Ethnobotanical study on traditional medicinal plants used by Oromo ethnic people of Goro district, Bale zone of Oromia region, Ethiopia

Kedir Adem Usman, Meseret C. Egigu and J.M. Sasikumar

Correspondence

Kedir Adem Usman, Meseret C. Egigu* and J.M. Sasikumar

School of Biological Sciences and Biotechnology, College of Natural and Computational Sciences, Haramaya University, Haramaya, P.O. Box 138, Ethiopia.

*Corresponding Author: marakye311@gmail.com

Ethnobotany Research and Applications 24:8 (2022)

Research

Abstract

Background: An ethnobotanical study was conducted among Oromo people in Goro district, Oromia region, Ethiopia to document ethnomedicinal uses of plants.

Methods: Semi-structured interviews, focus group discussion and field walks were used to collect data on medicinal plants and demography during October 2017- September 2018 from 369 non-traditional and 24 traditional medicine practitioners. Descriptive statistics and quantitative indices viz. Independent t-test, Analysis of Variance (ANOVA), multiple regression analysis, Informant Consensus Factor (ICF), Fidelity Level (FL), Preference Ranking (PR) and Direct Matrix Ranking (DMR) were performed to analyze the data.

Results: A total of 84 medicinal plants belonging to 45 families were documented. The family Asteraceae was represented by six species. Most of the plants were herbs (30). The most frequently used plant parts were leaves (39.36%) followed by roots (19.18%). Oral route was frequently (62.26%) cited way of remedy application. Gastrointestinal and Dermatological illnesses had the highest ICF value (0.80), whereas the least ICF value was for Parasitic infections (0.47).The highest FL (100%) was recorded for *Aloe ruspoliana* and *Nicotiana tabacum* for Wound and Leech repulsion, respectively. *Achyranthes aspera* was top-ranked plant to treat stomachache. The analysis of DMR revealed *Cordia africana* as top-ranked multipurpose plant. Gender, age and educational status significantly (p<0.05) affected the traditional medicinal knowledge. Results of multiple linear regression showed that age and educational status predicted traditional medicinal knowledge.

Conclusion: Our study explored the profound indigenous knowledge of the Oromo people of the study area. Their traditional knowledge on the medicinal plants must be validated with phytochemical and pharmacological studies and the knowledge needs to be preserved.

Keywords: Direct matrix ranking, Fidelity level, Goro district, Informant consensus factor, Preference ranking, Traditional medicine

Background

The indigenous people across the world have established their own local knowledge on plant utility, management and conservation since time immemorial (Cotton 1996). These people possess exclusive knowledge on plant

Manuscript received: 21/03/2022 – Revised manuscript received: 22/08/2022 - Published: 26/08/2022
http://dx.doi.org/10.32859/era.28.8.1-21

resources of their surroundings and depend on them for various purposes including food and medicine (Samar *et al.* 2015). Among the continents, Africa depend on plant-based traditional medicine for their health care requirements. Traditional medicine is the principal and in some cases the only source of healthcare system for many rural communities of Africa (Antiwi-Baffour *et al.* 2014).

Among African countries, a large number of Ethiopian populace has still been relying on traditional remedies of plant origin to treat humans' and livestock's ailments (Birhanu *et al.* 2015, Fassil 2005). Their dependence on traditional medicine is due to cultural acceptability, less accessibility to allopathic medication and due to dearth of primary healthcare centers in rural and remote hamlets. The indigenous knowledge on medicinal plants still exists in the nation because of its diverse ethnicity, socio-economic status and agro-ecologies. Nevertheless, many of the ethnic communities residing in different agro-ecologies are hitherto to be explored for their knowledge on traditional medicinal plants.

This indigenous knowledge, which is well-preserved by Ethiopian indigenous population can vanish owing to immigration of communities to urban areas for employment purpose, industrialization, rapid loss of natural habitats and drastic alteration of local ecology. Further, some previously reported ethnobotanical studies envisaged the signs of erosion of indigenous medicinal plant knowledge among the ethnic communities of Ethiopia (Andarghe *et al.* 2015, Araya *et al.* 2015, Kidane *et al.* 2014, Mesfin *et al.* 2009). Above all, a profound gap between the generations and a lackadaisical mindset of younger generation have caused waning in indigenous knowledge on plant utilization (Bekalo *et al.* 2009, Jima & Megersa 2018). Furthermore, modernization has started diminishing the interest on traditional practices of medicinal plants. To revamp the vanishing indigenous knowledge on various uses of the plants, ethnobotanical studies are of paramount importance. The ethnobotanical studies will pave way to preserve the dwindling indigenous knowledge on medicinal plants. Among others, knowledge on traditional medicine varies with geographical location. Albeit some ethnobotanical study reports (e.g., Assefa *et al.* 2021, Bussmann *et al.* 2011, Gelgelu *et al.* 2020, Jima & Megersa 2018, Tegene 2018) from Bale zone exist, no ethnobotanical study was conducted in Goro district of this zone to tap indigenous knowledge relating to the utilization of medicinal plants. This study was, therefore, conducted with the objective of documenting traditional medicinal plants used by ethnic Oromo community of Goro district to treat humans' and livestock's ailments together with the associated indigenous knowledge. Therefore, in this study, we attempted to record ethnobotanical practices for using traditional medicinal plants for the treatment of various humans' and livestock's ailments and associated indigenous knowledge among the ethnic Oromo community living in Goro district, Bale zone, Oromia region, Ethiopia.

Materials and Methods

Study area

The study was conducted in Goro district found in Bale Zone of the Oromia Region, Ethiopia at 490 km to southeast from Addis Ababa (Ethiopia's capital) and 60 km from the Zonal capital, Bale Robe (Figure 1.).

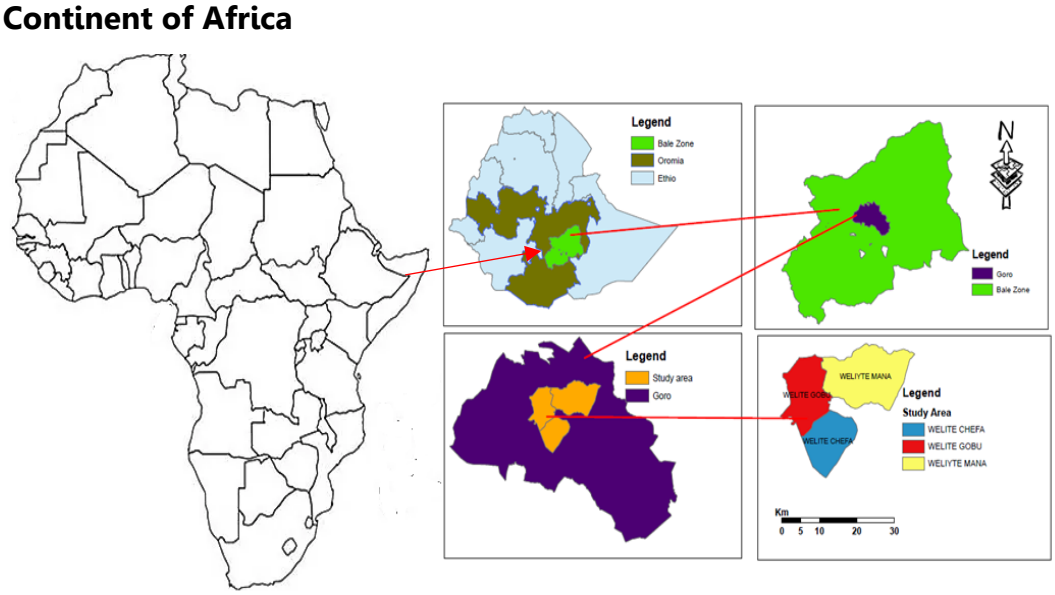

Figure 1. Location of the study site

The study area lies between 6° 0′29″&7°15″ N latitude and 40°10″& 40 °45″ E longitude and it covers a total area of 451,009 ha. The altitude of the district ranges from 500-2610 masl (Zenebe 2013). The mid-altitude areas (1600-2300 m above sea level) constitute 20% of the district and high altitude (>2300 m above sea level) areas cover 16% of the district. The remaining are low-lying areas. According to national census (CSA 2015), total population of the district was 86,106 of which 43,501 are men and 42,605 are women. About 8,531 are urban dwellers, whereas 77,575 are rural dwellers. Afaan Oromo is the main (89.45%) language of the study area, whereas Amharic (9.8%) and other languages (0.75%) are also spoken. Religion wise, 81.23 and 18.43% are followers of Islam and Christian, respectively. This district has 24 rural and 2 urban kebeles, totally 26 kebeles (kebele is the lowest administrative unit).

The average annual temperature of lowland areas ranges from 25 to 30°C, whereas that of highland areas ranges from 16 to 20°C. The mean annual rainfall is 1700 mm (Zenebe 2013). People of the district cultivate crops such as maize (*Zea mays*), tef (*Eragrostis tef*), Barley (*Hordeum vulgare*), wheat (*Triticum aestivum*), field peas (*Pisum sativum*) and broad beans *(Vicia faba).* They also rear livestock.

