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Ethnobotanical study of indigenous knowledge on medicinal plant uses and threatening factors around the Malga District, Southern Ethiopia

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The study conducted in Malga district in 2019 aimed at documenting indigenous medicinal plants use among the Kebeles community, and the factors threatening local knowledge on medicinal plants before suggesting ways to overcome such threats. A total of 100 informants were selected and snowball sampling techniques were used. Ethnobotanical data were collected using semi-structured interviews, field observations, guided field walk, and group discussion with traditional medicine practitioners. The ethnobotanical study reveals that 60 medicinal plant species are inventoried and are distributed across 55 genera and 37 families while they are used as a cure for 40 ailments. Of these, 36 medicinal plants were reported for human ailments treatment, 7 for livestock, and 17 for both human and livestock ailment treatment. Leave were reported as most frequently utilized plant part with 45.78%. Intestinal parasite ailments were reported as one of the common problems along with oral administration. Informant consensus analysis showed that ailments like rabies, poisoning, and snakebite scored the highest value (0.98), while and pneumonia and jaundice scored the lowest values (0.63). Agricultural expansion, firewood, deforestation, and cash crop expansions were reported as driving factors for the loss of medicinal plants. Here the Wereda administration, as well as concerned governmental and non-governmental bodies should interven to minimize the loss of medicinal plant and associated knowledge.

Key words: Malga Wereda, medicinal plant, Indigenous knowledge, Informant, consensus.

INTRODUCTION

Ethiopian has used traditional and veterinary medicine to treat diseases for generations (Anteneh et al., 2012) and majority of the population relies on traditional medicine as their primary form of health care (Elizabeth et al., 2014). Owing to its long period of practice and existence, traditional medicine has become an integral part of the culture of Ethiopian people (Mirgissa, 1998). In Ethiopia, approximately 80% of humans and 90% of the livestock population rely on traditional medicinal plants to cure different ailments (Dawit, 2001) as a result of difficulties

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in accessing modern health facilities, the cultural acceptability of healers and low cost of traditional medicine invited local communities to dwell traditional healers (Nguta et al., 2010).

Besides the importance, Ethiopia's traditional medicine and indigenous knowledge as elsewhere in Africa is faced with the problems of continuity and sustainability (Ensermu et al., 1992; Elizabeth et al., 2014). Nowadays herbal practitioners have to walk greater distances for collection of herbal medicine that once grew in the vicinity of their homes. Bizuneh et al. (2018) in their ethnobotanical study reported that, valuable indigenous knowledge associated with medicinal plants was under risk and need to be properly documented. Those studies so far conducted on medicinal plants in Ethiopia also reported that, the existing medicinal plants were on conservation risk (Belachew and Behailu, 2018; Muluken et al., 2018). Bizuneh et al. (2018) also stated that the problem is further compounded by the fact that traditional knowledge on traditional medicine is also being lost at an alarming rate.

Additionally, According to Gonfa et al. (2015), Solomon et al. (2016), Banchiamlak and Young (2019) reports those medicinal plants available in the study region (Sidama Zone) are becoming extinct through human induced factors or in the verge of disappearance and the associated knowledge held by elders has received less attention in the past. Furthermore, the rich ethnomedicinal knowledge held by the Sidama community at large and traditional medicine practitioners in particular needs an in-depth study and documentation (Nigatu et al., 2018) and medicinal plants are exposed to various destructive anthropogenic activities. Thus, this study aimed at inventorying the medicinal plants used and documenting the associated indigenous knowledge while raising awareness about the drivers threatening both knowledge and the sustainability of the resource around the Malga district of Southern Ethiopia before suggesting ways to overcome such threats.

MATERIALS AND METHODS

Description of the study area

The study was conducted in Malga district Southern Ethiopia. The district is bordered by Wondo Genet Wereda in the north, by Goriche and Shebedino Wereda in the South, to the west by Tula Administration and the east by Kokosa Wereda in Oromia Regional State. The Wereda geographically extends from 7° 0' N to 7° 00' 0.00" N Latitude and 38° 29' 59.99" to 38° 49' 99" E Longitude (Figure 1). The Malga district is divided into 23 Kebele Administrations (the smallest administrative unit in Ethiopia) and has three rural towns. The capital town of Malga district is Manicho which is located 26 km from the regional state capital, Hawassa town. Based on the data from the Wereda/district, the total land area is 32,651 hectares (ha) of which an estimated 18,177 ha are under cultivated land, 6,988 ha are used for cereal and *Enset venticosum* production and the rest are covered by forest, water, and grazing land. Cereal crops are grown in the highland part consisting of wheat, barley and beans, vegetables are also grown seasonally and continuously through irrigation at some distance of the rivers. Out of agricultural crops, scattered tree species were also observed in their homegardens including: *Croton macrostachyus Del., Juniperus Procera* Hochst. ex.Engl., *Erythrina brucei* Schweinf. emend. Gillett*, Eucalyptus species, Arundinaria alpina* K. Schum*., Cupressus lusitanica* Mill*., Ficus species* and *Euphorbia species.* During field observation and discussion session's local elders raised that previously, traditional homes of Sidama were constructed using timber from Juniperus species, but now days these tree species are becoming increasingly scarce and it is now common to use timber from eucalyptus as well. The rainfall and the temperature condition of the area were described based on the data collected from 1998-2009 by the National Meteorological Service Agency (NMSA) from Hawassa Station. The result of the analysis of data from NMSA showed that the range of mean monthly minimum and maximum temperature of the study area is 12.6 and 20°C and average annual rainfall will vary from 1,201-1,600 mm. The elevation of the area ranges from between 1,501–3,000 m above sea level. The agro-ecology of the Wereda has a 78% humid and 22% sub-humid tropical climate. Wereda had an estimated population of 127,844 in 2010, based on the 2007 census projections (Central Statistical Agency, 2007): having 50.6% male and 49.4% female.

