Cass. (Herb)	Asteraceae	*Nuugii* (O)	AF	Cough and Asthma	H	Seed: Seed is roasted, powdered, boiled, and drunk with honey	O
Hordeum vulgare L. (Herb)	Poaceae	*Garbuu* (O)	AF	Broken bones	H	Stem: Seed flour is made into porridge and eaten	O
Indigofera hochstetteri Bak. (Herb)	Fabaceae	*Qoricha hadha'a* (O)	AR	Tetanus	H	Leaf: Leaves are chopped, warmed on fire, and held in the affected area	D
				Tetanus	H	Root: The root of *Indigofera hochstetteri* is powdered, mixed with butter, and put on the affected area	D
Indigofera spicata Forssk. (Shrub)	Fabaceae	*Yayit Misir* (A)	F	Febrile illness	H	Leaf and stem: Fresh leaf and stem are smoked	N
Juniperus procera Hochst. Ex. Endl. (Tree)	Cupressaceae	*Yabesha Tsid* (A)	HG	Wound	H	Leaf: Fresh leaf is crushed, and the solution is creamed on the affected part	D
Justicia schimperiana (Hochst. ex Nees) T. Anderson (Shrub)	Acanthaceae	*Sensel* (A)	F	Rabies	B	Leaf: Leaf with *Salix mucronata* leaf are squeezed, and juice is given to humans and animals before food every morning	O
Kalanchoe densiflora Rolfe. (Herb)	Crassulaceae	*Endahula* (A)	RS	Wound	H	Leaf: Leaf is squeezed and creamed on the wound	D
				Elephantiasis	H	Leaf: Leaf is pounded and tied at the affected part	D
Lantana camara L. (Herb)	Verbenaceae	*Yawef qolo*(A)	F	Leishmaniasis	H	Leaf: Leaf is squeezed and sniffed	N
Lepidium sativum L. (Herb)	Brassicaceae	*Feexoo* (O)	HG	Stomach ache	L	Seed: Dried seed decoction is given to animals	O
Linum usitatissimum L. (Herb)	Linaceae	Talbaa (O)	AF	Indigestion	H	Seed: Seed powder is dissolved in water and drunk	O
Lippia adoensis Hochst. ex Walp. Var. *adoensis* (Shrub)	Verbenaceae	*Kusaayee* (O)	RS	Fungal infection	H	Leaf: Fresh leaf juice is mixed with little water and applied topically	O
				Ringworm	H	Leaf: Leaf is directly rubbed on the affected skin	D
Maesa lanceolata Forssk. (Tree)	Myrsinaceae	*Abbayii* (O)	F	Elephantiasis	H	Bark: Bark is pounded, mixed with butter, and creamed on the affected body	D
				Scabies	H	Leaf: Leaves are rubbed on the skin	D
Nicandra physalodes (L.) Gaertn. (Herb)	Solanaceae	*Haawwixii* (O)	RS	Liver problem	H	Leaf and root: Leaf and root are pounded together and mixed with cold water, and the solution is drunk	O
Nicotiana tabacum L. (Herb)	Solanaceae	*Tamboo* (O)	HG	Blotting	L	Leaf and root: Leaf and root are dried, powdered, mixed with salt, and made as bread. Slice is given to cattle for three days	O
				Gastroenteritis	L	Leaf: Fresh leaf juice is mixed with water and orally given to cattle	O

