



**ETHNOBOTANICAL STUDY OF TRADITIONAL MEDICINAL PLANTS
AND THEIR CONSERVATION STATUS IN MECHA WEREDA,
WEST GOJJAM ZONE OF ETHIOPIA**

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Abstract

An ethnobotanical study of medicinal plants and their conservation status was conducted in Mecha Wereda, West Gojjam Zone of Ethiopia from November 2012 to April 2013. A total of 16 kebeles were selected, from which 80 informants (five per kebele) were interviewed for data collection. Among the 80, 21 were key informants selected by purposive sampling method and other informants were selected randomly during transect walking. The ethnobotanical data collected through group discussion, semi-structured interview and participatory observation were subjected to calculate direct matrix ranking, informant consensus factor, fidelity level index and percentage of distribution. A total of 107 medicinal plants belong to 96 genera and 52 families were identified and recorded. Among the families, Asteraceae was the dominant (11.20%) followed by Solanaceae (7.47%). The majority (41.1%) of medicinal plants like *Brucea antidysenterica*, *Dodonaea angustifolia*, *Clusia lanceolata*, *Clerodendrum myricoides*, etc. were shrubs and herbs accounts for 36.5%. Plants like *Solanecio gigas*, *Echinops kebericho*, *Laggera tomentosa* and *Millettia ferruginea* were endemic to Ethiopia. Most frequently used plant parts for remedies preparation were leaves (29.8%) followed by roots (22.4%). Most remedial preparation method was squeezing (24.9%) followed by powdering (16.6%). Commonly used routes of administration was oral (55.4%) followed by dermal (26.9%). The highest (0.85) ICF was associated to dermatological diseases (scabies, dandruff, ringworm, eczema, etc.) followed by gastrointestinal and parasitic infections (0.84). The FL of *Acacia pilipisia*, *Ocimum lamiifolium*, *Ficus carica*, *Clerodendrum myricoides* and *Verbena officinalis* was calculated 100% for tonsillitis, febrile illness, wound, malaria and dysentery respectively. Currently, the main threats to medicinal plants were firewood, construction, grazing and agricultural expansion. Hence, the local communities are advised to give attention for *in-situ* and *ex-situ* conservation of the medicinal plants.

Keywords: Ethnobotany, Medicinal plants, Healers, Mecha Wereda, Indigenous Knowledge

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Introduction

Ethnobotany is the study of the indigenous knowledge on the medicinal plants. Plants have been used traditionally as a source of medicine for centuries against human and livestock diseases. In many parts of the world, indigenous people depend on plants as a source of food, medicine, construction and manufactures. Indigenous knowledge of the society accumulated during prolonged interactions with the natural world is remains fundamental for their physical, spiritual and social well-being¹. Ancient people in different localities have developed their specific knowledge, management and conservation technologies by practicing traditional medicine².

Ethiopian geographical diversity with different habitats and vegetation types favors medicinal plants growth and utilization. Multiple geographical diversity of the country coupled with multiethnic groups make the country home for wide traditional medicine^{3, 4, 5}. The practice of traditional medicine in the country is not only concerned with curing of diseases but also with the protection and promotion of human physical, spiritual, social, mental and material wellbeing⁶. Traditional medicinal plant practice in the country is still continues and widely accepted to use in the prevention and treatment of various ailments due to easy accessible^{3, 7}.

The documented medicinal plants in the country are limited compared to existing multiethnic and cultural diversity of the people. The rich floral diversity of the country provides countless resources for primary healthcare⁸⁻¹⁵.

Indigenous people of Mecha Wereda have the knowledge on practicing traditional medicinal plants to combat various human and livestock ailments. The utilization of medicinal plants to human and livestock welfare to date is a reflection of inadequacy of modern health service. Although the local communities are being used several medicinal plants, their indigenous knowledge is remained unexplored and undocumented so far. Therefore, this study has been conducted to document indigenous knowledge and conservation

status of traditional medicinal plants for the first time in Mecha Wereda.

Materials and Methods

Description of the study area

The study was conducted in Mecha Wereda, West Gojjam Zone of Ethiopia. Its altitudinal variation ranges from 1800-2800 m.a.s.l. and covers an area of 159,027 hectare¹⁶. From this area, according to the traditional agroclimatic zonation 80% covers Weyna Dega (Midland) that ranges between 1800-2500 m.a.s.l. and 20% is Dega (highlands) which covers 2500-2800 m.a.s.l.¹⁷. The geographical coordinates of the study area is ranges from 11⁰ 05'N-11⁰ 38'N and 37⁰ 00' E- 37⁰ 23'E (Fig. 1). The study area is bordered by the weredas such as 'Yilmana Densa' in East, 'Bahir Dar Zuria' in North and North East, 'Semien Achefer' in North, 'Dehub Achefer', 'Dangila' and 'Fagta Lekoma' in West and 'Sekela' in South. The study area received mean annual rainfall and temperature of 1703 mm and 18.8⁰C respectively last five years as per Merawi weather station meteorological data obtained from Addis Ababa, Ethiopia. The three different dominant soil types such as red, dark brown and black were favored to grow various types of plants¹⁷.

Reconnaissance survey

Reconnaissance survey was conducted from September 2012 to October 2012 in order to identify sampling sites. During the survey, 16 representative sites (kebeles) were selected from 43 kebeles using stratification sampling techniques.

Selection of informants

A total of 80 informants (58 males and 22 females) including 21 key informants were selected from the age of 20 and above. Age group of the informants consists of young (20-35), middle (36-49) and elders (50-80). The key informants were selected based on the recommendation of Martin¹⁸. By informing the academic value of the study, logistic letter and list of legal traditional healers in the wereda was obtained from the chairman of traditional healers' association. On the other hand, general informants were selected randomly during transect walking through the kebeles.