Sample size and sampling techniques

The study was conducted in six Kebeles in the Malga Wereda/district from July to August of 2019. Kebeles were purposively selected based on reconnaissance surveys and recommendations from local society (knowledgeable elders, religious leaders, and development agents). The selected Kebeles were 'Mellow,' 'Haro,''Haru merisa,''Elula chirariso,''Weteraresu, and 'Sintaro' (Figure 1). A total of 100 informants were selected. Based on Martin (1995) from a total 100 informant, 24 key informants were purposively selected based on recommendations from local authorities (Kebele administrator, knowledgeable elders, religious leaders, development agent and local guides). Appointments were made before visiting the key informants and the informants except for the key informants were selected through the Snowball method (Bailey, 1994) which consists in the search for new interviewees by the indication of people already interviewed. They were asked to give their knowledge about the plants they use against a disease, plant parts harvested methods, preparation of the remedy, details of administrations and the dosage (Banchiamlak and Young, 2019). The ages of the informants were between 18 to 93 years.

Ethnobotanical data collection

Following techniques described in Martin (1995) and Cotton (1996), ethnobotanical data were collected from July to August 2019. The techniques employed for data collection were group discussions; field observations, guided field walks and observation, and a semi-structured questionnaire pre-prepared in the Sidama language and finally translated into English (Appendix 1). Besides, four focus group discussions each of which consists of 6 members of traditional healers, religious leaders and knowledgeable elders were carried out. During this discussion session, questionnaires that were employed for informants were brought to discussion and validation of the information that was previously given by respondents. Floristic voucher specimens were collected with the help of traditional healers, knowledgeable elders, and development agents. The collected specimen was properly identified by comparing with already identified specimens in National Herbarium of Ethiopian using taxonomic literature such as Edwards et al. (1995,

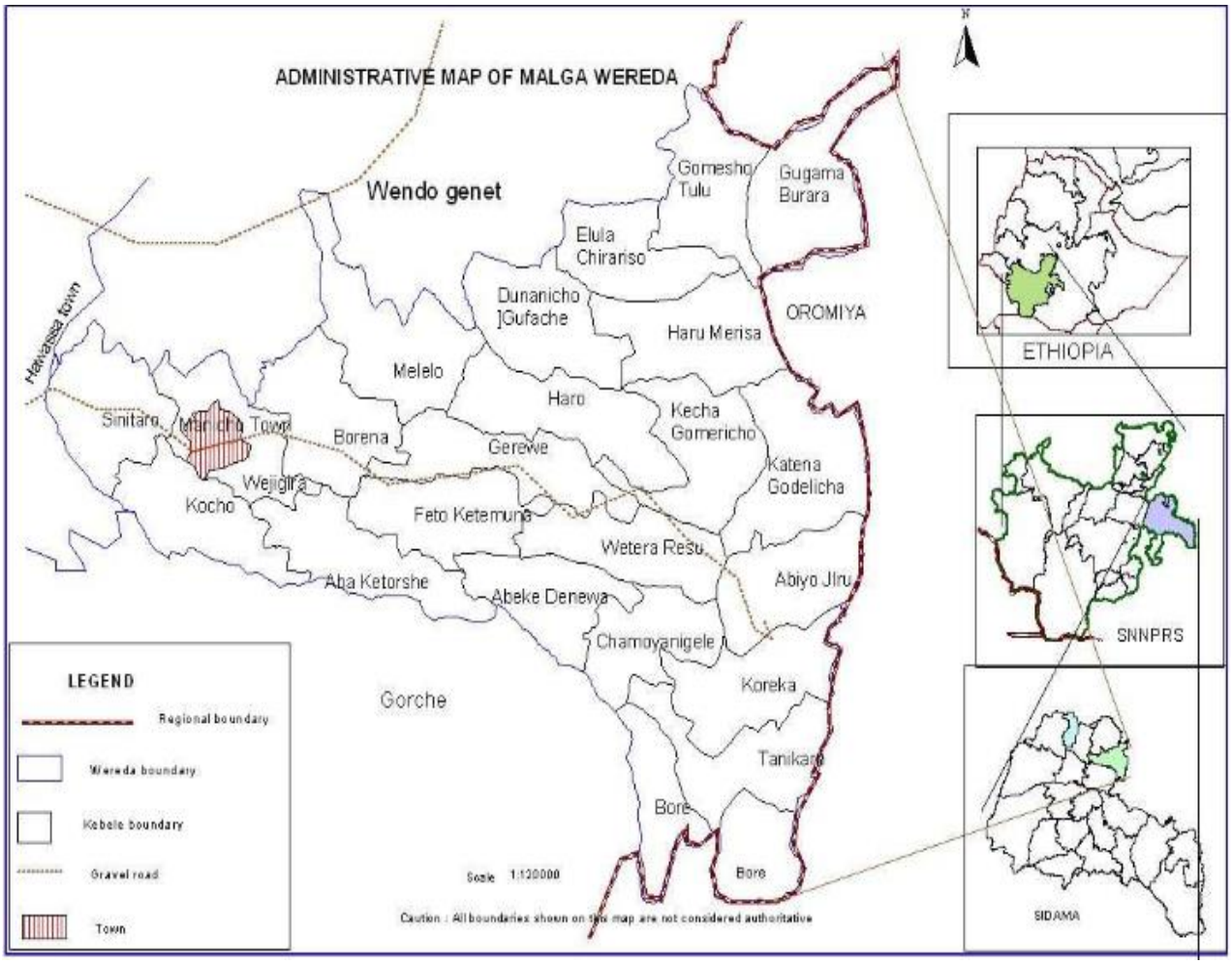

Figure 1. Map of Malaga District, Southern Ethiopia. Study areas were Kebeles: Melelo' Haro, Haru merisa, Elula chirariso, Weteraresu and Sintaro.