Preliminary survey for sampling in the study area

For the sampling purpose, visits were made to the study site for a reconnaissance survey from September 2017 to October 2017 to select three potential kebeles viz. Gobu, W/mana and Chefa based on the availability of medicinal plants and traditional medicine practitioners. Prior to ethnobotanical data collection, informants were selected from the selected kebeles. The total population size of the three selected kebeles was 9322. Therefore, the required sample size to represent the selected kebeles was determined by using the formula of Yemane (1967) as follows:

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

Where n=sample size for research; *N*=total number of population in the three kebeles (=9322); *e*=maximum variability or margin of error 5% (0.05); and 1= the probability of event occurring.

Thus, the required sample size was:

$$\frac{9322}{1 + (9322 * 0.0025)} = 393$$

A total of 393 informants (aged >25) were selected from the three Kebeles. Out of this, 369 informants were non-traditional medicine practitioners who were selected randomly from the three Kebeles. In order to meet the minimum sample size required, all available, i.e., 24 traditional medicine practitioners were included as key-informants (Tongco 2007) as they are proficient in traditional medicinal knowledge.

Ethnobotanical and socio-demographic data

Procedures of ethnopharmacological data collection (Martin 1995, Weckerle *et al.* 2017) were employed to gather information on ethnobotany of medicinal plants and socio-demographic features from October 2017 to December 2018. The techniques were semi-structured interviews, focus group discussions and direct guided field walks. Each respondent was interviewed separately to give the data on socio-demography (gender, age, and educational level), local names of the plants, diseases treated, habit, habitat, part(s) of plants used and their nature at preparation, approaches of preparation and modes of administration, dosages of remedies and additives used (if any). The informants were interviewed in Afaan Oromo though interview questions were initially prepared in English. Due to conservative culture among the male informants, permission was sought from them to interview the women informants after the purpose of the survey was explained. Accordingly, female informants were interviewed in their ambient vegetation. Based on prepared checklist, group discussion was made with the key-informants and guided field walks were performed with them for field observation and plant specimen collection.

Analysis of data

A descriptive statistical method was employed to summarize the ethnobotanical data. Independent T-test, one-way ANOVA and multiple regression were analyzed using SPSS (version 20) to compare knowledge on traditional medicinal plants between various socio-demographic groups. For this, respondents were grouped by gender (male vs female), grouped into three age categories (20-40, 41-60, >60), and 4 educational status categories (no formal

education, basic writing and reading, Grade 8-12, >Grade 12). Differences were considered as statistically significant at $p<0.05$.

Quantitative ethnobotanical indexes viz., Informant consensus factor (ICF), fidelity level (FL), preference ranking (PR) and direct matrix ranking (DMR) were also computed.

Informant consensus factor (ICF) was calculated for eight categories of human ailments to identify the agreements of the informants on the reported cures using the formula used by Teklehaymanot and Giday (2007). The ICF was calculated as follows:

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

The ICF values range from 0 to 1, with high values (i.e. close to 1) indicating a high consensus, i.e., more informants use the same species and value close to zero indicates a high variation in the use of plant species to treat a category of ailments.

Fidelity Level: The relative healing potential of each reported medicinal plant used against human and livestock ailments were evaluated using the fidelity level (FL) index. The fidelity level (FL), the percentage of informants claiming the use of a certain plant for the same major purpose was calculated for the most frequently reported ailments using the following equation (Alexiades 1996).

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

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 was computed following Martin (1995). The PR was conducted for six plant species more frequently mentioned to treat stomachache. In ranking exercise, 10 key informants were randomly selected and asked to rank plants based on their perceived effectiveness to cure the disease by assigning the highest value (6) for the most efficacious plant and lowest value (1) for the least efficacious plant.

Direct matrix ranking was conducted in order to compare multipurpose medicinal plants commonly reported by informants by following the method of Cotton (1996). Based on the relative benefits obtained from each plant, six multipurpose species were selected out of the total medicinal plants and six use diversities (use for medicine, fodder, firewood, construction, charcoal and furniture making). Ten key informants were selected and asked to assign use values (5 = best, 4 = very good, 3 = good, 2 = less used, 1 = least used and 0 = not used) for each purpose. The values given by 10 key informants for each species corresponding to each use purpose were averaged, and later summed up and ranked.

Results and Discussion

Medicinal plants documented and their diversity

From the three surveyed kebeles of the study area, a total of 84 medicinal plant species grouped under 75 genera and 45 families were reported for the treatment of 58 different health problems (Table 1). Sixty-three of these plants were reported for treating human ailments only, whereas 17 and 4 species were used to treat livestock only, and both livestock and human ailments, respectively (Table 1). Analysis of species diversity by family showed that Asteraceae is represented by 6 species followed by Fabaceae (5 species), Euphorbiaceae, Solanaceae and Anacardiaceae (4 species each), Rutaceae, Myrsinaceae, Myrtaceae and Moraceae (3 species each) (Table 2). The dominance of the Asteraceae family owes to its cosmopolitan distribution (Andenberg *et al.* 2007). Previous reports show high usage of this family for medicinal purpose in Ethiopia (e.g., Birhanu *et al.* 2015, Mesfin *et al.* 2009, Mogosse 2016) and in other countries (da Costa *et al.* 2021, Hosseini *et al.* 2021, Jafarirad & Rasoulpour 2019). Reports on the presence of diverse secondary compounds such as sesquiterpene lactones (Chadwick *et al.* 2013) and phenolic compounds (Jaiswal *et al.* 2011, Petropoulos *et al.* 2019) and bioactive investigations like anticancer activity (Tesfaye *et al.* 2021), antidiabetic activity (Gyang *et al.* 2004) and antimicrobial activity (Sasikumar *et al.* 2005, Teka *et al.* 2015) support the popularity of this family in traditional medicine use.

Table 1. List of medicinal plants used to treat human and livestock ailments

Scientific Name, Voucher No and Habit	Local name	Families	HB	Disease treated	CP	Route of administration	Part used, Preparation and application
Acacia albida Del. (KA11) **Tree**	**Garbii**	Fabaceae	Fl	Diarrhea	F	Oral	**Bark**. The internal part of the bark is crushed, mixed with water, filtered and drunk
				Dandruff	D	Dermal	**Pods.** The pods are pounded and used as a shampoo
Acacia etbaica Schweinf. (KA02) **Tree**	**Doddotii**	Fabaceae	W	Abdominal pain	F	Oral	**Root.** Fresh root is chewed and swallowed
Achyranthes aspera L. ** (KA08) **Herb**	**Derguu**	Amaranthaceae	W	Stomachache	F	Oral	**Root.** The root is chewed and swallowed
				Wound	F	Dermal	**Leaf.** The leaf is crushed with *Allium sativum* bulb then creamed on wounded part.
				Blood clot	F	Dermal	**Root.** Crushed root is tied on bleeding part of animals.
				Tonsillitis	F	Dermal	**Leaf.** Crushed leaf is mixed with coffee powder and then tied on neck with clean cloth
Acokanthera schimperi (A. DC.) Schweinf. (KA04) **Tree**	**Qaraaru**	Apocynaceae	W	Scabies & spider poison	F	Dermal	**Leaf.** The leaves are chopped, mixed with butter and applied on the infected part of the body.
Allium cepa L. (KA05) **Herb**	**Shunkurti diima**	Alliaceae	Fl	Asthma	FD	Oral	**Bulb.** The bulb is boiled with leaf of *Zingiber officinale* and the filtrate is drunk
Allium sativum L**.** (KA03) **Herb**	**Qullubi**	Alliaceae	Fl	Malaria	FD	Oral	**Bulb.** The mixture of crushed bulb and honey (two spoons) is consumed every morning until recovery
				Cough	F	Oral	**Bulb.** Peeled bulb is consumed
Aloe ruspoliana Baker. (KA06) **Herb**	**Hargiisaa**	Aloaceae	W	Wound	F	Dermal	**Sap.** The sap is creamed on wound
				Snake bite	F	Oral	**Sap.** The sap/jelly of the fresh leaf is mixed with honey and drunk.
Bidens pilosa L. (KA01) **Herb**	**Cogee**	Asteraceae	W	Ear problem	F	Ear	**Leaf.** The leaves are powdered and mixed with butter and then dropped in to the ear