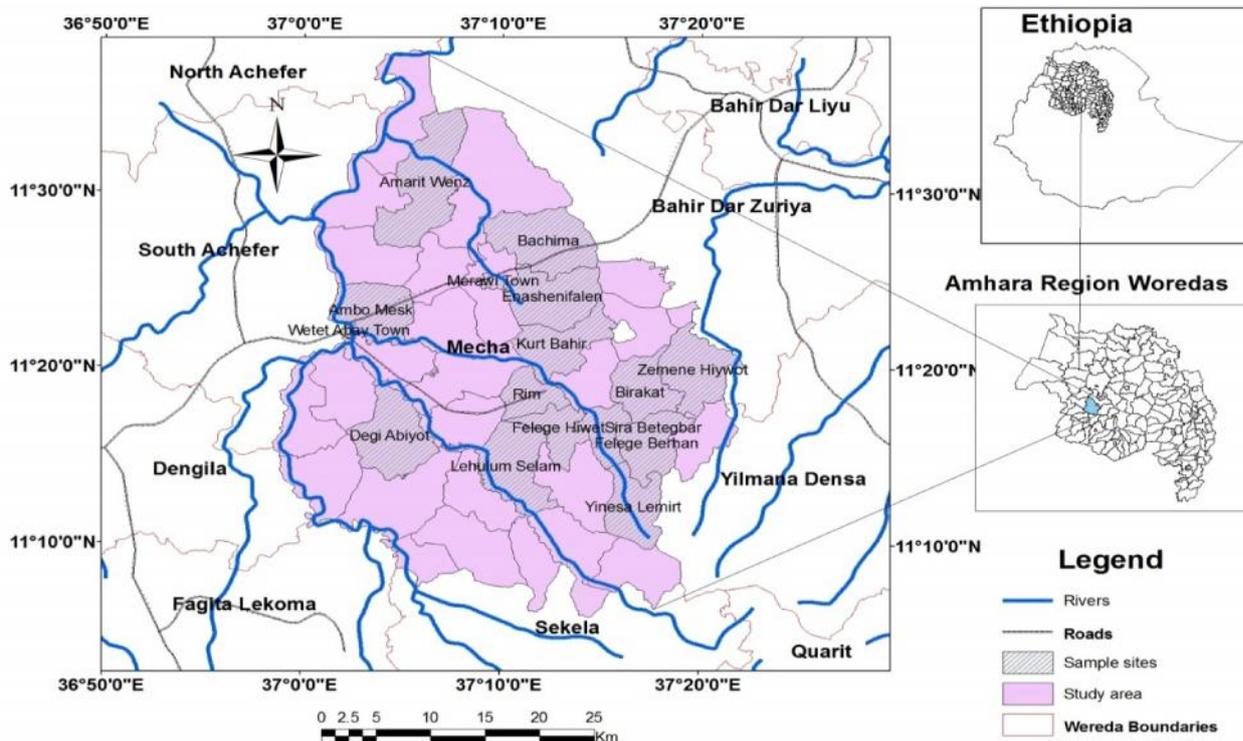


Fig. No. 01: Map of the study area

Ethnobotanical data collection

The primary data were collected through interviews and group discussion in the field with informants and secondary data were obtained from relevant literatures. The ethical consideration and consensus was made with informants before data collection as recommended by Cunningham¹⁹. Ethnobotanical data were collected from November 2012 to April 2013 by using semi-structured questionnaires and group discussion from homegardens and natural habitats. In addition, ethnomedicinal plants were also collected from local markets following the methods described by Martin¹⁸ and Alexiades²⁰. The information includes conservation practices, disease treated, parts of plants used, methods of preparation, and routes of administration. The voucher specimens of medicinal plants collected were identified by using Flora of Ethiopia and Eritrea and deposited at the National Herbarium of Ethiopia (ETH), Addis Ababa University.

Data analysis

Ethnobotanical data were subjected to calculate direct matrix ranking, informant consensus factor and fidelity level. The qualitative and quantitative analyses were carried out using analytical tools and MS-excel spreadsheet version 2010. Direct matrix

ranking was calculated as per the recommendation of Cotton¹.

Informant Consensus Factor (ICF)

ICF was calculated to determine the relative importance of each use directly from the degree of consensus in informants' responses. It was calculated for ten categories of diseases that identified based on causes of the diseases and symptoms treated. ICF was calculated following the methods of Trotter and Logan²¹.

$$ICF = \frac{Nur - Ns}{(Nur - 1)}$$

Where,

Nur: is the number of use reports from informants for a particular plant-usage category

Ns: is the number of species used for that plant usage category for all informants

Fidelity Level (FL)

FL of the medicinal plants was calculated for frequently reported diseases by the informants to quantify the importance of the species for a particular purpose or disease. The following formula recommended by Friedman *et al.*,²² was used to calculate FL value.

$$FL = \frac{Ni}{N} \times 100$$

Where,

N_i: The number of informants that claimed the use of a plant species to treat a particular disease

N: The number of informants that used the plant as a medicine for any given disease