1997, 2000); Hedberg and Edwards (1989, 1995), and Hedberg et al. (2003, 2004, 2006).

Data analysis

In this section, both qualitative and quantitative approaches to data analysis were used. Qualitative methods used were based on percentages and frequency to summarize the data on medicinal plants (Martin, 1995; Cotton, 1996). The most useful qualitative information gathered on medicinal plants reported by local people included: medicinal value, application, methods of preparation, routes of administration, disease treated, and parts used, and the habit was analyzed through descriptive statistics. To make a simple calculation, to determine proportions and to draw bar graphs, MS Excel spread sheet was also utilized. Regarding quantitative data analysis, the Informant Consensus Factor (Fic) was used to measure the total usage of plant species according to culture applicability. Health disorders were categorized into eight groups like plants with high FIC versus low FIC value to compare its pharmacological active. The FIC values will be high if maximum respondents acknowledge one or a few plants to treat a specific disease. The FIC value can be calculated by the formula FIC = nur – nt/nur – 1; Where FIC = informants consensus factor, nur = number of use citation, nt = number used species (Canales et al., 2005).

Ethical considerations

Participants gave their informed consent (EPIC) before commencing with the interview schedules as required by the University of Hawassa University ethics committee. Approval for the study was obtained from the Hawassa University, approval number: VPRTT/027/2019.

RESULTS AND DISCUSSION

The results of the ethnobotanical survey contributed to the inventory and document of 60 plant species divided into 55 genera and 37 families (Table 1). The dominant family was Fabaceae with five species, followed by Cucurbitaceae, Euphorbiaceae, Rutaceae, and Solanaceae each with four species and Asteraceae with three species. Different scholars in their study also

Table 1. Medicinal plants reported for the treatment of different ailments in Malga District, Southern Ethiopia.

Scientific name	Family	Folk name	Ha	Parts used	Preparation	Application	Diseases treated	Uses
Acokanthera schimperi (A.DC.) Schweinf.	Apocynaceae	Qararo	Sh	Fresh leaves/stem barks or seed	Crushing and pounding	Oral or dermal	Gonorrhea, Amoeba and evil eye	Human
Achyranthes aspera L.	Amaranthaceae	Nole	H	Fresh leaves/ fresh root	Pounding	Oral	Intestinal parasites and lung infection	Livestock
Albizia gummifera Oliv.	Fabaceae	Galcaca	T	Bulbs	Crushing, pounding and boiling	Oral	Lung infection, Cough, Jaundice	Human and livestock
Aloe sp.	Aloaceae	Argissa	H	Fresh leaf	No need	Oral	Intestinal parasites	Human
Antiaris toxicaria Lesch.	Moraceae	Dimbicho	T	Dry/fresh stem bark	Pounded/powdered	Oral	Rabies	Livestock
Artemisia abyssinica Sch.Bip. ex A.Rich.	Asteraceae	Sunado hayiso	H	Fresh leaf	Crushing and pounding	Oral	Malaria	Human
Argemone mexicana L.	Papaveraceae	Wajo uta	H	Dry/fresh leaves	Crushing and pounding	Oral	Diabetes	Human
Calpurnia aurea (Ait.) Benth	Fabaceae	Cekata	Sh	Dry/fresh leaves	Pounding	Dermal	Head and skin infection	Human
Carica papaya L.	Caricaceae	Papaya	T	Fresh leaves or dry/ fresh seeds or fruits	Cocking or pounding	Oral	Intestinal parasites, Malaria, Gastric illness	Human
Catha edulis (Vahl.) Forssk.ex Endl.	Celastraceae	Cate	Sh	Dry/fresh roots	Crushing	Oral	Amoeba	Human
Citrus limon (L.) Burm.F.	Rutaceae	Lomee	Sh	Fresh fruits	No need	Oral	Blood pressure	Human
Citrus sinensis (L.) Osbeck	Rutaceae	Burtukane	Sh	Fresh fruits	No need	Oral	Gastric illness, common cold	Human
Coffea arabica L.	Rubiaceae	Bunna	Sh	Fresh stem bark	Crushing ,pounding and boiling	Oral	Malaria, gastric illness, sudden sickness	Human and livestock
Commelina benghalensis L.	Commelinaceae	Lalunxe	H	Leaf/stemLatex	Extraction	Dermal	Skin infection	Human
Cordia africana Lam.	Boraginaceae	Wadicho	T	Freshstem bark	Chewing	Oral	sudden sickness	Human
Cucurbita pepo L.	Cucurbitaceae	Baqula	Cl	Dry seeds	Cocking	Oral	Tape worm	Human
Cucumis prophetarum L.	Cucurbitaceae	Basu baqula	Cl	Dry seed/whole	Pounding/chewing/ burning	Oral/nasal	Intestinal parasites, lung, infection, gonorrhea, glandular swelling	Human and livestock
Clematis hirsuta Guill. & Perr.	Rununculaceae	Fide	H	Dry fruits/seed/ whole	Pounding/powdering	Oral	Breast cancer , Tonsillitis	Human and livestock
Croton macrostachyus Del.	Euphorbiaceae	Masinna	T	Leaves/stem bark	Pounding/chewing/ rubbing	Oral /dermal	Wound cancer, tetanus, acute blooding, lung infection, gonorrhea, intestinal parasites	Human and livestock
Datura stramonium L.	Solanaceae	Banje	H	Fresh leaves	Pounding	Dermal	Head infection	Human
Delonix regia (Hook.) Raf.	Fabaceae	Mimi	T	Dry/fresh leaves	Crushing, pounding and boiling	Oral or dermal	Diabetes, acute bleeding, wound	Human
Dodonaea viscosa subsp. *angustifolia* (L.f.) J.G.West	Sapindaceae	Itancha	T	Fresh leaves	Crushed and pounded	Oral/dermal	Ecto-parasites	Livestock
Dovyalis caffra (Hook.f. & Harv.) Sim	Flacourtiaceae	Faranjete shisho	Sh	Fresh roots	Chewing	Dermal	Snake bite	Human
Ekebergia capensis Sparrm.	Melianthaceae	Godicho	T	Dry/fresh leaves/stem bark	Crushing and pounding	Oral	Intestinal parasites and Cough	Human and livestock
Ehretia cymosa Thonn.	Boraginaceae	Gidicho	T	Fresh stem bark	Crushing and pounding	Oral	Intestinal parasites	Livestock