Cadia purpurea (G. Piccioli) Aiton.*(KA10) **Shrub**	**Hinjirree**	Fabaceae	W	Coughing & Sneezing of donkey	F	Nasal	**Leaf.** Solution of chopped leaves is poured through the nostril of the animal
Calpurnia aurea (Ait.) Benth.* (KA12) **Shrub**	**Ceekata**	Fabaceae	W	Ectoparasite (louse)	F	Dermal	**Leaf.** Mixture of crushed leaves and kerosene is applied on the skin of cattle and calves until the louse is removed
Carica papaya. (KA18) **Tree**	**Papaye**	Caricaceae	Fl	Amebiasis	F	Oral	**Seed.** Mixture of powdered seeds and honey is consumed
Carissa spinarum L. (KA13) **Shrub**	**Hagamsa**	Apocynaceae	W	Diarrhea	F	Oral	**Leaf.** The leaf is chopped and boiled with *Coffea arabica* and the filtrate is drunk
				Evil eye	F	Oral	**Root.** Roots are burned and smoked
Citrus sinensis L. (KA14) **Shrub**	**Burtukana**	Rutaceae	Fl	Wound	F	Dermal	**Fruit.** The fruits juice is mixed with latex of *Euphorbia tirucalli* and *Citrus lemon* juice and creamed on wounded part
Coffea arabica L. (KA16)**Shrub**	**Buna**	Rubiaceae	Fl	Common cold	D	Oral	**Seed.** Powder of roasted seeds is boiled and mixed with juice of lemon and ginger and then drunk
				Fire burn	D	Dermal	**Seed.** The seeds is roasted, powdered and applied on wound
Cordia africana L. (KA15)**Tree**	**Waddessa**	Boraginaceae	W	Smell of foot & Dental problem	D	Dermal	**Bark**. Dried bark is powdered and applied on the legs and also used as tooth powder to get relief from dental problems
Croton macrostachyus Hochst. ex Delile ** (KA07) **Tree**	**Bakkanisaa**	Euphorbiaceae	W	Ringworm	F	Dermal	**Sap.** The fresh sap is applied on the infected part
				Anthrax	F	Nasal	**Root.** Root of *Croton macrostachyus* and *Carissa spinarum* are chopped together and mixed with crushed fruits of *Lageniaria siceraria* and the filtrate is applied through the nostrils of cattle and goat.
				Arthritis	F	Oral	**Leaf.** Leaves of *Croton macrostachyus* and bulb of *Allium sativum* are crushed

							together and the filtrate is drunk with camel milk
				Blood clot	F	Dermal	**Sap.** Exudates are put on the cut skin to stop or reduce bleeding
				Malaria	D	Dermal	**Bark** is put on fire and the smoke is used to protect from mosquito bite
Cucumis dipsaceus Ehrenb. ex Spach.** (KA09) **Climber**	**Dabaaqula**	Cucurbitaceae	W	Retained placenta	F	Oral	**Root.** Fresh root is pounded and mixed with water and then drunk.
				Ear pain	F	Ear	**Fruit.** Fruits are cut and its sap is added to ear canal.
				Eye disease	F	Eye	**Leaf.** Leaf is crushed and its juice is dropped in the eye
Cucurbita pepo L. (KA17) **Climber**	**Hiddi hoolotaa**	Cucurbitaceae	Hg	Stomachache	FD	Oral	**Seed.** Seeds are boiled in water, then the filtrate is drunk
Cynodon dactylon L. (KA36**) Herb**	**Saardo**	Poaceae	W	Snake poison	F	Oral	**Stem.** The stem is chewed
Datura stramonium Mill. (KA19) **Herb**	**Banjii**	Solanaceae	Fl	Scabies and ear wound	F	Dermal	**Leaf.** Leaves are crushed and mixed with salt then creamed on wounded area
*Dodonaea angustifolia*L. f. **(KA35) **Shrub**	**Dhittacha**	Sapindaceae	W	Scabies	F	Dermal	**Leaf.** Leaves are crushed and mixed with butter and then creamed
				Bone fracture	D	Dermal	**Leaf.** Paste of leaf powder is tied on fractured bone with bark of *Dombeya schimperiana*
Dombeya schimperiana A.Rich.S.L.(KA21)**Shrub**	**Dannisa**	Sterculiaceae	W	Abdominal pain	D	Oral	**Leaf.** Mixture of pounded leaf and honey is consumed
Dovyalis abyssinica (A.Rich.) Warb. (KA34) **Shrub**	**Koshimoo**	Flacourtiaceae	Hg	Taeniasis	D	Oral	**Seed.** Dried seed is roasted and mixed with honey and given to eat
Ehretia cymosa Thon. (KA20) **Tree**	**Ulaaga**	Boraginaceae	W	Rheumatism	F	Oral	**Leaf.** The fresh leaf is boiled together with roots of *Rumex nepalensis* and the filtrate is drunk for three days.
Elaeagnus commutate Bernh. ex Rydb.*(KA79) **Herb**	**Hiddi waraabessa**	Elaeagnaceae	W	Coughing	F	Nasal	**Leaf.** The juice of the leaf collected after squeezing is given through the nose to cattle
Eleusine jaegeri Pilger. (KA33)**Herb**	**Coqorsa**	Poaceae	W	Snake bite poison	F	Derma	**Stem.** The stem is pounded and rubbed on the affected skin for three days.

Embelia schimperi Vatke. (KA22) **Shrub**	**Haanquu**	Myrsinaceae	Hg	Tape worm	D	Oral	**Fruit.** Fruit is pounded, dissolved in water, and the decoction is drunk early morning before meal
Ensete ventricossum (Welw.) *Cheesman*]. (KA23) **Herb**	**Warqee**	Musaceae	Fl	Abdominal pain	F	Oral	**Leaf.** The base of the leaves are chopped and fermented for 10-12 days and then consumed
				Diarrhea	D	Oral	**Root.** Dried root decoction with sugar and salt is given.
*Eucalyptus camaldulensis*Dehnh. (KA32) **Tree**	**Bargamoo diima**	Myrtaceae	Hg	Stomachache	F	Oral	**Leaf** is chewed and swallowed
Eucalyptus globules Labill. (KA24) **Tree**	**Bargamoo adii**	Myrtaceae	Hg	Common cold	F	Nasal	**Leaf** is crushed roughly and boiled in water and its smoke is inhaled until the patient sweats and sneezes.
Euclea racemosa Murr. Subsp. s*chimperi* (A. DC.) White. (KA31) **Shrub**	**Mi'essa**	Ebenaceae	W	Gonorrhea	DF	Oral	**Roots** of *Euclea racemosa* and *Cucumis ficifolius* are crushed and mixed with sparrow's meat and honey and then swallowed
				Toothache	F	Oral	**Root** is chewed and kept in the teeth
Euphorbia candelabrum Trémaux ex Kotschy *(KA25) **Tree**	**Hadamma**	Euphorbiaceae	W	Wound and Tumors ("*nyaqarsa*")	F	Dermal	**Sap.** The sap is mixed with kerosene and urine then creamed on affected part until recovery
Euphorbia tirucalli L.(KA30) **Shrub**	**Aannoo**	Euphorbiaceae	W	Skin infection/ *kintarot*	F	Dermal	**Sap.** The fresh latex of *Euphorbia tirucalli* is creamed on the affected part
Ficus capensis L. (KA26) **Tree**	**Odaa**	Moraceae	W	Toothache	DF	Dermal	**Bark.** The bark is kept on the affected teeth
Ficus sycomorus L. (KA29) **Tree**	**Qilxu**	Moraceae	W	Wound	F	Dermal	**Sap.** The latex is creamed on the wounded part
Ficus thonningii Blume. (KA27) **Tree**	**Dambii**	Moraceae	W	Vomiting	F	Oral	**Bark.** The inner bark is chewed and swallowed
				Loss of appetite	F	Oral	**Root.** The root is chewed and swallowed
Galium hametum Hochst. (KA28) **Herb**	**Maxxanne**	Rubiaceae	W	Snake venom	F	Oral	**Leaf and Root.** The leaves and roots are chopped together and mixed with honey and then consumed one cup at morning for three days
Grewia ferruginea Hochst. ex A. Rich.(KA55) **Shrub**	**Dhoqonuu**	Tiliaceae	W	Dandruff	F	Dermal	**Leaf** is crushed and used as shampoo to wash hair

Guizotia scabra (via) Chiov. (KA37) **Herb**	**Hadaa**	Asteraceae	Fl	Liver disease	F	Oral	**Root and bark** are crushed and mixed with honey and then consumed
Guizotiaabyssinica (L. f.) Cass.) *(KA54) **Herb**	**Nuugi**	Asteraceae	Fl	Swelling (*Mada gatetti*)	F	Dermal	**Seed** is roasted, powdered and creamed on the affected part
Heteromorphatrifoliata (H.L.*Wendl.*) *Eckl.* & Zeyh *(KA38) **Shrub**	**Al-haanqaa**	Apiaceae	W	Urine mixed with blood	D	Oral	**Leaf.** The leaves are powdered with the leaves of *Croton macrostachyus*, and is made as solution and given one liter orally once in a day.
Justicia schimperiana T. Anderson. (KA52) **Shrub**	**Dhummuga**	Acanthaceae	W	Rabies	F	Oral	**Leaves** of *Justicia schimperiana* and *Phytolacca dodecandra* are powdered and mixed well with coffee and white honey and drunk
Kalanchoe petitiana. A.Rich. (KA40) **Herb**	**Kontoma**	Crassulaceae	W	Swelling	F	Dermal	**Leaf.** The leaves are heated and tied on swelling part of livestock
Lantana camara L. (KA53)**Shrub**	**Qorsoo sinbira**	Verbenaceae	W	Diarrhea	D	Oral	**Seed.** Seed decoction of dried seed is given with sugar and salt.
*Lepidium sativum*L. (KA39) **Herb**	**Shunfaa**	Brassicaceae	Fl	Leprosy	D	Oral	**Seed.** The seed is crushed and soaked in water for two days, and then the filtered bitter juice is drunk
Linum usitatissimum L.* (KA51) **Herb**	**Telbaa**	Linaceae	Fl	Constipation	F	Oral	**Seed.** The powdered seed is mixed with water, then the solution is given to animal
				Placenta retention	D	Oral	**Seed.** The solution of powdered seed mixed with salt and given to animal
Lycopersicon esculentum Mill.(KA50) **Herb**	**Timatima**	Solanaceae	Fl	Hypertension	F	Oral	**Fruit.** Heat processed tomatoes are given
Maesa lanceolata Forrsk.* (KA41) **Shrub**	**Abbayyi**	Myrsinaceae	W	Leech infection	F	Nasal	**Leaf.** Chopped leaves are mixed with water and applied through the nostril
Mangifera indica L. (KA50) **Tree**	**Maangoo**	Anacardiaceae	Fl	Vomiting	F	Oral	**Fruit.** juice is drunk
Myrsine africana L. (KA49) **Shrub**	**Qacamoo**	Myrsinaceae	W	Endoparasite (Tape Worm)	F	Oral	**Seed.** Seeds are pulverized and mixed with honey and then consumed
Nicotiana tabacum L.* (KA48) **Herb**	**Tambo**	Solanaceae	Hg	Leech infection	D	Oral	**Leaf.** Leaves of *Nicotiana tabacum* are crushed, mixed with water then given to cows to drink