				Wound	H	Leaf: Dried leaf powder is mixed with *Coffea arabica* seed powder and applied topically	D
Ocimum gratissimum L. (Shrub)	Lamiaceae	*Daamakasee* (O)	RS	Febrile illness	H	Leaf: Leaf of *Ocimum gratissimum* is smashed, and the solution is sniffed nasally	N
				Headache, Cough	H	Leaf: Fresh or dried leaf is crushed, mixed with coffee, and drunk	O
				Allergy	H	Leaf: The leaf of *Ocimum gratissimum* is squeezed, and its drop is applied to the skin	D
Phytolacca dodecandra L'Her (Shrub)	Phytolaccaceae	*Handoode* (O)	RS	Anemia	H	Leaf: Leaf is squeezed, and juice is drunk	O
				Stomachache, Scabies, Itching, and Rabies	B	Leaf: Fresh leaf juice is mixed with water and given orally to humans and livestock	O
				Liver problem	H	Root: Root is pounded, mixed with water, and drunk	O
Podocarpus falcatus (Thunb.) Endl. (Tree)	Podocarpaceae	*Zigba* (A)	F	Stomach ache	H	Leaf: Leaf combined with the leaf of *Syzgium guineense* are pounded, mixed with water, and drunk	O
				Diarrhea	H	Leaf: Fresh leaf is smashed, and the extract is drunk	O
Premna schimperi Engl. (Tree)	Verbenaceae	*Urggeesaa* (O)	F	Eye disease	L	Leaf: Leaves are chewed and spitted on cattle eye	E
				Toothache	H	Root: Root is chewed, and the solution is held in the mouth and swallowed	O
Prunus africana (Hook.f.) (Tree)	Rosaceae	*Hoomii* (O)	F	Wound	L	Bark: Bark is powdered and added directly to wounds of donkey, mule, and horse	D
Rhynchosia elegans A.Rich. (Climber)	Fabaceae	*Tero Areg* (A)	F	Rabies	B	Leaf: Dried leaf powder is mixed with little water and drunk	O
Ricinus communis L. (Shrub)	Euphorbiaceae	*Qoobboo* (O)	HG	Amoebiasis	H	Seed: The dried seed is chewed	O
				Anthrax	H	Seed: Dried seed powder is mixed with water. and drunk	O
				Blotting	L	Root: Root is pounded with salt, mixed with cold water, and given to cattle to drink	O
Rosmarinus officinalis L. (Herb)	Lamiaceae	*Yesiga Metibesha* (A)	HG	Toothache	H	Leaf: Fresh leaf is chewed	O
Rumex abyssinicus Jacq. (Herb)	Polygonaceae	*Meqmeqo* (A)	AR	Dandruff	H	Leaf: Dried leaf powder is mixed with butter and applied to the skin	D
Ruta chalepensis L. (Herb)	Rutaceae	*Xeenaadaama* (O)	HG	Stomachache	B	Leaf: Fresh leaf is crushed with *Allium sativum* bulb and consumed	O
Rumex nepalensis Spreng. (Herb)	Polygonaceae	*Tultii* (O)	AR	Stomachache	H	Root: Roots are chewed, and juice is swallowed	O
				Skin infection	H	Leaf: Leaf is directly rubbed on the affected skin	D
				Amoebiasis	H	Root: Root is pounded and drunk with tea	O
Rumex nervosus Vahl (Shrub)	Polygonaceae	*Embacho* (A)	F	Scabies and acne	H	Stem or leaf: Fresh stem or leaf is crushed, and the solution is mixed with *lemon* juice and water to wash with	D
Salix subserrata Willd. (Shrub)	Salicaceae	*Aleltu* (O)	F	Stomachache	H	Leaf: Dried leaf powder is mixed with milk and drunk	O
Schinus molle L. (Tree)	Anacardiaceae	*Qundoo barbarree* (O)	RS	Pharyngitis	H	Fruit: Fruit is chewed for sore throat	O
				Eye disease	L	Leaf and fruit: Leaf and fruit are chewed and spitted on cattle, equines, goats, and sheep's eye	E

Solanum marginatum L.f. (Shrub)	Solanaceae	*Hiddii* (O)	RS	Plague	L	Fruit: Fresh fruit is smashed, mixed with water, and applied topically on the affected body part of livestock	D
				Skin infection	H	Fruit: Fruit is creamed on the affected skin area	D
				Stomach ache	H	Root: Root tip is chewed and swallowed	O
Syzygium guineense (Willd.) DC. (Tree)	Myrtaceae	*Baddessa* (O)	F	Hookworm	H	Bark: Bark and exudates of *Aloe pubescens* concoction are drunk	O
Triticum aestivum L. (Herb)	Poaceae	*Qamadii* (O)	AF	Skin infection	H	Seed: Seed is chewed, and the bolus is put on the swollen area	D
Verbascum sinaiticum Benth. (Herb)	Scrophulariaceae	*Gurra Harree* (O)	GL	Urinary retention	L	Root: Root is crushed, mixed with water, and given to animal	O
Vernonia amygdalina Delile (Tree)	Asteraceae	*Ebicha* (O)	F	Stomachache	H	Leaf: Fresh leaf, combined with leaves of *Rumex nervosus* and *Justicia schimperiana*, are pounded, mixed with water, and drunk	O
				Urinary retention	H	Leaf: The squeezed fresh leaf is added to water and drunk	O
				Toothache	H	Leaf: Leaves of *Vernonia amygdalina* and bulb of *Allium sativum* are chewed.	O
				Toothache	H	Stem: Stem is used as a teeth brush at the affected site	O
Vigna membranacea A.Rich. (Climber)	Fabaceae	*Hidda hantuutaa* (O)	RS	Rabies	L	Root: Root is dried, powdered, baked with *teff* flour, and given to cattle to eat	O
Zingiber officinale Roscoe *(*Herb)	Zingiberaceae	*Zingibaa*	HG	Common cold	H	Leaf: leaves are boiled in water and drunk	O