Table 1. Contd.

Eucalyptus citriodora Hook.	Myrtaceae	Shitote barzafe	T	Fresh leaves	Rubbing	Nasal	headache	Human
Euphorbia ampliphylla Pox.	Euphorbiaceae	Care	Sh	Fresh tem latex	No need	Oral	Intestinal parasites	Human
Euphorbia tirucalli L.	Euphorbiaceae	Shuramo care	Sh	Freshstem latex	No need	Dermal	Skin cancer	Human
Ficus sur Forssk.	Moraceae	Odako	T	Dry fruits or fresh stem bark	Crushing, pounding and powdering	Oral and dermal	Malaria, Wound, Acute bleeding and Vomiting	Human
Hypoestes forskaolii (Vahl)R.Br	Acanthaceae	Xexxe	H	Fresh root	Pounding	Oral	Intestinal parasites	Livestock
Juniperus procera Hochst. ex.Engl.	Cuppressaceae	Honcho	T	Fresh leaf	Crushing and pounding	Oral	Pneumonia/Lung infection	Human and livestock
Kalanchoe petitiana A. Rich	Crassulaceae	Hancululee	H	Fresh leaves	Heating	Dermal	Leg swelling, skin infection	Human
Lactuca inermis Forssk.	Asteraceae	Amessa	H	Fresh leaf/whole plant	Crushing and pounding	Oral	Anemia	Human
Lagenaria siceraria (Molina) Standl.	Cucurbitaceae	Surupha	Cl	Fresh seeds or dry seeds	Pounding	Oral	Jaundice, Intestinal parasites	Human
Measa lanceolata Forssk.	Myrsinaceae	Gowacho	Sh	Dry seed	Chewing/sniffed	Oral/nasal	Nasal problem, asthma and Skin infection	Human and livestock
Melia azedarach Forssk.	Meliaceae	Kiniin	Sh	Fresh/dry leaves	Pounding or chewing	Oral or dermal	Malaria, Intestinal parasites, Wound and Tetanus	Human
Millettia ferruginea (Hochst.) Bak.	Fabaceae	Hengedicho	T	Fresh stem bark	Crushing and pounding	Oral/dermal	Ecto-parasites	Human and Livestock
Momordica foetida Schumach.	Cucurbitaceae	Herase	Cl	Whole part	Crushing and pounding	Oral	Glandular swelling	Human
Moringa stenopetala L.	Moringaceae	Shiferaw	Sh	Fresh leaves	Cocking	Oral	Diabetes	Human
Nicotiana tabacum L.	Solanaceae	Arado	Sh	Dry seeds /fresh leaves	Crushing and pounding	Nasal /oral	Common cold, Headache	Human and livestock
Nuxia congesta R.Br.ex Fresen.	Loganiaceae	Burcanna	T	Fresh leaves	Pounding	Oral	Intestinal parasites	Livestock
Olea europaea subsp. cuspidata (Wall. ex G.Don.) Cif	Oleaceae	Ejerssa	T	Dry/fresh branches/ Fresh leaves	Chewing or cocking	Oral	Teeth problem, Intestinal parasites	Human
Pittosporum abyssinicum Del	Pittosporaceae	Bobanticho	T	Fresh stembark	Sniffed	Nasal	Headache	Human
Phytolacca dodecandra L'Herit.	Phytolaccaceae	Haranjicho	Sh	Fresh/dry leaves	Pounding and powdering/rubbing	Oral/dermal	Intestinal parasites, Lung infection, Rabies Stop pregnancy	Human and livestock
Ricinus communis L.	Euphorbiaceae	Qomboho	T	Fresh/dry stem bark/ Dry/fresh root	Crushing, pounding/chewing	Oral and dermal	Pneumonia (Lung infection), Body swelling	Human and livestock
Rhamnus prinoides L'Herit.	Rhamnaceae	Xaddo	Sh	Fresh leaves	Rubbing	Dermal	Skin infection	Human
Ranunculus multifidus Forssk.	Rununculaceae	Umixagicho	H	Dry leaves	Pounding/powdering	Oral/nasal	Pneumonia/Lung infection Headache	Human and livestock
Rhus glutinosa A. Rich	Anacardiaceae	Oloncho	T	Dry/fresh stem bark	Boiling	Oral	Vitamin shortage	Human
Rubus apetalus Poir.	Rosaceae	Gora	Sh	Fresh leaves	Chewing	Dermal	Body swelling, Wound	Human
Ruta chalepensis L.	Rutaceae	Sunkurtaa	H	Fresh leaves	Pounding/rubbing	Oral/nasal	Vomiting, evil eye, pneumonia, Intestinal parasite	Human and livestock

Table 1. Contd.