Ocimum sp. (KA42) **Herb**	**Qoricha michii**	Lamiaceae	W	Headache and fever	F	Oral	**Leaf.** The leaves are crushed, mixed with white honey and consumed. Crushed leaves will also be sniffed
Olea africana L. (KA46) **Tree**	**Ejersa**	Oleaceae	W	Common cold	DF	Nasal	**Stem and leaf** are put on fire and the vapor is inhaled during bedtime
Oncoba spinosa Forsskal. (KA44) **Tree**	**Akukuu**	Flacourtiaceae	W	Sexual impotency	D	Oral	**Bark.** Dried stem bark powder is cooked with chicken and consumed once a day
Opuntia ficus-indica (L.) *Mill.*(KA43) **Shrub**	**Shoonka**	Cactaceae	W	Jaundice	F	Oral	**Fruit.** The fruit is mixed with dry powdered leaf of *Phytolacca dodecandra* and *Solanum marginatum* and then mixed with milk and drunk.
Orobanche minor Smith.* (KA45) **Herb**	**Butte warabessa**	Orobanchaceae	W	Urine retention	F	Oral	**Whole plant.** The whole part is pounded, mixed with *Ruta chalepensis* leaves, decocted and given to cattle to drink
Osyris quadripartite Salzm. ex Decne. (KA47) **Shrub**	**Waatoo**	Santalaceae	W	Evil eye	D	Nasal	**Roots** are crushed and put on fire and then the smoke is sniffed
Pappea capensis Eckl. & Zeyh.(KA74) **Tree**	**Biiqaa**	Sapindaceae	W	Liver disease	F	Oral	**Bark.** The inner part of the bark is chopped and boiled, and after addition of milk or butter, it is drunk once a day for five days
Persea americana Mill. (KA56) **Tree**	**Abukadoo**	Lauraceae	Fl	Enteritis and Kidney Infection	F	Oral	**Fruit**. The fresh fruit is mixed with egg and honey and then consumed.
Phytolacca dodecandra L'Hér.(KA81) **Climber**	**Andode**	Phytolacaceae	W	Itching	F	Dermal	**Leaf.** The leaves of *Phytolacca dodecandra* and *Ruta chalepensis* are crushed together and used for washing during Itching
Podocarpus falcatus (P.gracilior)(KA73) **Tree**	**Birbirsa**	Podocarpaceae	W	Fever and joint pain	F	Oral	**Leaf.** The filtrate of chopped leaf solution is drunk
Premna schimperi Engl. (KA57) **Shrub**	**Urgessa**	Verbenaceae	W	Gum bleeding	D/F	Dermal	**Root.** Powdered root is mixed with water and rubbed on affected gum by using cotton dipped into the mixture.

Psidium guajava L. (KA67) **Tree**	**Zeeyituna**	Myrtaceae	Hg	Toothache	F	Oral	**Fruit. Piece of f**resh fruit is mixed with salt held between teeth.
Raphanus sativus L.* (KA58) **Herb**	**Zaroo**	Brassicaceae	Fl	Bloating	D	Oral	**Seed** is powdered and , mixed with some sort of food and given to cattle to consume
*Rhamnus prinoides*L Hér. (KA72) **Shrub**	**Geeshoo**	Rhamnaceae	Fl	Tonsillitis	F	Oral	**Root and leaves** are crushed with *Lepidium sativum* seeds, bulbs of *Allium sativum* and honey, and consumed
*Rhus glutinosa*Hochst. ex A.Rich.*(KA59) **Shrub**	**Xaaxessaa**	Anacardiaceae	W	Urine Retention	DF	Oral	**Leaf.** Dried or fresh leaf is mixed with leaves of *Ruta chalepensis* and the decoction is given to cattle
Rhus natalensis Bernh. ex *Krauss*(KA66) **Shrub**	**Daboobessaa**	Anacardiaceae	W	Snake bite	F	Oral	**Leaf:** Leaves are pounded and the extract is mixed with coffee and then drunk
Ricinus communis L.* (KA82) **Shrub**	**Qobboo**	Euphorbiaceae	W	Ascariasis	D	Oral	**Root.** The pounded root is mixed with salt and half a cup the solution is given to cattle
				Actinomycosis (*kurufsisa*)	F	Oral	**Seed.** Seeds are crushed and mixed with salt and given to cattle to consume
				Ulcer	D	Oral	**Seed.** The dried seeds are pounded and mixed with butter and creamed on the ulcerated skin of donkey
Rosa abyssinica R.Br. (KA70) **Shrub**	**Gorsana**	Rosaceae	W	Toothache	F	Dermal	**Root** is chewed and held on the teeth
Rumex abyssinicus Jacq. (KA60) **Herb**	**Shabbe**	Polygonaceae	W	Malaria	F	Oral	**Leaf.** The leaves of *Rumex abyssinica* are crushed with root of *Hagenia abyssinica* boiled with goat milk and consumed
				Swelling	F	Dermal	**Leaf.** Leaves are chewed and put on the swollen area
Rumex nervosus Vahl. (KA69) **Shrub**	**Dhangaggoo**	Polygonaceae	W	Abdominal Pain	F	Oral	**Leaf**. The leaves are chewed and swallowed directly
Ruta chalepensis L.(KA61) **Herb**	**Sillixi (cilaaddama)**	Rutaceae	Hg	Stomachache	F	Oral	**Leaf.** Fresh leaf is crushed with *Allium sativum* bulb then the solution is given for human and livestock.

Schinus molle L.* (KA63) **Tree**	**Qondaberbere**	Anacardiaceae	Hg	Bloating	F	Oral	**Leaf.** Leaves are pounded and mixed with hot water and cooled, and then salt is added and given to the animal during bloating
Schrebera alata(Hochst.) Welw.(KA77) **Tree**	**Dhama'ee**	Oleaceae	W	Throat Pain	F	Oral	**Bark.** The inner stem bark is chewed and then its juice is swallowed.
Solanum incanum L. (KA84) **Herb**	**Hiddi**	Solanaceae	Hg	Stomachache	F	Oral	**Root** The root tip is chewed and swallowed
Tagetes minuta L. (KA75) **Herb**	**Ajo**	Asteraceae	Fl	Ectoparasite	F	Dermal	**Leaf and Stem.** Both of them are cut and kept in a room to prevent arthropod infestation
Teclea nobilis Del.*(KA76) **Tree**	**Hadheessaa**	Rutaceae	W	Black leg (*Abagorba*)	F	Oral	**Leaf.** The leaves are pounded mixed with water and given to cattle to drink
Trigonella foenum-graecum L. (KA80) **Herb**	**Shiqoo**	Fabaceae	Fl	Stomach che	F	Oral	**Seed.** The powder of the seeds is mixed with water and kept overnight and then sugar is added and drunk before breakfast every morning for three days
Urtica simensis Hochst. (KA62) **Herb**	**Dobbii**	Urticaceae	W	Diabetes	D	Oral	**Leaf.** Dried leaf powder is boiled with tea and drunk
Verbascum sinaiticum Benth.* **(**KA68) **Herb**	**Gurra harree**	Scrophulariaceae	W	Coccidiosis	F	Oral	**Leaf.** Fresh leaf is squeezed and mixed with *Ruta chalepensis* leaf and *Allium sativum* bulb, and then given orally to chicken
Vernonia amygdalina Del.*(KA71) **Shrub**	**Ebicha**	Asteraceae	W	Placenta retention	F	Oral	**Leaves**. The leaves are crushed and mixed with remnants of local beer ('*Tella*') and given orally for delayed placenta
Xanthium abyssinicum Wallr.(KA64) **Herb**	**Qoree abdulakim**	Asteraceae	Hg	Fungal disease on skin	F	Dermal	**Sap.** Sap from twigs will be smeared on the skin
Zingiber officinale Roscoe.(KA78) **Herb**	**Zenjibila**	Zingiberaceae	Hg	Abdominal pain	DF	Oral	**Root.** Roots are powdered and mixed with milk and consumed with bulbs of *Allium sativum*
Ziziphus spina-christi (*L.*) Desf. (KA65) **Tree**	**Qurqura**	Rhamnaceae	W	Involuntary urination on bed	D	Oral	**Root**. Dry root is pounded and mixed with yogurt and consumed

Key: Hb = Habitat (W =Wild, Hg= Home-garden, Fl=Farmland, Cp = Condition of preparation, F = Fresh, D = Dried, F/D = Fresh/Dried, *=used for livestock ailment, **=used for both, KA= is name of the collector and the number in parenthesis is collection number