Results

Diversity of medicinal plants

The local community in the study area practicing about 107 ethnomedicinal plant species belongs to 96 genera and 52 families in crude form. Among the families, Asteraceae was found to be the most dominant (11.2%) that contains 12 species under nine genera followed by Solanaceae (7.4%) containing eight species under five genera, and Fabaceae and Lamiaceae, each have five species (4.7%) under five genera (Table 1). From the collected medicinal plants, 84 (78.5%) species were used for the treatment of human ailments, five species (4.7%) for livestock and 18 species (16.8%) used to treat both livestock and human ailments. The traditional practitioners were collecting 15% of ethnomedicinal plants from homegardens and 85% from the natural habitats. In addition, ethnomedicinal plants like *Embelia schimperi* and *Glinus lotoides* were also collected from the local markets. Among the medicinal plants, 44 species (41.1%) were shrubs followed by 39 species herbs (36.5%), 17 species trees (15.9%) and seven species climbers (6.5%). The commonly known medicinal plants with greater than 25% of informants' agreements in the study area were

Embelia schimperi (70%), *Justicia schimperiana* (65%), *Allium sativum* (60%), *Cynoglossum coeruleum* (43.8%), *Croton macrostachyus* (41.3%), *Glinus lotoides* (38.8%), *Lepidium sativum* (36.3%), *Ruta chalepensis* (30%), *Plantago lanceolata* (27.5%) and *Rumex nervosus* (27.5%). About 5.7% of the collected medicinal plants like *Solanecio gigas*, *Echinops kebericho*, *Laggera tomentosa*, *Plectocephalus varians* (Asteraceae), *Millettia ferruginea* (Fabaceae) and *Cyphostemma molle* (Vitaceae) were endemic to Ethiopia. Among these, *Millettia ferruginea*, *Cyphostemma molle* and *Solanecio gigas* were very rare and *Echinops kebericho* was approaching to extinct in the study area because of overharvesting its root for medicine.

Parts used, preparation and methods of remedies administration

Most remedies (29.8 %) were prepared from leaves followed by roots (22.4%) as indicated in Fig. 2. The majorities (50.3%) of remedies were prepared from fresh materials followed by dried materials (40.4%) and the remaining (9.3%) either dry or fresh or both. The most common type of remedial preparation was squeezing (24.9%) followed by powdering (16.6%) and infusion (14.5%) as depicted in Fig 3. Most prepared remedies were applied orally (55.4%) followed by dermal (26.9%) and oral and nasal together (6.7%) as depicted in Fig. 4.

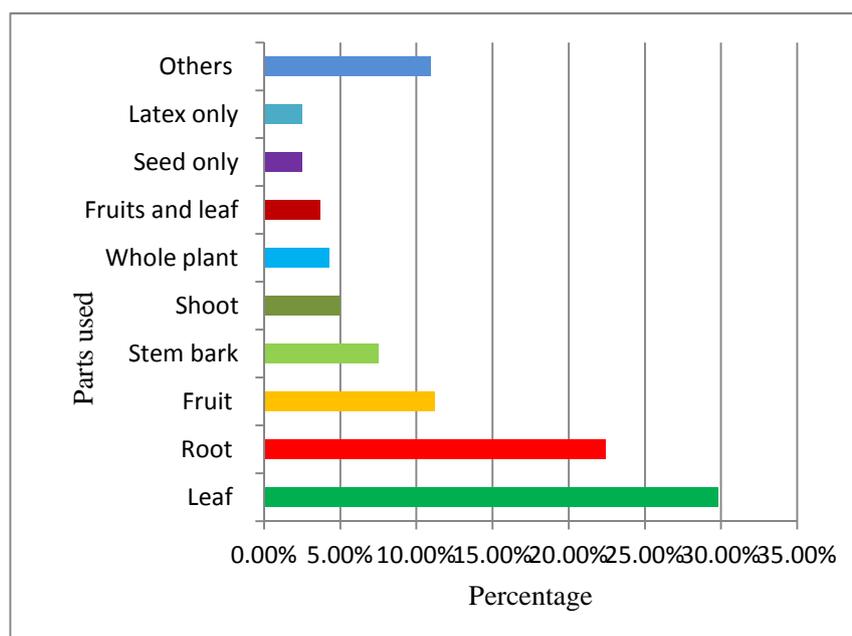


Fig. No. 02: Parts used for preparation of remedies

Table No. 01: List of traditional medicinal plants used to treat human and livestock diseases, GG: Getaneh Gebeyehu; all local names are in Amharic language