Senna occidentalis (L.) Link	Fabaceae	Hamash haqa	Sh	Fresh/dry leaves	Pounding	Dermal	Poisoning	Human
Sesbania sesban (L.) Merr.	Fabaceae	Arbeti	Sh	Fresh leaves	Pounding	Dermal	Body swelling	Human
Solanum incanum L.	Solanaceae	Borbodho	Sh	Fresh/dry roots	Chewing	Oral/ dermal	Intestinal parasites, Nasal blooding and Snake bite	Human
Solanum nigrum L.	Solanaceae	Xunayee	H	Fresh root/leaf/fruit	Chewing and swallowing	Oral	Intestinal parasites	Human
Toddolia asiatica (L.) Lam.	Rutaceae	Harangama	Sh	Fresh leaf/root	Cocking and rubbing	Oral	Glandular swelling, body swelling	Human
Urtica dioica L.	Urticaceae	Lalesa	Cl	Fresh/dry roots	Crushing, pounding/chewing	Oral/dermal	Gonorrhea , Fever, Evil eye	Human and livestock
Vernonia amygdalina Del.	Asteraceae	Hecho	Sh	Fresh/dry leaves	Pounding/powdering or chewing or cocking	Oral	Intestinal parasites, Jaundice, Malaria	Human and livestock
Vernonia auriculifera Hiern	Asteraceae	Reejje	Sh	Dry/fresh leaves or fresh root	Crushing and pounding or chewing	Oral and dermal	Body swelling, Wound, Head infection	Human
Zingiber officinale Rosc.	Zingiberaceae	Jaanjiiweello	H	Dry/fresh rhizome	Crushing/pounding/ chewing	Oral	Common cold	Human and livestock

Ha, Habit; T, Tree, Sh, Shrub; H, Herb; Cl, Climber.

reported similar findings such as Balcha (2014), Mekonen et al. (2015), Banchiamlak and Young (2019). Of these 36 plant species, 60% were used as human medicines, seven plant species (11.67%) as livestock medicines and 17 plant species (28.33%) were used for treating both human and livestock diseases (Table 1). Regarding habit diversity, 18 plant species (30%) were trees, 22 (36.67%) shrubs, 15 (25%) herbs and 5 (8.33%) were climbers (Table 1). Alemayehu (2010), Kefyalew (2015) and Abiyot et al. (2018) reported that shrubs were the most harvested forms as source of medicines.

Socioeconomic characteristics of the interviewed respondents

As can be seen in Table 2, 100 informants participated in the ethnobotanical survey of the Malga district. Of these, 77% were men, 23% women, and 24 were key informants. The majority of respondents were more than 50 years old (37%). Eleven informants were between 20 and 30 years old, 19 informants were between 31 and 40 years old, 33 informants were between 41 and 50 years old and 37 informants were above 50 years old. Majority of the informants had attended different level school (53%) (Table 2).

Common ailments and plant species used in the study area

As shown in Table 1, traditional healers had amazing and surprising indigenous knowledge on diagnosis, treatment, and determination of ailments. The medicinal plant species recorded in the Malga are also used as remedies in other parts of Ethiopia. Among a total of 60 medicinal plants, 11 in Gonfa et al. (2015); 21 in Nigatu et al. (2018) and 26 species in Banchiamlak and Young (2019). Hence, this widespread report on the use of these medicinal plants by different groups of the societies in different localities could be attributed to different cultural groups, which could validate the medicinal properties of these species. People of Ethiopia over a wide area therefore may tend to use the same medicinal species as a result of the wider distribution of medicinal plants in the country and to a certain extent their usefulness (Gonfa et al., 2015).

The practitioners commonly diagnose each health problem by interviewing and visual inspection of the patient. The patients are commonly interviewed for symptoms observed and the duration of the diseases. Such as changes in eye color, tongue color, throats are all visually inspected by the practitioner. For diseases like fibril illness, evil eye, and Jaundice, the local people prefer traditional healers for treatment (Figure 2). Some of the medicinal plants in this study were also reported to cure specific diseases (Miruts, 2010; Banchiamlak and Young, 2019). *Vernonia amygdalina*, *Solanum incanum*,

Table 2. Distribution of respondents according to socio-economic characteristics.

Socio-economic characteristics	Number of respondents	Percentage
Gender		
Male	77	77
Female	23	23
Age (years)		
20-30	11	0.11
31-40	19	0.19
41-50	33	0.33
>50	37	0.37
Education		
Non formal education	47	0.47
Primary education	31	0.31
Secondary education	13	0.13
Post-secondary education	9	0.09

Croton macrostachyus, Carica papaya, Arundo donax, and *Momordica boivinii* were reported to cure intestinal parasites and associated illness. *Datura stramonium* and *Vernonia auriculifera* were also reported to cure head infection (Fungal disease) and *Allium sativum*, *Vernonia amygdalina*, *Zingiber officinale, Artemisia abyssinica,* and *Melia azedarach* were claimed as the treatment for malaria.

Similarly, the medicinal value of *Commelina benghalensis*, Croton macrostachyus, *Hypoestes forskaoli*i, Phytolacca dodecandra, Ruta chalepensis, and *V. amygdalina* as a treatment for intestinal parasite and skin infection was reported by (Gonfa et al., 2015; Nigatu et.al, 2018). In Nepal, Shandesh et al. (2009) in their ethnobotanical study reported that Achyranthes aspera and Urtica dioica are the most effective medicinal plants to cure intestinal parasite and fever-related ailments.

Importance of medicinal plants

Informant consensus factors

Based on the conditions of the disease and treatment resemblance, diseases in the study area have been grouped into different categories as described by Canales et al. (2005). As shown by Table 3, the medicinal plants that were presumed to be effective in treating a certain disease had higher ICF values, which indicated that these diseases were more common than those with low ICF. Based on the used citations of the key informants, plant species were clustered into eight different categories) to calculate the ICF values. The ICF values range between 0.63 (Pneumonia and jaundice) and 0.98 (Rabies, poisoning, and snake bite). Thus, all clusters had an ICF value greater than 0.5 showing that all of them could be considered for validation in support of its traditional use.