Table 2. Diversity of the documented medicinal plants

Family	Number of genera	Percent (%)	Number of species	Percent (%)
Asteraceae	5	6.67	6	7.14
Fabaceae	4	5.33	5	5.95
Solanaceae	4	5.33	4	4.76
Euphorbiaceae	3	4	4	4.76
Anacardiaceae	3	4	4	4.76
Rutaceae	3	4	3	3.57
Myrsinaceae	3	4	3	3.57
Myrtaceae	2	2.67	3	3.57
Moraceae	1	1.33	3	3.57
Apocynaceae	2	2.67	2	2.38
Alliaceae	1	1.33	2	2.38
Rubiaceae	2	2.67	2	2.38
Boraginaceae	2	2.67	2	2.38
Cucurbitaceae	2	2.67	2	2.38
Poaceae	2	2.67	2	2.38
Sapindaceae	2	2.67	2	2.38
Flacourtiaceae	2	2.67	2	2.38
Verbenaceae	2	2.67	2	2.38
Oleaceae	2	2.67	2	2.38
Rhamnaceae	2	2.67	2	2.38
Polygonaceae	1	1.33	2	2.38
The remaining 25 species	1	33.33	1	29.76

Plant life-form, habitat of the medicinal plants and parts used

In terms of life-form, 30 medicinal plant species were herbs followed by shrubs (27 species), trees (24 species) and climbers (3 species). The dominance of herbs as medicinal plants could be attributed to rapid and profuse growth of herbaceous plants (Farooq *et al.* 2019). The same result was reported by similar previous works (e.g., Ahmed 2021, Gonfa *et al.* 2020, Meragiaw *et al.* 2016, Mukaila *et al.* 2021).

Most (53, 63.09%) of the medicinal plants were obtained from wild habitats including forest, around rivers, grass lands and roadsides while 31 (36.9%) of them were from farmland and/or home-garden. Those plants obtained from the latter habitats were cultivated for purposes other than medicine. For example, *Allium cepa*, *Allium sativum*, *Carica papaya*, *Citrus sinensis*, *Lepidium sativum* and *Ruta chalepensis* were cultivated as food or spices. Our result is in accord with results of earlier similar research conducted in different parts of the country (e.g., Constant & Tshisikhawe 2018, Gebre & Chinthapalli 2021, Mesfin *et al.* 2014, Tadesse *et al.* 2015). People of Goro district prepare remedies from various plant parts. As reported from indigenous people of other localities in Ethiopia (e.g., Bekele 2007, Ketema 2015, Weldearegay & Awas 2021), leaf was the predominantly cited plant part followed by root and seed for the preparation of remedies in this study (Figure 2).

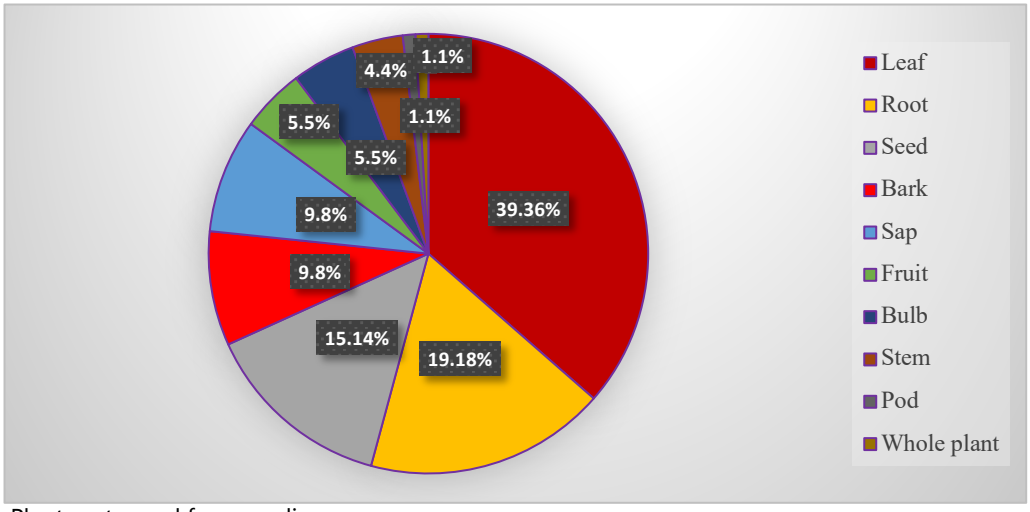

Figure 2. Plant parts used for remedies

On the contrary, results of other studies showed that root is the first plant part followed by leaf (Abera 2003, Alemayehu *et al*. 2015, Regassa *et al*. 2017). Even from the same Bale Zone, but different district (Berbere district), Jima & Megersa (2018) reported root as the most cited plant part for remedy preparations. This suggests that people of different locality have different beliefs on the curative potential of plant parts that should be verified through pharmacological investigations. Unless excessively harvested, more dependence on leaves for remedy preparations may not be a threat to the mother plant. However, in this study, use of roots and seeds for remedy preparations appeared to be substantial and thus may threaten the regeneration and survival of plants (Jima & Megersa 2018).

Modes of remedy preparation, dosage and route of application

In Goro district, remedies are prepared directly when plant materials are fresh or after drying. Use of fresh materials, however, was highly (71.4%) preferred as compared to dried form, which accounted only for 20.9%. For some ailments (7.7%), respondents reported the possibility of using in either fresh or dry form. The dominant use of fresh plant material may be attributed to its therapeutic potential because of its intact ingredients (Chaachouay *et al*. 2022). Similar results were reported previously by different researchers (eg. Alemneh 2021, Birhanu & Ayalew 2018, Gebre & Chinthapali 2021, Yineger *et al*. 2008) who have undertaken research in different parts of the country. Crushing for decoction and pounding to concoct were the two main remedy preparation methods in Goro district. These approaches are reported as major methods of preparation of remedies in many studies conducted in different parts of Ethiopia regardless of ethnicity (Ahmed 2021, Alemneh 2021, Birhanu & Ayalew 2018, Yineger *et al*. 2008). During our interview and discussion with key-informants, we noticed that dosage to be taken is determined based on the age, sex and physical appearance of patients. For example, to treat black leg disease of cattle, two glasses (ca. 600 ml) of *Teclea nobilis* leaf suspension is prescribed while half of it is recommended for calves. Lack of exact measurement may result in adverse conditions such as nausea and vomiting (Dawit & Ahadu 1993). Depending on the nature of disease and body parts under illness, the local people employ various routes of remedy application. Mostly remedies are taken orally though other routes such as dermal, nasal, auricular and ocular were also reported (Figure 3). Similar approach was reported by different researchers who studied traditional medicine in different parts of the country (e.g., Agisho *et al*. 2014, Assegid & Tesfaye 2014, Alemayehu *et al*. 2015, Gebre & Chinthapalli 2021, Ketema 2015, Kewessa *et al*. 2015).

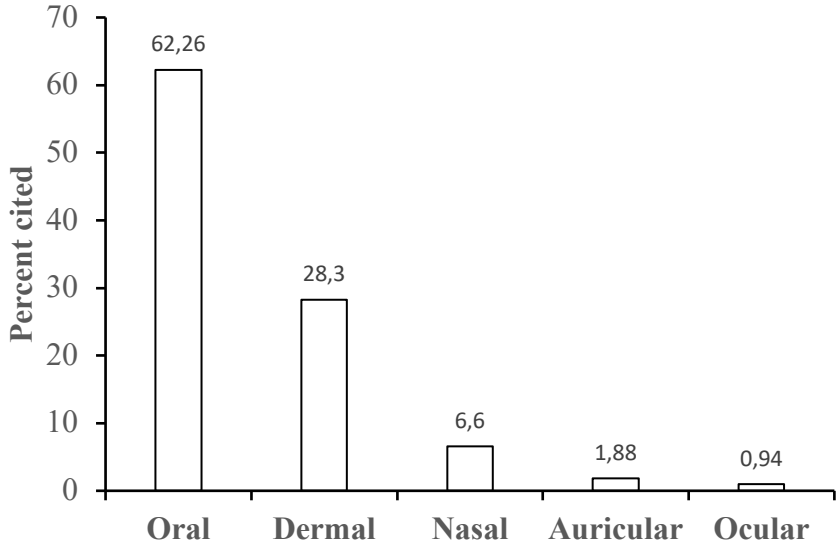

Figure 3. Route of administration of remedies

Informant consensus factor (ICF)

The extent of closeness of traditional knowledge among the respondents on the use of traditional medicinal plants to treat ailments was done by computing ICF values using eight disease categories. The maximum ICF value, which shows complete agreement between respondents is 1 with agreement level decreasing as values decrease from 1 to 0, which is complete disagreement (Gazzaneo *et al*. 2005). In this study, ICF values ranged from 0.47 to 0.86. Highest agreement (0.86) was on gastrointestinal related diseases followed by dermatological related diseases (0.85) and degenerative diseases (0.8). The least agreement (0.47) was for treatment of parasitic infections such as insect ecto-parasites and helminthic parasites (taeniasis and ascariasis) (Table 3). Highest agreement on the

treatment of gastrointestinal related diseases may be attributed to its commons in the study area so that people exchange information on its remedy (Heinrich *et al.* 1998). Less agreement on the treatment of parasitic infections may be due to the rare occurrence of parasitic infections in the study area (Heinrich 2000).