Botanical and Family name (Voucher No.)	Local name	Ailments treated	Parts used, methods of preparation and routes of application
<i>Acanthus polystachius</i> Del., Acanthaceae, (GG31)	Kosheshile	Trachoma	Fresh root juice with water is given orally after food
		Wound	Dried leaf powder mixed with butter is pasted topically
<i>Acacia abyssinica</i> Hochst. ex Benth., Fabaceae, (GG22)	Girar	Evil eye	Dried or fresh root grind with garlic and water is given nasally
		Wound	Dried stem bark powder is pasted topically
<i>Acacia pilispina</i> Pic.-Serm., Fabaceae, (GG91)	Cheba	Tonsillitis	Fresh bark juice is given orally
<i>Achyranthes aspera</i> L., Amaranthaceae, (GG20)	Telenji	Wound	Dried leaf powder with butter is pasted topically
		Retained placenta	Fresh stem juice with water is given orally
<i>Acmella caulirhiza</i> Del., Asteraceae, (GG46)	Yemidir berberie	Toothache	Fresh flower is given for chewing
		Eye infection	Fresh whole plant juice is applied to cattle through eye
<i>Aloe macrocarpa</i> Tod., Aloaceae, (GG47)	Irate	Gastritis	Fresh latex with honey is given orally
		Emaciation	Fresh leaf juice with salt is given orally
<i>Allium sativum</i> L., Alliaceae, (GG55)	Nech shinkurt	Eye infection	Fresh bulb juice is squeezed and applied
		Typhoid	Dried or fresh bulb with <i>Allium cepa</i> and <i>Nigella sativa</i> is soaked in water, filtered and given orally
<i>Asparagus scaberulus</i> A. Rich., Asparagaceae, (GG98)	Yesiet kest	Toothache	Fresh root juice is given orally
		Fire wound	Fresh shoot is crushed and applied
<i>Bersama abyssinica</i> Fresen., Melianthaceae, (GG64)	Azamir	Ascariasis	Fresh leaf boiled with milk and potato is given orally
<i>Brucea antidysenterica</i> J.F. Mill., Simaroubaceae, (GG07)	Abalo	Eczema	Dried fruit powder mixed with butter is applied topically
		Hookworm	Dried root and <i>Phytolaca dodecandra</i> leaf powdered, mixed with water is given orally
		<i>Tinea nigra</i>	Dried fruit and <i>Cucumis ficifolius</i> dried leaf is powdered, mixed with butter and applied topically
		Retained placenta	Fresh leaf juice with water is given orally for livestock
<i>Buddleja polystachya</i> Fresen., Loganiaceae, (GG101)	Amfar	Scabies, Itching	Dried leaf powder mixed with butter is applied topically
<i>Calpurnia aurea</i> (Ait.) Benth., Fabaceae, (GG01)	Digita	Giardia, amoebiasis	Seed powder mixed with honey is given orally
		Malaria	Fresh leaf and <i>Allium sativum</i> soaked in water is given orally
		Diarrhea	Fresh leaf soaked in water is given orally
<i>Capparis tomentosa</i> Lam., Fabaceae, (GG11)	Gumero	Chagas	Dried stem bark is fumigated for infected cattle

Table No. 01 : Contd.,

<i>Carissa spinarum</i> L., Apocynaceae, (GG77)	Agam	Stabbing pain	Fresh root juice with water is given orally
		Evil eye	Dried or fresh root and <i>Allium sativum</i> bulb juice with water is given nasally
<i>Chenopodium opulifolium</i> Koch & Ziz., Chenopodiaceae, (GG74)	Sinin	Toothache	Fresh leaf juice with water is given orally
<i>Clematis simensis</i> Fresen., Ranunculaceae, (GG62)	Yeazo hareg	Swelling	Fresh leaf juice with water is applied topically
<i>Clerodendrum myricoides</i> (Hochst.) Vatke, Lamiaceae, (GG104)	Misrich	Malaria	Dried leaf and fruit mixed with honey is given orally
<i>Clausena anisata</i> (Willd.) Benth., Rutaceae, (GG97)	Limich	Coccidiosis	Fresh leaf juice with water is given orally for hen
<i>Clutia lanceolata</i> Forssk., Euphorbiaceae, (GG60)	Fiyelefeji	Hemorrhoid	Dried leaf powder mixed with water and filtrate is given nasally
		Itching	Dry fruit powder mixed with butter is applied topically
<i>Convolvulus steudneri</i> Engl., Convolvulaceae, (GG93)	Flasot	Stomachache	Dried powder of whole plant mixed with honey is given orally
		Swelling	Dry leaf powder mixed with butter is applied topically
<i>Cordia africana</i> Lam., Boraginaceae, (GG66)	Wanza	Gastritis	Fresh latex is given orally before food
		Involuntary urine flow	Dried seed powder homogenized with water is given orally
		Jaundices	Dried stem bark with <i>Croton macrostachyus</i> stem bark powder boiled with milk is given orally
<i>Croton macrostachyus</i> Del., Euphorbiaceae, (GG12)	Bisana	Ring worm	Fresh shoot juice with water is applied topically
		Wound	Dried shoot powder mixed with butter is applied topically
		Malaria	Dried stem bark powder mixed with honey is given orally
<i>Cucumis ficifolius</i> A. Rich., Cucurbitaceae, (GG42)	Yemidir embuay	Retained placenta	Crushed fresh root mixed with water is given orally
		TB (Lung)	Mixture of dried fruit, <i>Gnidia involucreta</i> root and <i>Allium sativum</i> bulb soaked with local beer is given orally
<i>Cucurbita pepo</i> L., Cucurbitaceae, (GG58)	Duba	Tape worm	Dried seed is given for eating before food
		Ear lesion	Fresh flower is crushed and applied topically
<i>Cynoglossum coeruleum</i> Hochst. A. Rich. DC., Boraginaceae, (GG14)	Shemgegit	Febrile illness	Fresh leaf juice is given orally
<i>Cyphostemma molle</i> (Bak.) Descoings, Vitaceae, (GG18)	Etse-zewie	Snake bite	Fresh root is given for chewing
<i>Datura stramonium</i> L., Solanaceae, (GG05)	Astenager	Dandruff	Fresh leaf juice is applied topically
		Toothache	Dried or fresh boiled seed vapor is fumigated