Notes: Habitat; Agricultural field (AF), Home garden (HG), Forest (F), Roadside (RS), Grazing land (GL), Around river (AR), and on the tree (OT). Treatment for; Human (H), Livestock (L), Both (B), and Pet animal (P). Route; Oral (O), Nasal (N), Dermal (D), Eye (E), Anal (A). Common Name; *Affan Oromo* (O) and *Amharic* (A)

Taxonomic diversity, habitat, and habit

Analysis of taxonomic diversity showed that Asteraceae was represented by seven species, followed by Fabaceae (6 species). Solanaceae and Lamiaceae were represented by four species each. The families such as Cucurbitaceae, Poaceae, Verbenaceae, Rutaceae, Euphorbiaceae, Moraceae, and Polygonaceae were represented by three species each. Myrtaceae, Capparidaceae, and Cupressaceae were represented by two species each, and the rest (22 families) contributed one species each. Several studies from Ethiopia (Birhanu et al. 2015; Mogosse 2016; Megersa and Woldetsadik 2022) and other countries such as Brazil and Iran (da Costa et al. 2021; Hosseini et al. 2021) reported the abundance of the Asteraceae family in their ethnobotanical records. Extensive growth and a vast number of species may be responsible for the dominance of Asteraceae. Moreover, the high recognition of this family in traditional medicine may be due to diverse bioactive molecules (Petropoulos et al. 2019).

Relating to habitat, the majority (74.28%) of the collected plants were from wild habitats, including forests, roadsides, riverbanks, agricultural fields, and grazing land, whereas 25.71% of the plants were collected from home gardens. These results agree with other reports of the country (Abera 2014). Except for those from home gardens, most medicinal plants appeared out of human management. Thus, they are deemed to be given due attention for conservation.

Concerning the life forms, the majority of the medicinal plants (32.85%) were shrubs, followed by herbs (31.42%), trees (25.71%), climbers (8.5%), and epiphytes (1.42%). Similar results from various parts of the country corroborate our findings (Lulekal et al. 2008). The broader use of shrubs and herbs could be associated with their high abundance in the area. In most other studies conducted in Ethiopia, these life forms were reported as predominant life forms used in traditional medicine (Meragiaw et al. 2016; Gonfa et al. 2020; Mukaila et al. 2021).

Plant parts used, methods of preparation, and modes of administration

For preparing plant remedies, the locals mostly use leaves followed by the root, seed, fruit, sap, stem, entire plant, bulb, and bark (Figure 2). Similar studies in different parts of Ethiopia (Bekele 2007; Ketema 2015; Weldearegay and Awas 2021) also show the leaf as a predominantly used plant in remedy preparations. Preference for the leaf over other plant parts may be due to its perceived curative potential by local people, which serves for pharmacological investigation in novel drug discovery. More dependence on leaves for remedy preparations may not endanger the survival of the mother plant (Jima and Megersa 2018).

The survey unveiled that most of the remedy preparations were in Fresh form (73%), followed by Dry shape (22%) and fresh or dried form (5%). Using a fresh form may help prevent the loss of active constituents during drying or the preparation of the drugs (Chaachouay et al. 2022). Different authors commonly reported the use of fresh plant parts in Ethiopia (Yineger et al. 2008; Abera 2014; Birhanu and Ayalew 2018; Alemneh 2021; Megersa and Woldetsadik 2022).