Table 3. Informant consensus factor on major categories of ailment

Disease categories	Number of species used (n_t)	Use citation (N_{uc})	ICF
Gastrointestinal related diseases (Bloating, Diarrhea, Stomachache, Loss of appetite, Constipation, Vomiting)	18	115	0.86
Dermatological related diseases (Wound, Fire burn, Ringworm, Scabies, Skin infection, Dandruff, Fungal infection)	17	111	0.85
Dental problem, Tonsillitis and Throat pain	9	40	0.79
Respiratory disorders (Asthma, Common cold and Cough)	7	27	0.76
Parasite infections (Ectoparasite (Louse), Endoparasite (Taeniasis and ascariasis)	10	18	0.47
Poison (Snake bite and Spider poison)	6	25	0.79
Febrile illness	9	36	0.77
Degenerative diseases (Diabetes, kidney and hepatic illnesses)	13	61	0.80

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

Fidelity level

Fidelity level (FL) index points out the most important medicinal plant that people use to effectively treat a given illness. If many people cite a given plant to treat the same ailment rather than citing it for many different ailments, the FL value will be the highest (Friedman *et al.* 1986). In this survey, we calculated the FL index for medicinal plants that were cited most to treat the frequently reported human ailments. Results of the FL index ranged from 64 to 100% (Table 4). *Aloe ruspoliana* (FL=100%) and *Nicotiana tabacum* (FL=100%) were reported independently by many respondents to treat wound and Leech repulsion, respectively. The highest FL index of these medicinal plants suggests their therapeutic efficiency against the respective diseases. Earlier report from Ethiopia (Belayneh *et al.* 2020) showed the use of *A. ruspoliana* for skin disease of cattle. The traditional use of *N. tabacum* for the treatment of leech repulsion has also been well vindicated (Amenu 2007). Hence, further investigations on pharmacology and phytochemical analysis of these two plant species should be given priority to effectively use them against the mentioned health problems. The least FL index (FL=64%) was reported on *Opuntia ficus-indica* for the treatment of Jaundice (Table 4). Plants with lower FL value shall also be given due attention regardless of their perceived low efficacy not to lose knowledge related to them in the future (Chaachouay *et al.* 2019).

Table 4. Fidelity level index of the most frequently reported medicinal plants

Botanical Names	Ailment treated	N_P	N	FL	FL (%)
Aloe ruspoliana	Wound	42	42	1	100
Nicotiana tabaccum	Leech	13	13	1	100
Calpurnia aurea	Ectoparasite	34	37	0.92	92
Coffee arabica	Fire burn	44	48	0.92	92
Datura stramonium	Scabies and ear lesion	30	34	0.88	88
Eucalyptus globulus	Common cold	21	26	0.81	81
Croton macrostachyus	Malaria	12	17	0.71	71
Opuntia ficus-indica	Jaundice	9	14	0.64	64

Note: NP=No. of informants who independently indicate the use of species; N=Total No. of informants that used the plant to treat major aliments.

Preference ranking (PR)

Preference ranking made by ten key informants on six medicinal plants reported as remedy for stomachache showed that *Achyranthes aspera* was the most preferred plant followed by *Solanum incanum* (Table 5). Previously these plants have been cited as remedy for stomachache by other authors (e.g., Assefa *et al.* 2021, Bussmann *et al.* 2011, Moravec *et al.* 2014). Moreover, *Achyranthes aspera* was previously evaluated for antimicrobial activity (Gupta *et al.* 2010) and analgesic activity (Sutar *et al.* 2008). Anti-ulcerogenic activity of *Solanum incanum* was also reported by Belayneh *et al.* (2021). This preference may be related to their efficacy to treat stomach trouble so that further

pharmacological investigation is essential to authenticate the traditional medicinal claim by the people of the study area.

Table 5. Preference ranking of medicinal plants used to treat 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}		
Achyranthes aspera	5	4	5	3	4	5	4	3	3	4	40	1st
Solanum incanum	5	4	3	5	3	3	4	5	3	2	37	2nd
Ruta chalepensis	2	5	3	4	5	2	3	4	4	3	35	3rd
Trigonella foenum- graecum	4	2	1	3	5	4	4	5	1	1	30	4th
Eucalyptus camaldulensis	2	4	3	5	4	3	1	3	3	1	29	5th
Cucurbita pepo	3	4	2	1	1	2	4	5	3	1	26	6th

Note: 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 highest efficacy and 1 denotes lowest efficacy.

Direct Matrix Ranking

Some medicinal plants were screened for their multipurpose use from the study area. In this study, direct matrix ranking was conducted using six use categories, and result revealed that *Cordia africana* was the most utilized plant by local people for various purposes (Table 6). The fact that *C. africana* is being highly exploited may endanger this species to local extinction in the future. Therefore, it deserves great attention not to lose it. Moreover, ecological investigation on its regeneration status in the study area should be investigated so as to understand its conservation status.

Table 6. Direct matrix ranking for six multipurpose plant species

Use Categories	Plant species					
	Calpurnia aurea	*Cordia africana*	*Croton macrostachyus*	*Eucalyptus globulus*	*Olea europeae*	*Dodonaea angustifolia*
Firewood	5	4	2	4	5	4
Medicinal	4	5	5	5	4	3
Construction	3	4	3	5	4	2
Fodder	2	5	2	3	3	4
Charcoal	0	2	3	2	2	3
Timber	0	5	4	5	2	2
Grand Total	14	25	19	24	20	18
Rank	6th	1st	5th	2nd	3rd	4th

The impact of socio-demographic factors on traditional medicinal knowledge

Results of this study showed that male respondents cited significantly higher number of medicinal plants than females (p=0.007) (Table 7). Reporting of higher number of medicinal plants by men than women show the relatively better knowledge of men in traditional medicine. Teklehaymanot & Giday (2007) earlier reported that knowledge on traditional medicine is traditionally transferred to sons than daughters in many parts of Ethiopia through verbal communication. Thus, such biasness might have contributed to the observed difference. There was a significant difference (one-way ANOVA, p< 0.001) between age categories in reporting medicinal plants. Informants with >60 years of age reported higher number of medicinal plants than those of age ≤60 (Table 7). High level medicinal knowledge of older people could be due to the accumulated knowledge of elderly people obtained through their long years of interaction with their environments (Brandt *et al.* 2013, Giday 2001). Previous studies (Abebe & Teferi 2021, Giday *et al.* 2009, Girmay *et al.* 2021, Kassa *et al.* 2020, Tefera & Kim 2019) support our results. The relatively lower medicinal knowledge of younger respondents suggests the possible dwindling of information flow that can be seen as one of the perils to indigenous knowledge. Thus, older generation should transfer their knowledge to the youngsters as early as possible. Traditional medicinal knowledge was also significantly varied between educational level of the respondents (p=0.002). The number of cited medicinal plants appeared to decrease with increasing level of education as it was reported previously from different parts of the country by different authors (e.g., Abebe & Teferi 2021, Gebre & Chinthapalli 2021, Giday *et al.* 2009, Girmay *et al.* 2021, Kassa *et al.* 2020). In this study, we surveyed three kebeles. Comparison of the medicinal knowledge of the people between kebeles showed no significant difference between them. Of course, the three kebeles have more or less similar agro-ecologies (for example, they are from mid-lands) that affects occurrence of similar vegetation. It is also possible that people of the three kebeles face the same illness types that they exchange information on the treatment of ailments. Results of multiple linear regression analysis showed that age (unstandardized

coefficient, β=2.218, p<0.001) and educational status (unstandardized coefficient, β=1.124, p=0.029) of respondents predicted traditional medicinal knowledge. This finding was supported by results of Yineger *et al.* (2008), Kidane *et al.* (2018) and Weldearegay and Awas (2021).

Table 7. The impact of Socio-demographic status on traditional medicinal knowledge

Socio-demographic features	No. of informants	Percentage (%)	Mean value of number of plants known	
Gender				***P*-value of t-test**
Male	265	69	4.75	0.007
Female	119	30.9	3.19	
Age				***P*-value of ANOVA**
25-40	73	19	2.95	0.000
41-60	219	57	4.07	
≥60	92	23.9	5.75	
Educational level				***P*-value of ANOVA**
No formal education	203	52.8	5.00	0.002
Elementary (grade 1-8)	92	23.9	4.04	
Grade 9-12	58	15	3.00	
Higher level education (>Grade 12)	31	8.07	2.50	

Conclusions

The findings of large number of medicinal plants infers the presence of rich traditional medicinal knowledge and people's dependence on traditional medicine apart from allopathic medication. Socio-demographic status such as age, gender and educational level were found to affect the knowledge of the indigenous people on traditional medicine. Since traditional knowledge is diminishing among the younger generations, knowledge transfer from elderly people should be encouraged. These medicinal plants, especially those with high preference ranking, ICF and FL should be subjected to pharmacological investigations to validate their efficacy and safety for extensive usage.

Declarations

List of abbreviations: Not applicable

Ethical considerations: No ethical committee letter was obtained as human intervention study was not our aim. In view of ethical consideration, approaching of the informants was systematic. Respondents were informed that the objective of the research was for education purpose, but not for commercial purpose and provided their oral prior informed consent.