Nineteen plant species were reported to be used for the treatment of intestinal parasite alone and wound and body swelling together followed by a lung infection and liver problem (15 species); malaria, vomiting, and typhoid (11 species); common cold, asthma, nasal blooding, fibril illness (10 species); skin and head infections (10 species); rabies, poisoning, and snake bite (5 species); evil spirit and the evil eye (4 species). The ailments rabies, poisoning, and snake-bite scored the highest value (0.98) with 166 use-reports for 5 plant species. The species responsible for this high consensus were *Antiaris toxicaria, Dovyalis caffra, Senna occidentalis, Solanum incanum and Phytolacca dodecandra* with 166 of the 60 reported medicinal plants, followed by the evil spirit and evil eye were scored the second highest value (0.97) with 122 use-reports for 4 plant species. The species responsible for this high consensus was *Acokanthera schimperi, Olea europea* subsp*. Cuspidata, Ruta chalepensis and Urtica dioeca* with 122 of the 60 reported medicinal plants. Skin and head infections scored the third highest value (0.93) with 121 use reports for 10 plant species were as *Calpurnia aurea, Commelina benghalensis, Datura stramonium, Dodonaea angustifolia, Kalanchoe petitiana, Measa lanceolata, Mill ettia ferruginea, Rhamnus prinoides, Ranunculus multifid us* and *Vernonia auriculifera.* This indicates that informants use relatively few taxa to treat specific disease conditions and they tend to have consistency in the use of plant species.

Medicinal plants used to treat those ailments were more popular and effective to cure the ailments and the ailments are more common than the others in the area.

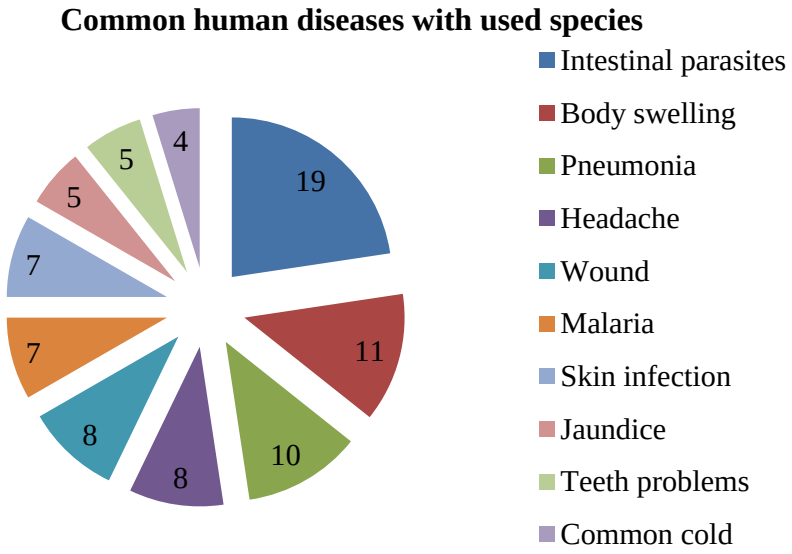

Figure 2. Common human ailments and medicinal plants used in Malga district

Table 3. Informant consensus factor by categories of diseases in the study area.

Category	Species	Use citations	ICF
Rabies, poisoning and snake bite	5	166	0.98
Evil spirit and evil eye	4	112	0.97
Skin and head infections	10	121	0.93
Common cold, asthma, nasal blooding and fibril illness	10	119	0.92
Malaria, vomiting and typhoid	11	82	0.88
Wound and body swelling	19	109	0.83
Intestinal parasite	19	72	0.75
Pneumonia (Lung Infection) and jaundice	15	39	0.63

Informants reported that they would not need modern medicine for those diseases treatment rather they used traditional medicinal plants. The low value of ICF indicates that the informants disagree on taxa to be used in the treatment within a category of illness. In this study, the lower ICF value scored for the category of diseases like Pneumonia (Lung Infection) and jaundice (Liver problem) scored the lowest value (0.63).

Parts of medicinal plants used

Leaves were reported as the most frequently utilized plant part with (45.78%) (Figure 3A). A large proportion of herbal preparation from leafs was also reported by Gonfa et al. (2015), Bizuneh et al. (2018), Abiyot et al. (2018), Nigatu et al. (2018); Banchiamlak and Yound (2019). Those from root sources were reported by Alemayehu (2010), Lulekal et al. (2014), Melesse et al. (2015). Similarly, leaf are claimed as the dominant plant parts used in the remedy preparations for livestock ailment treatment (Gonfa et al., 2015; Banchiamlak and Yound, 2019). Both leaf and stem bark accounts for 75% (Figure 3B) from the total remedy preparation followed by whole plant parts and root (12.5%) each respectively. Like human remedy preparation, the leaf is the most harvested form in remedy preparation for livestock ailment treatment. But, remedy preparations from stem bark, roots, and whole plants are risk to plant survival. So, in this work, the researcher suggested that, the local people must adopt alternative ways of conservations of medicinal plants in their home gardens to minimize losing of the floral diversity. In both human and livestock treatments, leaves are more harvested parts of the plants which covered 38.71% followed by bark (20.97%), seed (16.13%); root (14.52%); whole plant (4.84%); fruits (3.23%) and latex (1.61%) (Figure 3C). The preference of leaves to other plant parts may be due to the easy preparations compared to remedy preparations from other plant parts. Furthermore, leaves carry copious amounts of plant secondary metabolites that have medicinal properties as reported (Bhattarai et al., 2006).