Table No. 01 : Contd.,

<i>Dipsacus pinnatifidus</i> Steud. ex A. Rich., Dipsacaceae, (GG51)	Kelem	Eye infection	Fresh root juice drop is applied on cattle eye
<i>Dodonaea angustifolia</i> L.f., Sapindaceae, (GG84)	Kitkita	Bone fracture	Paste of dried leaf powder with water is tied on fractured bone of the cattle
		Wound	Dried leaf powder with butter is applied topically
		Dysentery	Fresh leaf soaked with water and sugar is given orally
		Malaria	Dried leaf and fruit mixed with <i>Allium sativum</i> and honey is given orally
		Rabies	Dried root powder mixed with milk is given orally
<i>Echinops kebericho</i> Mesfin, Asteraceae, (GG48)	Kebericho	Epidemic diseases	Dried or fresh root is fumigated orally or nasally for human or horses
<i>Embelia schimperi</i> Vatke, Myrsinaceae, (GG35)	Enkoko	Tape worm	Dried fruit soaked with local beer is given orally
<i>Eucalyptus globulus</i> Labill., Myrtaceae, (GG44)	Nech bahirzaf	Common cold	Fresh leaf boiled vapor is inhaled orally and nasally
<i>Euphorbia platyphyllos</i> L., Euphorbiaceae, (GG65)	Anitr	Tumor	Fresh latex is applied for external tumor
<i>Ficus carica</i> L., Moraceae, (GG39)	Beles	Wound	Fresh latex is applied topically
<i>Ficus sur</i> Forssk., Moraceae, (GG28)	Shola	Wart	Fresh leaf boiled with sugar is applied topically on donkey
<i>Ficus vasta</i> Forssk., Moraceae, (GG61)	Warka	Diarrhea	Dried stem bark powder with salt is given orally for cattle
<i>Feoniculum vulgare</i> Miller, Apiaceae, (GG68)	Ensillal	Diuretic	Whole plant juice with water is given orally
		Cough	Fresh leaf soaked with milk is given orally
<i>Gardenia ternifolia</i> Schumach. & Thonn., Rubiaceae, (GG40)	Gambilo	Evil eye	Dried root and stem bark with <i>Allium sativum</i> powder mixed with water is given orally or nasally
<i>Glinus lotoides</i> L., Molluginaceae, (GG33)	Amkin	Tape worm	Powder of dried fruit and <i>Guizotia schimperi</i> is given orally before food
<i>Gnidia involucrata</i> Steud. ex A. Rich., Thymelaeaceae, (GG53)	Yezenjero telba	Malaria	Dried root and leaf soaked with local beer is given orally
		Rheumatism	Dried root with leaf and root of <i>Plumbago zeylanica</i> boiled with water is given orally
<i>Grewia ferruginea</i> Hochst. ex A. Rich., Tiliaceae, (GG75)	Lenquata	Constipation	Dried leaf powder with water is given orally
		Dysentery, Retained placenta	Fresh latex soaked with water, egg and salt is given orally for cattle
<i>Hagenia abyssinica</i> (Bruce) J. F. Gmel., Rosaceae, (GG89)	Kosso	Tape worm	Dried fruit powder cooked with food is given orally
		Hypertension	Fresh flower and fruit soaked with water is given orally

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<i>Jasminum grandiflorum</i> L., Oleaceae, (GG95)	Tembebel	Boils	Dried root powder with water is applied topically
		Common cold	Dried root boiled vapor is inhaled orally or nasally
<i>Justicia schimperiana</i> (Hochst. ex Nees) T. Anders., Acanthaceae, (GG02)	Simeza	Malaria	Dried leaf and shoot boiled with water, salt and butter is given orally
		Coccidiosis	Fresh leaf juice with water is given orally for hen
<i>Kalanchoe petitiiana</i> A. Rich., Crassulaceae, (GG99)	Endawula	Swelling	Fresh leaf juice with water is applied topically
		Toothache	Fresh root is given for chewing
		Tonsillitis	Fresh root crushed with water is given orally
<i>Kanahia laniflora</i> (Forssk.) R. Br., Asclepiadaceae, (GG71)	Arust	Tumor	Fresh leaf juice with latex is given orally or applied topically
		Wart	Fresh or dried whole plant powder mixed with butter is applied topically on donkey
<i>Laggera crispata</i> (Vahl) Hepper & Wood. Asteraceae, (GG102)	Kes bedeje	Asthma	Fresh or dried leaf soaked with water is given nasally
<i>Laggera tomentosa</i> (Sch. Bip. ex A. Rich.) Olivo & Hiern, Asteraceae, (GG106)	Gimie	Common cold	Fresh leaf boiled vapor is inhaled nasally or orally
<i>Lagenaria abyssinica</i> (Hook.f.) C. Jeffrey, Cucurbitaceae, (GG37)	Yekil embuay	Leech infection	Fresh fruit juice is given nasally for cattle
<i>Lantana trifolia</i> L., Verbenaceae, (GG23)	Yeregna kolo	Eye infection	Dried fruit and leaf roasted and powdered is applied topically
		Heart failure	Dried fruit powder with water is given orally
<i>Leonotis ocyimifolia</i> (Burm. F.) Iwarsson Lamiaceae, (GG34)	Yeferes zeng	Diarrhea	Dried leaf and fruit powder mixed with honey is given orally
<i>Lepidium sativum</i> L., Brassicaceae, (GG79)	Feto	Stomachache	Dried seed powder mixed with <i>Hordeum vulgare</i> and water is given orally for human and livestock
<i>Maesa lanceolata</i> Forssk., Myrsinaceae, (GG80)	Kilaba	Leprosy	Dried or fresh leaf with <i>Clematis simensis</i> leaf powder mixed with butter is applied topically
<i>Malva verticillata</i> L., Malvaceae, (GG17)	Yewusha nacha	Vomiting	Fresh root is crushed and given orally
		Dysentery	Dried root with <i>Calpurnia aurea</i> root soaked with water is given orally
<i>Maytenus senegalensis</i> (Lam.) Exell Celastraceae, (GG76)	Koba	Veneral diseases	Dried, roasted stem bark powder with butter is applied topically
		Sexual impotency	Dried stem bark powder cooked with hen meat is given orally
<i>Merremia pterygocaulos</i> (Steud. ex Choisy) Hall. f., Convolvulaceae, (GG105)	Libawit	Unspecific diseases	Fresh or dried whole plant soaked with water is given bathing