Consent for publication: Oral permission was obtained from all authors

Availability of data and materials: The data generated for the present study is available upon request

Competing interests: The authors have no conflict of interest.

Funding information: This work was done through the financial support of the Ministry of Education, Ethiopia.

Authors' contributions: The first author, Kedir Adem Usman, conducted field trips and contributed to manuscript writing. Meseret C. Egigu and J. M. Sasikumar contributed to research design, field expeditions, analysis of the data and writing.

Acknowledgements

The authors express their great sense of gratitude to Ministry of Education of Ethiopia for funding the research. They also thank the informants of the local ethnic community of the study area.

Literature Cited

Abebe BA, Teferi SC. 2021. Ethnobotanical Study of Medicinal Plants Used to Treat Human and Livestock Ailments in Hulet Eju Enese Woreda, East Gojjam Zone of Amhara region, Ethiopia. Evidence Based Complementary and Alternative Medicine Article ID 6668541:1-11.

Abera B. 2003. Medicinal plants used in traditional medicine in Jimma Zone, Oromia Regional State southwest Ethiopia. Ethiopian Journal of Health Sciences 13:85-94.

Agisho H, Osie M, Lambore T. 2014. Traditional medicinal plant utilization, management and threat in Hadiya Zone, Ethiopia. Journal of Medicinal Plants Studies 2:94-108.

Ahmed AJ. 2021. Ethnobotanical study of medicinal plants used by people of Gumer Woreda, Gurage Zone, SNNPR, Ethiopia. Academic Journal of Biotechnology 9:1-20.

Alemayehu G, Asfaw Z, Kelbessa E. 2015. Ethnobotanical study of medicinal plants used by local communities of Minjar-shenkor District, North Shewa zone of Amhara region, Ethiopia. Journal of Medicinal Plants Studies 3:1-11.

Alemneh D. 2021. Ethnobotanical study of medicinal plants used for the treatment of domestic animal diseases in Yilmana Densa and Quarit Districts, West Gojjam Zone, Amhara Region, Ethiopia. Ethnobotany Research and Applications 22:1-14.

Alexiades M. 1996. Collecting ethnobotanical data. An introduction to basic concepts and techniques. In: Selected Guidelines for ethnobotanical research: A field manual. The New York Botanical Garden Press. New York, USA. Pp.58-94.

Amenu E. 2007. Use and management of medicinal plants by indigenous people of Ejaji area (Chelya Woreda) West Shoa, Ethiopia: An ethnobotanical approach. M. Sc. Thesis, Addis Ababa University.

Andarge E, Shonga A, Agize M, Tora A. 2015. Utilization and conservation of medicinal plants and their associated Indigenous Knowledge (IK) in Dawuro Zone: An ethnobotanical approach. International Journal of Medicinal Plant Research 4:330-337.

Anderberg A, Baldwin BG, Bayer RG, Breiwier J, Jeffrey C, Dillon MO, Eldenäs P, Funk V, Garcia-Jacas N, Hind DJN, Karos PO, Lack HW, Nesom G, Nordenstam B, Oberprieler C, Panero JL, Puttock C, Robinson H, Stuessy TF, Susanna A, Urtubey E, Vogt R, Ward J, Watson LE. 2007. Compositae. In: Kadereit JW & Jeffrey C. (eds). The families and genera of flowering plants, Springer, Berlin, Germany. Pp.61-588.

Antiwi-Baffour SS, Ajediran IB, David NA, Seidu AM, Patrick FA. 2014. The place of traditional medicine in the African society: The science, acceptance and support. American Journal of Health Research 2:49-54.

Araya S, Abera B, Gidey M. 2015. Study of plants traditionally used in public and animal health management in Seharti Samre District, southern Tigray, Ethiopia. Journal of Ethnobiology and Ethnomedicine 11:67-81.

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 Journal of Ethnobiology 4:42-52.

Assegid A, Tesfaye A. 2014. Ethnobotanical study of wild medicinal trees and shrubs in Benna Tsemay District, Southern Ethiopia. Journal of Science and Development 2:17-33.

Bekalo TH, Woodmatas SD, Woldemariam ZA. 2009. An ethnobotanical study of medicinal plants used by local people in the lowlands of Konta Special Woreda, southern nations, nationalities and peoples regional state. Journal of Ethnobiology and Ethnomedicine 5:1-15.

Bekele E. 2007. Study on actual situation of medicinal plants of Ethiopia, prepared for Japan Association for International Collaboration of Agriculture and Forestry, Addis Ababa, Ethiopia.

Belayneh A, Demissew S, Bussa NF, Bisrat D. 2020. Ethno-medicinal and bio-cultural importance of Aloes from south and east of the Great Rift Valley floristic regions of Ethiopia. Heliyon 6:e04344.

Belayneh YM, Amare GG, Meharie BG, Kifle ZD. 2021. Evaluation of the antiulcerogenic activity of hydromethanol extracts of *Solanum incanum* L. (Solanaceae) leaves and roots in mice; single and repeated dose study. Metabolism Open 11:1-8.

Birhanu A, Ayalew S. 2018. Indigenous knowledge on medicinal plants used in and around Robe Town, Bale Zone, Oromia Region, Southeast Ethiopia. Journal of Medicinal Plants Research 12:194-202.

Birhanu T, Abera D, Ejeta E. 2015. Ethnobotanical study of medicinal plants in selected Horro Gudurru Woredas, Western Ethiopia. Journal of Biology, Agriculture and Healthcare 5:83-93.

Brandt R, Mathez-Stiefel SL, Lachmuth S, Hensen I, Rist S. 2013. Knowledge and valuation of Andean agroforestry species: The role of sex, age, and migration among members of a rural community in Bolivia. Journal of Ethnobiology and Ethnomedicine 9:1-13.

Bussmann RW, Swartzinsky P, Worede A. Evangelista P. 2011. Plant use in Odo-Bulu and Demaro, Bale region, Ethiopia. Journal of Ethnobiology and Ethnomedicine 7:1-21.

Chaachouay N, Benkhnigue O, Fadli M, El Ibaoui H, Zidane L. 2019. Ethnobotanical and ethnopharmacological studies of medicinal and aromatic plants used in the treatment of metabolic diseases in the Moroccan Rif. Heliyon 5:e02191.

Chaachouay N, Zidane L, Douira A. 2022. Herbal medicine used in the treatment of human diseases in the Rif, northern Morocco. Arabian Journal of Science and Engineering 47:131-153.

Chadwick M, Trewin H, Gawthrop F, Wagstaff C. 2013. Sesquiterpenoids lactones: benefits to plants and people. International Journal of Molecular Sciences 14:12780-12805.

Constant NL, Tshisikhawe MP. 2018. Hierarchies of knowledge: ethnobotanical knowledge, practices and beliefs of the Vhavenda in South Africa for biodiversity conservation. Journal of Ethnobiology and Ethnomedicine 14:1-28.

Cotton CM. 1996. Ethnobotany: Principles and applications. John Wiley and Sons, New York, USA.

CSA (Central Statistical Agency). 2007. Population and housing census for Ethiopia, statistical report results at country level. Central Statistical Authority, Addis Ababa, Ethiopia.

da Costa FV, Guimarães MFM, Messias MCTB. 2021. Gender differences in traditional knowledge of useful plants in a Brazilian community. PLOS ONE 16:e0253820.

Dawit A, Ahadu A. 1993. Medicinal plants and enigmatic health practices of Northern Ethiopia. Berhanena Selam Printing Press, Addis Ababa, Ethiopia.

Farooq A, Amjad MS, Ahmad K, Altaf M, Umair M, Abbasi AM. 2019. Ethnomedicinal knowledge of the rural communities of Dhirkot, Azad Jammu and Kashmir, Pakistan. Journal of Ethnobiology and Ethnomedicine 15:1-30.

Fassil H. 2005. Beyond Plants, Professionals and Parchments: The role of home-based medicinal plant use and traditional health knowledge in primary health care in Ethiopia. Ethnobotany Research and Applications 3:37-49.

Friedman J, Yaniv Z, Dani A, Palewitch D. 1986. A preliminary classification of the healing potential of medicinal plants, based on the rationale analysis of an ethnopharmacological survey among bedouins in the Negev desert. Journal of Ethnopharmacology 16:275-287.

Gazzaneo LRS, de Lucena RFP, de Albuquerquev UP. 2005. Knowledge and use of medicinal plants by local specialists in a region of Atlantic Forest in the state of Pernambuco (Northeastern Brazil). Journal of Ethnobiology and Ethnomedicine 1:1-8.

Gebre T, Chinthapalli B. 2021. Ethnobotanical study of the traditional use and maintenance of medicinal plants by the people of Aleta-Chuko woreda, south Ethiopia. Pharmacognosy Journal 13:1097-1108.

Gelgelu T, Kebedeb F, Abebeb, W. 2020. Ethnobotanical study of medicinal plants used by local people in treatments of human and livestock ailments in Gasera Woreda, Bale zone, Oromia regional state, Ethiopia. Scientific Journal of Biological Sciences 9:253-276.

Giday M, Asfawb Z, Woldub Z. 2009. Medicinal plants of the Meinit ethnic group of Ethiopia: An ethnobotanical study. Journal of Ethnopharmacology 124:513-521.

Giday M. 2001. An Ethnobotanical study of medicinal plants used by the Zay people in Ethiopia. Centrum för Biologisk Mångfald (CBM):s Skriftserie 3:81-89.