Furthermore, regarding route administration, most (63.41%) of the medicinal recipes were administrated orally, followed by the external dermal route of application (28.46%) for dermatological ailments, nasal (4.88 %), eye (2.44%), and anal (0.81%). Except for a few site-specific ailments, such as dermatological diseases, remedies are taken orally for most reported ailments. Our result agrees with many reports from different parts of Ethiopia (Yineger et al. 2008; Agisho et al. 2014; Kefalew et al. 2015).

Quantification of TK on medicinal plants

Jaccard's similarity index (JI)

Comparative ethnobotanical studies between people from different *Kebele*s of study sites are necessary to assess the similarity in TK. This analysis for similarity or consensus on the medicinal uses may lead to the discovery of novel plant-based drugs (Leonti 2011). In our study, JI similarity values (Table 2) suggested that people of the three *Kebele*s have more or less similar knowledge of medicinally using the same plant species. That could be the same vegetation composition, which is due to the similarity in agroecology between *Kebeles* and the high exchange of information between the people of the three *Kebeles* on the medicinal value of the reported species.

Informant Consensus Factor values

Based on the information elicited from the informants, the ailments claimed to be treated by medicinal plants were sorted into eight categories and tabulated (Table 3). The ICF values for the eight ailment categories ranged from 0.51 to 0.73. The highest ICF (0.73) was associated with illnesses of Sensory organs, followed by diseases related to the Respiratory system (0.72) and the Genitourinary system (0.62). The disease categories with minor agreement among the informants were Parasite infections (0.50) and Liver disorders (0.50).

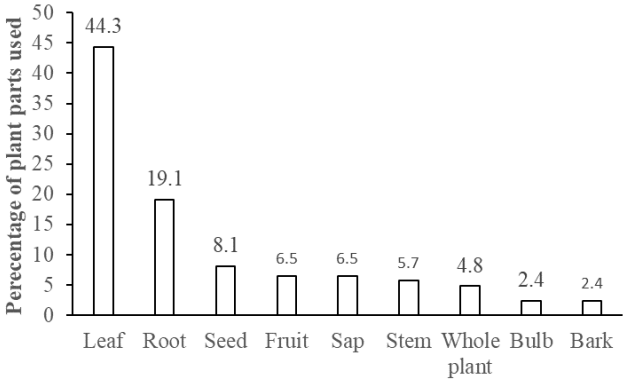

Figure 2. Plant parts used for remedy preparations

Table 2. Jaccard's similarity Index of TK between the *Kebele*s

Kebeles	Imboro	Koba	Dike
Imboro	1	0.91	0.83
Koba	0.91	1	0.75
Dike	0.83	0.75	1

The maximum ICF value for Sensory organs indicates the high information exchange and agreement on the medicinal value of the reported medicinal plants among the ethnic people of the study site. On the contrary, the least ICF for Parasite infections and Liver disorders indicates the informants' contradictory understating of this disease category or the seldom occurrence of this illness in the study area (Heinrich 2000).

Fidelity Level (FL) index

Table 4 presents the FL values for medicinal plants used for a specific ailment as informed by the respondents. Computation of FL showed that the index values varied between 0.62 - 0.97. Out of 70 medicinal plants documented, *Juniperus procera* was a highly cited plant with the highest FL index value (0.97) for wounds, followed by *Podocarpus falcatus* for treating stomachache with an FL index value of 0.90. The species with the lowest FL (0.62) was *Coccinia abyssinica* (*Anchote*) for healing a broken bone. Moreover, a previous report from eastern Ethiopia justified the claim of *J. procera* for healing wounds (Kandari et al. 2015). The maximum FL index value of *J. procera* indicated the people's high preference for this plant for the treatment of wounds. Therefore, in vivo wound healing activity in animal models and phytochemical analysis of this plant are warranted. The plants with low FL index values could also be given attention to preserving the therapeutic knowledge related to them. For instance, previous reports revealed that *C. abyssinica* is widely used in southwestern Ethiopia to patch broken bones because of its high content of calcium (Aga and Bada 1997; Ketema 2015), though its FL value appeared lower in this particular study.