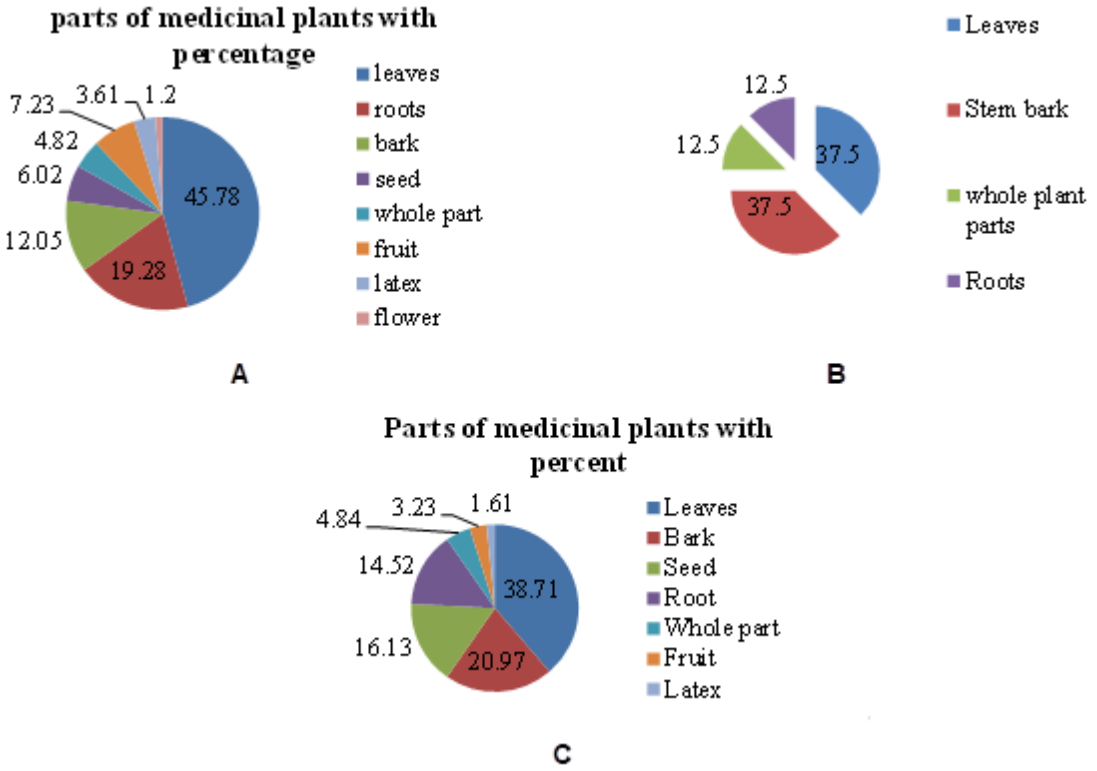

Figure 3. Medicinal plants of Malga district. **A.** Plant parts used only for human ailments treatment; **B.** Plant parts used only for livestock ailments treatment; **C.** Plant parts used for both human and livestock ailments treatments.

Methods of preparation

The principal methods of remedy preparation are chewing (24.69%), followed by pounding (19.75%), crushing and pounding (14.81%) and rubbing (12.35). Among those, crushing, pounding, and powdering are common ones. Crushing and pounding cover 50%, pounding 37.5%, and powdering (12.5%). This result is in agreement with the earlier founding (Emiru et al., 2011; Gonfa et al., 2015; Bizuneh et al., 2018) who noted that the principal method of remedy preparation was through crushing. The highest medicinal plant knowledge acquisition by the healers in this study area was from parents or close relatives. They have the only oral-based transmission of knowledge. The healers have very high intentions to keep their traditional knowledge secret. These limits the knowledge transfer from generation to generation and lead to destruction of the indigenous knowledge which held by local communities. Some informants argue that mixing and using some medicinal plants taken with foods is better than taking alone. For instance, dry fruit of *F. sur* mixed with honey and taken orally as food is used to treat malaria. Leaf of *V. amygdalina* and *Croton macrostachyus* mixed with salt and honey used as medicine to treat intestinal parasites and *M. lanceolata, Croton macrostachyus* and *V. amygdalina* powdered and mixed to treat milk production shortages of the livestock.

Forms used

Informants claimed that fresh forms of the preparations were considered more powerful than dried ones; to treat humans and livestock ailments. Similar results were reported in earlier studies (Belachew and Behailu, 2018; Abiyot et al., 2018 and Nigatu et al., 2018). This could be associated with the components and activities of active principles of fresh preparations. They also claimed that the application of remedy in fresh forms is more relevant than a dry one because it is easy to prepare and handle. This account for 74.52% of the total plants and 25.48% were used in dry forms (Figure 4). Similar results were reported earlier (Belachew and Behailu, 2018, Abiyot et al., 2018; Nigatu et al., 2018) which could be associated to the components and activities of active principles of fresh preparations. Here harvesting of the fresh plant parts minimizes the chances of preservation for later use and affects the sustainable utilization of medicinal plants. In this study, remedy preparation from single plant parts accounted for 88.77% and preparations from combined plant species were about 11.23%. This consensus was in

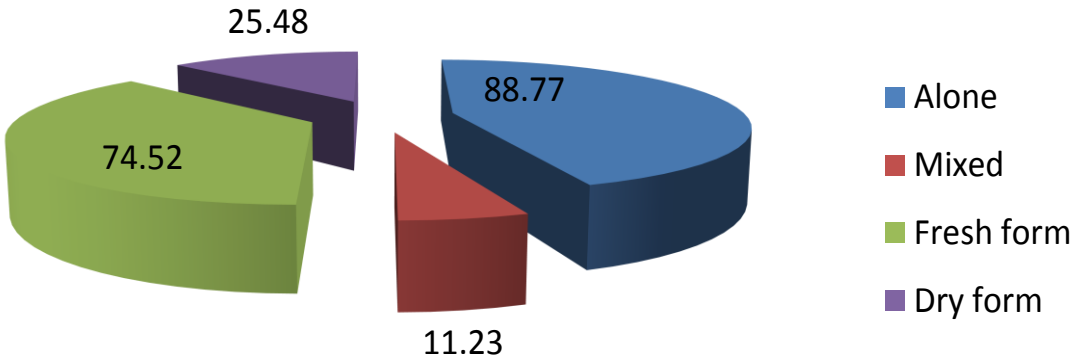

Figure 4. Forms used and composition of remedy preparation.

agreement with those of Bizuneh et al. (2018).