Girmay M, Lulekal E, Bekele, T. Demissew, S. 2021. Use and management practices of medicinal plants in and around mixed woodland vegetation, Tigray regional state, Northern Ethiopia. Ethnobotany Research and Applications 21:1-26.

Gonfa N, Tulu D, Hundera K, Raga D. 2020. Ethnobotanical study of medicinal plants, its utilization, and conservation by indigenous people of Gera district, Ethiopia. Cogent Food and Agriculture 6:1852716.

Gupta RN, Kartik V, Manoj P, Singh PS, Alka G. 2010. Antibacterial activities of ethanolic extracts of plants used in folk medicine. *International Journal* of *Research* in *Ayurveda* and *Pharmacy* 1:529-535.

Gyang SS, Nyam DD, Sokomba EN. 2004. Hypoglycaemic activity of *Vernonia amygdalina* (chloroform extract) in normoglycaemic and alloxan-induced hyperglycaemic rats. Journal of Pharmacy and Bioresources 1:61-66.

Hanazaki N, Herbst DF, Marques MS, Vandebroek I. 2013. Evidence of the shifting baseline syndrome in ethnobotanical research. Journal of Ethnobiology and Ethnomedicine 9:1-11.

Heinrich M, Ankli A, Frei B, Weimann C, Sticher O. 1998. Medicinal plants in Mexico: healers' consensus and cultural importance. Social Science and Medicine 47:1863-1875.

Heinrich M. 2000. Ethnobotany and its role in drug development. Phytotherapy Research 14:479-488.

Hosseini SH, Hossein B, Ghara AR, Sahebkar A, Shakeri A. 2021. Ethnobotany of the medicinal plants used by the ethnic communities of Kerman province, Southeast Iran. Journal of Ethnobiology and Ethnomedicine 17:1-35.

Jafarirad S, Rasoulpour I. 2019. Pharmaceutical ethnobotany in the Mahabad (West Azerbaijan) biosphere reserve: ethno-pharmaceutical formulations, nutraceutical uses and quantitative aspects. Brazilian Journal of Pharmaceutical Sciences 55:e18133.

Jaiswal R, Kiprotich J, Kuhnert N. 2011. Determination of the hydroxycinnamate profile of 12 members of the Asteraceae family. Phytochemistry 72:781-790.

Jima TT, Megersa M. 2018. Ethnobotanical study of medicinal plants used to treat human diseases in Berbere district, Bale zone of Oromia regional state, south east Ethiopia. Evidence Based Complementary and Alternative Medicine Article ID 8602945:1-16.

Kassa Z, Asfaw Z, Demissew S. 2020. An ethnobotanical study of medicinal plants in Sheka zone of Southern Nations Nationalities and Peoples Regional State, Ethiopia. Journal of Ethnobiology and Ethnomedicine 16:1-15.

Ketema M. 2015. Assessment of indigenous knowledge on medicinal plants of Deder Woreda, East Hararghe zone of Oromia, Ethiopia. MSc Thesis, Haramaya University,

Kewessa G, Abebe T, Demessie A. 2015. Indigenous knowledge on the use and management of medicinal trees and shrubs in Dale district, Sidama zone, southern Ethiopia. Ethnobotany Research and Applications 14:171-182.

Kidane B, Tinde VA, Laurentius JG, Asfaw Z. 2014. Use and management of traditional medicinal plants by Male and Ari ethnic communities in southern Ethiopia. Journal of Ethnobiology and Ethnomedicine 10:1-15.

Martin G. 1995. Ethnobotany: A method manual. Chapman and Hall, London, UK.

McCarter J, Gavin MC. 2015. Assessing variation and diversity of ethnomedical knowledge: A case study from Malekula Island, Vanuatu. Economic Botany 1-11.

Meragiaw M, Asfaw Z, Argaw M. 2016. The Status of ethnobotanical knowledge of medicinal plants and the impacts of resettlement in Delanta, north western Wello, northern Ethiopia. Evidence Based Complementary and Alternative Medicine Article ID 5060247:1-24.

Mesfin F, Demissew S, Teklehaymanot T. 2009. An ethnobotanical study of medicinal plants in Wonago district, SNNPR. Journal of Ethnobiology and Ethnomedicine 5:28-32.

Mesfin F, Seta T, Assefa A. 2014. An ethnobotanical study of medicinal plants in Amaro woreda, Ethiopia. Ethnobotany Research and Applications 12:341-354.

Mogosse S. 2016. Assessment of ethnomedicinal plants and associated indigenous knowledge in Oda-bultum District, West Hararghe Zone of Oromia region, Ethiopia. MSc Thesis, Haramaya University.

Moravec I, Fernandez El, Vlkova M, Milella L. 2014. Ethnobotany of medicinal plants of northern Ethiopia. Boletín Latinoamericano y del Caribe de Plantas Medicinales y Aromáticas 13:116-123.

Mukaila YA, Oladipo OT, Ogunlowo I, Ajao AA, Sabiu S. 2021. Which plants for what ailments: A quantitative analysis of medicinal ethnobotany of Ile-Ife, Osun State, South western Nigeria. Evidence Based Complementary and Alternative Medicine Article ID 5711547:1-21.

Petropoulos SA, Fernandes Â, Tzortzakis N, Sokovic M, Ciric A, Barros L, Ferreira ICFR.2019. Bioactive compounds content and antimicrobial activities of wild edible Asteraceae species of the Mediterranean flora under commercial cultivation conditions. Food Research International 119:859-868.

Regassa R, Bekele T, Megersa M. 2017. Ethnobotanical study of traditional medicinal plants used to treat human ailments by Halaba people, southern Ethiopia, Journal of Medicinal Plants Studies, 5:36-47.

Samar R, Shrivastava PN, Jain M. 2015. Ethnobotanical study of traditional medicinal plants used by tribe of Guna district, Madhya Pradesh, India. International Journal of Current Microbiology and Applied Sciences 4:466-471.

Sasikumar JM, Doss PA, Doss A. 2005. Antibacterial activity of *Eupatorium glandulosum* leaves. Fitoterapia 76:240-243.

Sutar NG, Sutar UN, Sharma YP, Shaikh IK, Kshirsagar SS. 2008. Phytochemical investigation and pharmacological screening of leaves of *Achyranthus aspera* Linn. as analgesic and antipyretic. Bioscience Biotechnology Research Asia 5:841-844.

Tadesse A, Kagnew B, Kebede F, Kebede M. 2018. Ethnobotanical study of medicinal plants used to treat human ailment in Guduru District of Oromia regional state, Ethiopia. Journal of Pharmacognosy and Phytotherapy 10:64-75.

Tefera BN, Kim YD. 2019. Ethnobotanical study of medicinal plants in the Hawassa Zuria district, Sidama zone, Southern Ethiopia. Journal of Ethnobiology and Ethnomedicine 15:1-21.

Tegene AS. 2018. An Ethnobotanical Study of Traditionally Used Medicinal Plants for Treatment of Human Diseases in Goba District of Bale Zone, Southeast Ethiopia. Advances in Life Science and Technology 68:1-7.

Teka A, Rondevaldova J, Asfaw Z, Demissew S, Van Damme P, Kokoska, L. Vanhove W. 2015. *In vitro* antimicrobial activity of plants used in traditional medicine in Gurage and Silti Zones, south central Ethiopia. BMC Complementary and Alternative Medicine 15:1-7.

Teklehaymanot T, Gidey M. 2007. Ethnobotanical study of medicinal plants used by people in Zegie Peninsula, Northern Ethiopia. Journal of Ethnobiology and Ethnomedicine 3:1-12.

Tesfaye S, Braun H, Asres K, Engidawork E, Belete A, Muhammad I, Schulze C, Schultze N, Guenther S, Bednarski PJ. 2021. Ethiopian medicinal plants traditionally used for the treatment of cancer; Part 3: selective cytotoxic activity of 22 Plants against human cancer Cell Lines. *Molecules* 26:1-11.

Tongco DC. 2007. Purposive sampling as a tool for informant selection. Ethnobotany Research and Applications 5:147-158.

Watson LE. 2007. Compositae. In: Kadereit, JW. & Jeffrey C. (eds). The families and genera of flowering plants, Springer, Berlin, Germany. Pp.61-588.

Weckerle CS, de Boer, Puri HJ, Rajindra K, Tinde V, Bussmann RW, Marco L. 2018. Recommended standards for conducting and reporting ethnopharmacological field studies. Journal of Ethnopharmacology 220:125-132.

Weldearegay EM, Awas T. 2021. Ethnobotanical study in and around Sirso natural forest of Melokoza district, Gamo Goffa zone, southern Ethiopia. Ethnobotany Research and Applications 22:1-24

Yemane T. 1967. Statistics, An introductory Analysis, 2nd Ed., Harper and Row, New York, USA.

Yineger H, Yewhalaw D, Teketay D. 2008. Ethnomedicinal plant knowledge and practice of the Oromo ethnic group in southwestern Ethiopia. Journal of Ethnobiology and Ethnomedicine 4:1-10.

Zenebe M. 2013. Productivity of *Eucalyptus camaldulensis* (Dehnh.) in Goro Woreda of Bale zone, Ethiopia. Research Journal of Agriculture and Environmental Management, 2:252-260.