Table No. 01 : Contd.,

<i>Milletia ferruginea</i> (Hochst.) Bak., Fabaceae, (GG67)	Birbira	Chigger	Dried fruit powder is applied topically
<i>Momordica foetida</i> Schumach., Cucurbitaceae, (GG24)	Yekura hareg	Toothache	Fresh root is given for chewing
		Cough	Fresh whole plant water vapor is inhaled nasally or orally
		wound	Fresh leaf paste is applied topically
<i>Myrtus communis</i> L., Myrtaceae, (GG50)	Ades	Scabies	Dried leaf powder mixed with butter is applied topically
<i>Nicotiana tabacum</i> L., Solanaceae, (GG69)	Tinbaho	Ear lesion	Fresh leaf juice is applied
		Common cold	Fresh leaf juice with water is given nasally
		Leech infection, Bloating	Fresh leaf juice with water is given nasally or orally for cattle
<i>Ocimum lamiifolium</i> Hochst. ex Benth., Lamiaceae, (GG45)	Damakese	Febrile illness	Fresh leaf juice with water is given orally or nasally
<i>Olea europaea</i> subsp. <i>cuspidata</i> (Wall.ex G. Don) Cif., Oleaceae, (GG52)	Woirra	Irritation of eye	Fresh shoot juice with water is applied
		Brain tumor	Dried fruit and <i>Embelia schimperi</i> fruit powder with water is given nasally before food
<i>Osyris quadripartita</i> Decn., Santalaceae, (GG32)	Keret	Skin lesion	Dried leaf powder with water is applied topically on cattle
<i>Otostegia integrifolia</i> Benth., Lamiaceae, (GG09)	Tunjit	stomachache	Fresh leaf is given for chewing
		Malaria	Fresh leaf soaked with <i>Allium sativum</i> is given orally
<i>Periploca linearifolia</i> Quant.-Dill. &A. Rich., Asclepiadaceae, (GG63)	Moider	Invoking sprit	Dried root powder mixed with milk is given orally
		Devil sickness	Dried root with animal dung fire fumigation is inhaled orally or nasally
<i>Physalis peruviana</i> L., Solanaceae, (GG29)	Nech awut	Gastritis	Fresh fruit and leaf boiled with tea is given orally
<i>Phytolaca dodecandra</i> L'Herit, Phytolaccaceae, (GG36)	Endod	Rabies	Dried or fresh root and leaf soaked in honey is given orally
		Bloating	Fresh leaf soaked with water is given orally for cattle
<i>Plantago lanceolata</i> L., Plantaginaceae, (GG04)	Gorteb	Wound	Fresh squeezed leaf juice is applied topically
<i>Plectocephalus varians</i> (A. Rich.) C. Jeffrey ex Cufod., Asteraceae, (GG100)	Etse-yohanes	Tumor	Whole fresh plant is squeezed and applied
		Hemorrhoid	Fresh root juice is given orally and nasally
<i>Plumbago zeylanica</i> L., Plumbaginaceae, (GG57)	Amira	Stomach tumor	Fresh shoot boiled with water is given orally
		Tonsillitis	Fresh or dried leaf boiled with water is given orally
<i>Prunus persica</i> (L.) Batsch, Rosaceae, (GG54)	Kok	Swelling	Dried leaf powder mixed with food is given orally
<i>Pterolobium stellatum</i> (Forssk.) Brenan, Fabaceae, (GG73)	Kentefa	Asthma	Dried bark powder is given orally and nasally

Table No. 01 : Contd.,

<i>Rhamnus prinoides</i> L'Herit., Rhamnaceae, (GG81)	Gesho	Scabies	Dried leaf powder is applied topically
		Tonsillitis	Crushed fresh fruit and shoot drops is given nasally
<i>Rhus vulgaris</i> Meikle, Anacardiaceae(GG38)	Kammo	Wound	Dried leaf powder is applied topically
		TB (Lung)	Dried fruit powder is given orally before food
<i>Ricinus communis</i> L., Euphorbiaceae, (GG56)	Gulo	Invoking sprit	Fresh root juice is given orally
		Toothache	Fresh root is given for chewing
<i>Rosa abyssinica</i> Lindley, Rosaceae (GG10)	Kega	Tape worm	Fresh fruit is given for eating
<i>Rubia cordifolia</i> L., Rubiaceae, (GG26)	Minchir	Delivery epitasis	Dried root powder with water is given orally
<i>Rubus apetalus</i> Poir., Rosaceae, (GG72)	Enjory	Gastritis	Dried leaf and fruit soaked with water is given orally
<i>Rumex abyssinicus</i> Jacq., Polygonaceae (GG13)	Mekimeko	Tinea vesicular	Dried rhizome powder is applied topically
		TB (Lung)	Dried rhizome powder with <i>Calpurnia aurea</i> leaf is boiled and given orally
<i>Rumex nepalensis</i> Spreng., Polygonaceae (GG49)	Tult	Stomachache	Fresh root boiled with ginger is given orally
		Retained placenta	Fresh root is inserted vaginally for few minutes
		Wart	Juice of fresh leaf and <i>Plantago lanceolata</i> is applied
<i>Rumex nervosus</i> Vahl, Polygonaceae, (GG06)	Embacho	Eye infection	Fresh leaf juice drop is applied through eye
		Circumcision	Fresh leaf boiled with water is applied
<i>Ruta chalepensis</i> L., Rutaceae, (GG27)	Tenadam	Common cold	Fresh shoot boiled with coffee is given orally and nasally
		Malaria	Dried or fresh shoot boiled with Ginger is given orally
<i>Salvia merjamie</i> Forssk., Lamiaceae, (GG15)	Jawula	Swelling	Fresh root boiled with water is given orally for cattle
		Gastritis	Fresh whole plant boiled with water is given orally
<i>Salix mucronata</i> Willd., Salicaceae, (GG107)	Shunshuna	Jaundices	Dried stem bark powder boiled with water is given orally
<i>Schinus molle</i> L., Ancardiaceae, (GG92)	Kundoberberie	Jaundices	Dried fruit soaked with <i>Solanum nigrum</i> leaf is given orally
<i>Schrebera alata</i> (Hochst.) Welw., Oleaceae, (GG96)	Etse-mesewr	Unspecific disease	Fresh leaf soaked with honey is given orally
<i>Sida schimperiana</i> Hochst. ex A. Rich., Malvaceae, (GG43)	Chifrig	Eye infection	Fresh leaf juice drop is applied through eye
<i>Solanecio gigas</i> Vatke, Asteraceae, (GG103)	Boz	Fetus abnormal	Fresh root soaked with honey is given orally
		Epidemic diseases	Powder of dried leaf and stem bark, caster bean is given orally for cattle
<i>Solanum anguivi</i> Lam., Solanaceae, (GG16)	Zerch embuay	Prevent conceive	Dried leaf and stem bark powder is given orally