Routes of administration and dosage used

Internal ailments were commonly treated by drinking, chewing and swallowing. Skin infections like snake bite were treated by rubbing and painting on the infected parts. Ailments like jaundice and pneumonia were treated by crushing and pounding, decoction and infusion applied through oral administration. Headache was treated through nasal smell and evil eye through oral administration and different methods were used to the other ailments (Table 1). The choice of oral administration is related to the use of some solvents or additives (honey, milk, butter and food) that are commonly believed to serve as a vehicle to transport the remedies (Tolosa et al., 2013; Balcha, 2014; Nazim et al., 2017; Abiyot et al., 2018, Belachew and Behailu, 2018; Nigatu et al., 2018; Banchiamlak and Young, 2019). For example, stems and roots of *Bersama abyssinica* are chewed or powders and drunk against intestinal parasites. There was not a proper dosage observed like modern medicines but were taken according to disorder and need. Ethno medicines were used with tea-spoons and finger-tips which passing from generation to generation. Such as finger length for root and stem bark, pinch for powdered plant parts, numbers for leaves, seeds, fruits and flowers, cup for decoction and infusion for plant parts, were used to estimate and fix the dosage of the medicine (Nazim et al., 2017). The healers believe the effectiveness of the traditional medicines but the measurements used to determine the dosages are not standardized and doses are given depend on the age, physical fitness, stage of illness, pregnancy, and the presence or absence of any disease other than the disease to be treated. The absence of adverse effects of traditional medicines was frequently mentioned by the healers. If the dosage is more than the treated person can handle milk is added to minimize the power of the medicine.

Threats to medicinal plants and opportunity to overturn the threats

In the study area, human induced factors were recorded as the main threats to plant species in general and medicinal plants in particular. As shown in Figure 5, the most important threatening factors include in descending order the agricultural expansions (25%), firewood (20%), deforestation (18%), cash crop expansions (16%) and charcoal production (7%) reflected a threat on medicinal plants. According to elder local informants, most of Malga area was covered with forests until about the 1940s. However, high deforestation rates over the years have left only highly disturbed remnant forests which are now confined to the mountain slopes.

Conclusion

The results of the study has revealed that about 60 medicinal plant species used by the local community were inventoried reflecting the richness and the diversity of the medicinal plant resource of the Malga District Southern Ethiopia. The associated knowledge of the local people is deep-rooted in the time-honored use practices of herbal medicine as illustrated by the end use of the medicinal plants: 36 species were noted to treat human ailments, 7 species for livestock ailment treatment, and 17 species for both human and livestock health treatments. In addition, 28 different human and 12 livestock ailments were recorded. Shrubs were found to be dominant as traditional medicinal plant remedy sources in the study area followed by trees, herbs, and climbers. Leaves were also found to be the most harvested plant parts for the preparation of the remedies followed by bark and roots. In the preparation of medicines, single plants were used to prepare the medicines to cure the diseases rather than mixing. The routes of administration are mainly internal in which oral administration is the common one. However, both the plant resources and the indigenous knowledge of herbal

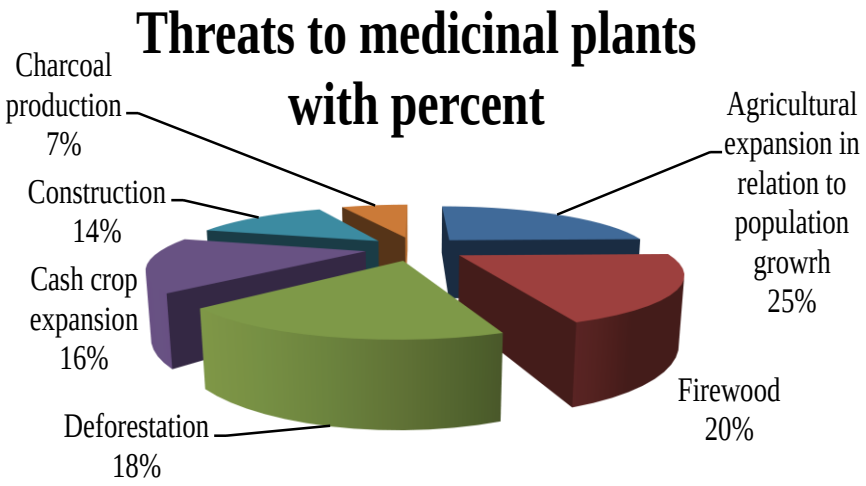

Figure 5. Threats for medicinal plants.

medicine are under threat. The main factors leading to the loss of plant species in the study area are agricultural expansion driven by population growth and cash crop expansion (*Catha edulis* and *Coffee Arabica*). The study site had rich medicinal plant diversity. But, the knowledge on medicinal plants is shrinking due to its secrecy, and oral-based knowledge transfer to close relatives. The medicinal plant resources, the associated traditional knowledge, and medical practices are in great need of protection through the implementation of appropriate conservation strategies.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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