Preference ranking (PR) of important medicinal plants

A simple preference ranking helps to judge the mainly used medicinal plants for treating a specific disease. The results of the PR analysis of the ten most cited plants by informants for treating stomachache are presented in Table 5. Among them, *Ruta chalepensis* ranked top, followed by *Carissa spinarum* and *Coffea arabica*. High preferences for these plants may be connected to the peoples' indigenous knowledge of their curative potential (Leonti 2011). Our result on *R. chalepensis* concord with an earlier study from southern Ethiopia (Avigdor et al. 2014). Reports from other parts of the Oromia and Amhara regions revealed that *R. chalepensis* and other medicinal plants were used to treat stomach aches (Osman et al. 2020). Hence, further pharmacological and phytochemical evaluation is essential to validate those people's traditional claim of R. chalepensis.

Table 3. Informant consensus factor (ICF) for eight ailment categories

Categories of ailments	Nt	Nur	ICF
Sensory organs (Nasal bleeding, Eye disease)	5	16	0.73
Respiratory system (Cough, Common cold, Asthma, Pharyngitis)	8	26	0.72
Genitourinary system (Gonorrhea, Retained placenta, Urinary Retention)	4	9	0.62
Common ailments (Headache, Fever, Febrile illness, Toothache)	15	36	0.6
Dermatology-related ailments (Scabies, Ring Worm, Dandruff, Wart, Wounds, Eczema, Acne, Itching, Loxoscelism)	24	56	0.58
Gastrointestinal-related ailments (Gastroenteritis, Blotting, Indigestion, Stomach ache, Diarrhea)	22	46	0.51
Parasite infections (Elephantiasis, Leishmaniasis)	4	7	0.5
Liver disorders	2	9	0.5

Notes: nur= number of use citations for each disease category; nt= number of species

Table 4. Fidelity Level (FL) index of most commonly used medicinal plants

Medicinal plants	The main ailment treated	NP	N	FL (%)
Juniperus procera	Wound	28	29	97%
Podocarpus falcatus	Stomachache	28	31	90%
Euphorbia lathryis	Heartburn	25	29	86%
Premna schimperi	Eye disease	23	27	85%
Embelia schimperi	Taeniasis	21	26	81%
Coffee arabica	Diarrhea	18	24	75%
Datura stramonium	Toothache	19	26	73%
Indigofera hochstetteri	Tetanus	18	25	72%
Croton macrostachyus	Wound	25	37	67%
Coccinia abyssinica	Broken bone	22	35	62%

Notes**:** NP= No. of informants who independently indicate the use of species; N= Total No. of informants that used the plant to treat primary ailments

Table 5. Preference ranking of medicinal plants used for treating stomachache

Plant species	Respondents' (R_1-R_{10}) Scores										Total	Rank
	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}		
Ruta chalepensis	10	10	10	10	9	9	9	9	8	6	90	1st
Carissa spinarum	10	8	9	8	5	8	7	9	9	9	82	2nd
Coffea arabica	10	10	9	7	7	9	8	8	6	4	78	3rd
Vernonia amygdalina	6	5	7	10	8	8	5	4	10	9	72	4th
Rumex nepalensis	3	5	5	7	10	4	7	9	10	8	68	5th
Podocarpus falcatus	10	10	9	7	2	3	3	7	5	5	61	6th
Solanum marginatum	10	9	2	5	4	8	9	2	3	8	60	7th
Eucalyptus globulus	1	3	6	5	6	9	10	2	4	8	54	8th
Salix subserrata	1	1	2	8	9	4	4	7	5	2	43	9th
Ehretia cymosa	3	1	1	8	1	5	2	6	1	4	32	10th

Notes: Scores given by the respondents (R_1-R_{10}) are based on the effect of the plants to cure cough, i.e., number 6 denotes the highest efficacy, and 1 denotes the lowest efficacy