Table No. 01 : Contd.,

<i>Solanum dasyphyllum</i> Schumach., Solanaceae, (GG19)	Gemer embuay	Cough	Dried fruit powder is given orally before food
		Snake bite	Fresh root is given for chewing
		Leech infection	Fresh fruit juice is given nasally for cattle
<i>Solanum incanum</i> L., Solanaceae, (GG105)	Embuay	Chigger	Fresh fruit juice is applied topically
<i>Steganotaenia araliacea</i> Hochst. ex A. Rich., Apiaceae, (GG78)	Nechillo	Herpes zoster	Dried whole plant roasted with dried hyena feces is applied
		Eye infection	Fresh leaf juice is applied
<i>Stephania abyssinica</i> (Dill and Rich). Walp., Menispermaceae, (GG08)	Etse-Eyesus	Stomachache	Fresh leaf boiled with milk is given orally
		Rabies	Fresh leaf and root soaked with honey is given orally
<i>Stereospermum kunthianum</i> Cham., Bignoniaceae, (GG59)	Zana	Gonorrhea	Dried bark powder mixed with butter is applied
<i>Syzygium guineense</i> (Willd.) DC., Myrtaceae, (GG82)	Doqima	Leprosy	Dried leaf powder mixed with honey is applied
<i>Tagetes minuta</i> L., Asteraceae, (GG41)	Awulesh-agbi	Common cold	Fresh shoot water vapor is inhaled orally and nasally
<i>Trichodesma zeylanicum</i> (Burm. f.) R. Br., Boraginaceae, (GG85)	Amera	Appetizer	Dried whole plant boiled with water is given orally
<i>Verbascum sinaiticum</i> Benth., Scrophulariaceae, (GG25)	Ketetina	Swelling	Dried root powder paste is applied topically on cattle
<i>Verbena officinalis</i> L., Verbenaceae, (GG70)	Atuch	Dysentery	Fresh whole plant boiled with tea is given orally
		Stomachache	Fresh root is given for chewing
<i>Vernonia adoensis</i> Sch. Rip. ex Walp., Asteraceae, (GG30)	Ras kimir	Kidney diseases	Dried root boiled with water is given orally
		Sexual impotency	Dried root powder is given orally
<i>Vernonia amygdalina</i> Del., Asteraceae, (GG03)	Girawa	Wound	Crushed dried leaf is applied topically
		Amoebiasis, Giardia	Dried or fresh leaf soaked with honey is given orally
		Stomach pain	Fresh leaf soaked with water is given orally for cattle
<i>Vernonia auriculifera</i> Hiern., Asteraceae, (GG90)	Dangorita	Eye infection	Juice of fresh leaf and <i>Momordica foetida</i> is applied
<i>Withania somnifera</i> (L) Dunal, Solanaceae, (GG94)	Gizawa	Renal disease	Fresh leaf and fruit soaked with water is given orally
		Evil eye	Dried or fresh root chopped with garlic is tied on the neck
		Headache	Fresh leaf and stem juice is given orally
<i>Xanthium strumarium</i> L., Asteraceae, (GG85)	Etse-tsehay	Hemorrhoid	Fresh leaf boiled with water is given orally
		<i>Tinea vesicular</i>	Fresh leaf juice is applied topically
<i>Ximenia caffra</i> Sond., Olacaceae, (GG83)	Enkoy	Herpes zoster	Dried stem bark powder with butter is applied topically