Table 6. Direct matrix ranking of selected multipurpose plant species

	Use categories									
Plant species	**Charcoal**	**Construction**	**Fencing**	**Firewood**	**Food**	**Forage**	**Furniture**	**Medicine**	**Total**	**Rank**
Syzygium guineense	5	4	2	5	4	4	4	3	31	1st
Podocarpus falcatus	5	5	3	5	0	0	5	3	26	2nd
Carissa spinarum	3	0	4	4	5	4	0	5	25	3rd
Eucalyptus globulus	2	5	5	5	0	0	4	3	24	4th
Prunus africana	4	4	1	5	0	2	4	3	23	5th
Juniperus procera	3	5	3	4	0	0	4	3	22	6th
Cupressus lusitanica	3	5	2	4	0	0	4	3	21	7th
Croton macrostachyus	5	2	2	4	0	0	2	5	20	8th
Acacia abyssinica	5	2	1	4	1	1	2	3	19	9th
Ficus sur	2	3	1	3	3	3	1	3	19	9th
Maesa lanceolata	4	2	2	4	1	1	1	3	18	10th
Vernonia amygdalina	2	0	3	3	0	4	1	4	17	11th
Premna schimperi	2	2	3	3	0	1	1	4	16	12th
Bersama abyssinica	2	0	3	4	0	0	0	5	14	13th
Total	**47**	**39**	**35**	**57**	**14**	**20**	**33**	**50**	295	
Rank	**3rd**	**4th**	**5th**	**1st**	**8th**	**7th**	**6th**	**2nd**		

Direct matrix ranking for multi-utility plants

Fourteen medicinal plants were reported for seven uses other than medicinal value. Thus, direct matrix ranking was done using eight use categories. Among the use categories, the category of firewood was top-ranked with a score of 57. Therefore, other environmental-friendly alternative energy sources such as biogas should be sought to minimize the burden. Table 6 shows that *Syzygium guineense* ranked top to be used highly for the eight use categories. The fact that *S. guineense* is being highly exploited shows its possible reduction in its distribution and abundance unless care is taken. Therefore, it deserves significant attention, not lost it. Moreover, ecological investigation on its regeneration status in the study area should be investigated to understand its conservation status.

Traditional knowledge of medicinal plants

This study recorded the outcome of the analysis on the impact of socio-ethnographic factors TK on the informants. Generally, people's TK on medicinal plants is influenced by sociodemographic factors such as gender, age, and educational status (McCarter and Gavin 2015). In the present study, TK on medicinal plants significantly (P=0.002; Independent T-test) differed between male and female informants. The male informants reported more medicinal plants informed than their female counterparts, suggesting their higher traditional knowledge of medicinal plants. Our result accords with some previous reports from Ethiopia (Tefera and Kim 2019) and overseas (Pakistan) (Shaheen et al. 2017). This observed difference may be due to the oral transmission of TK on medicinal plants to sons

rather than daughters of the family (Teklehaymanot and Gidey 2007)

Our result also showed that the TK on medicinal plants varied significantly (one-way ANOVA; $P<0.001$). The informants at >60 years of age reported more (8.0) medicinal plants than those aged 41-60 and 25-40, who reported 7.0 and 5.0 medicinal plants, respectively. That suggests that older people play a critical role in transferring TK on medicinal plants to the next generation as they possess superior expertise in using medicinal plants in their vicinity for various diseases. Some previous ethnobotanical studies in Ethiopia (Giday et al. 2009; Tefera and Kim 2019; Kassa et al. 2020; Abebe 2021) and overseas (Ecuador) (Weckmüller et al. 2019) support our findings. The results also revealed that differences in educational status significantly impacted the TK on medicinal plants (one-way ANOVA; $P=0.002$). Respondents with no formal education reported more (8.0) medicinal plants than those with elementary and secondary education, which reported six plants each. The study unveiled that the higher the education among the informants, the lower the TK on medicinal plants, and the same trend was previously reported in other country areas (Giday et al. 2009; Tefera and Kim 2019; Kassa et al. 2020; Abebe 2021). On the other hand, sociodemographic traits such as occupation, marital status, and religion did not influence the TK of the informants on the use of medicinal plants in the studied area.

In conclusion, documentation of a considerable number of medicinal plants from the three *Kebele*s shows the presence of rich TK of medicinal plants by the local people and their dependence on them to treat various human and livestock ailments. Our results also implicated that gender, age, and educational status of the people influences the medicinal knowledge of the local people. Moreover, to maintain the level of medicinal plants and associated knowledge, the local people should be encouraged to conserve plants and free transfer knowledge on medicinal plants.

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