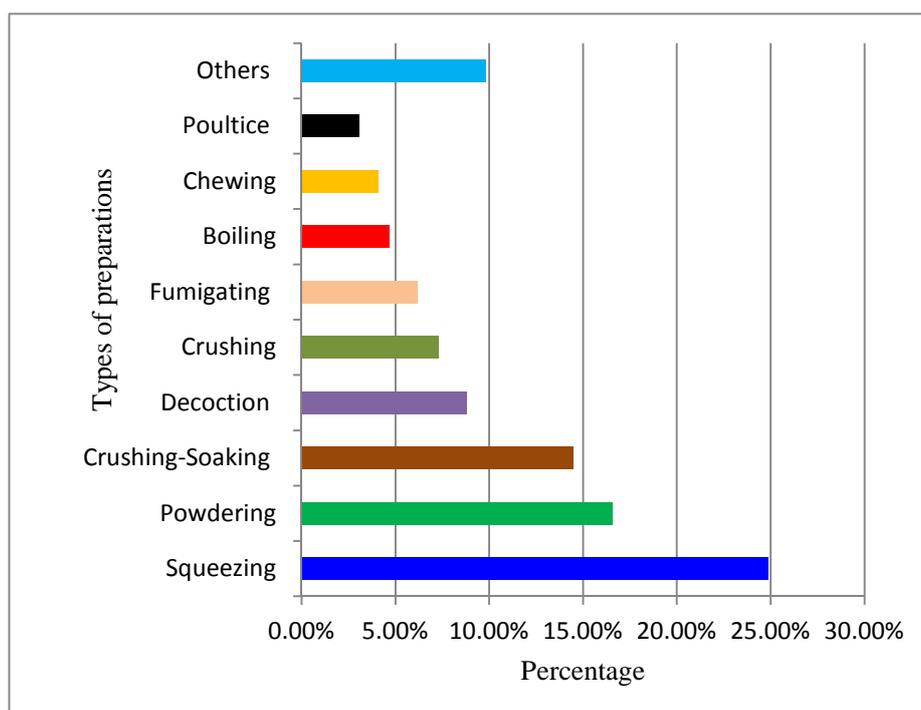


Fig. No. 03: Types of remedial preparation

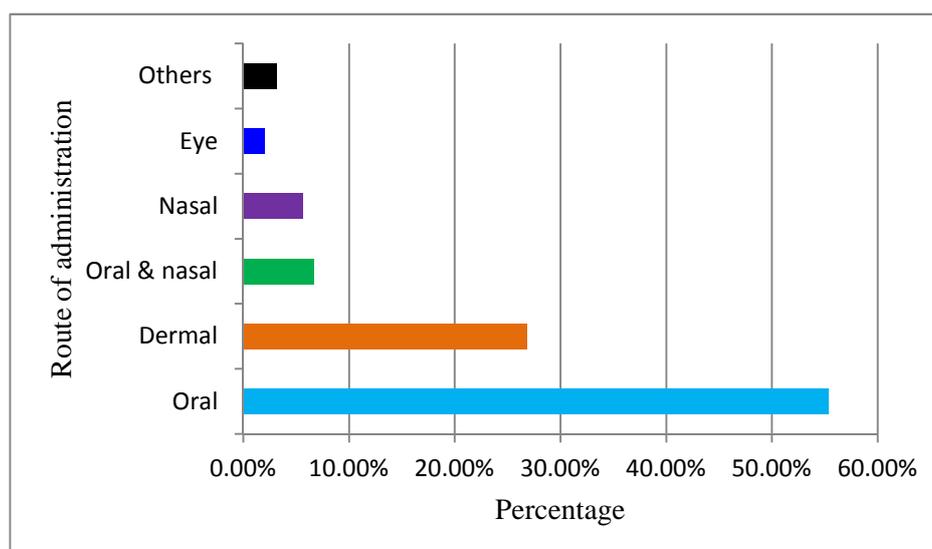


Fig. No. 04: Routes of remedies administration

Direct matrix ranking of medicinal plants

The average direct matrix ranking for most frequently cited medicinal plants used for firewood, medicine, construction, charcoal, forage and edible was calculated and converted into percentage. Based on the key informants' agreement, the order of medicinal plants was *Cordia africana* (83.3%) followed by *Ficus sur* (80%), *Rhus vulgaris* (76.7%), *Syzygium guineense* (73.3%), *Rosa abyssinica* (60%) and *Croton macrostachyus* (56.7%) respectively.

Informant consensus factor (ICF)

Informant consensus factor was calculated on the identified frequently reported ten diseases categories. The highest ICF value (0.85) was obtained from diseases related to dermatological problems such as scabies, dandruff, ringworm, eczema, boils and leprosy followed by gastrointestinal disorder and parasitic infection (0.84) like gastritis, diarrhea, dysentery, ascariasis, giardia and amoeba. The least ICF (0.43) was associated with genitourinary diseases such as diuretic, gonorrhea and sexual impotency (Table 2).

Table No. 02: Informant consensus factor of frequently reported diseases categories

Category of diseases	Diseases included	Ns	Nur	ICF
Dermatological problems	Scabies, dandruff, ringworm, eczema, herpes zoster, wound, cut, circumcision, boils, leprosy, wart	29	183	0.85
Gastro-intestinal disorder and parasitic infections	Stomachache, gastritis, diarrhea, dysentery, tapeworm, ascariasis, hook worm, giardia, amoeba, typhoid	24	142	0.84
Emergency diseases	Febrile illness, evil eye, invoking sprit	17	96	0.83
Livestock diseases	Coccidiosis, emaciation, dysentery, stomachache, bloating, leech infection, eye infection, ectoparasites	23	119	0.81
Rabies and internal diseases	Malaria, hemorrhoids, rheumatism	14	63	0.79
Poisonous diseases	Snake bite	2	5	0.75
Throat and respiratory diseases	Tonsillitis, cough, common cold, asthma, TB (lung)	19	61	0.70
Organ diseases	Toothache, ear lesion, eye infection, liver, kidney, heart failure, renal problem	22	49	0.56
Genitourinary problems	Diuretic, gonorrhea, sexual impotency	8	14	0.43

Fidelity Level (FL)

The fidelity level of medicinal plants for frequently reported diseases were calculated and reported in Table 3. The FL of *Acacia pilipisia*, *Ocimum lamiiifolium*, *Cynoglossum coeruleum*, *Ficus carica*, *Clerodendrum myricoides* and *Verbena officinalis*

was calculated 100% for the disease of tonsillitis, febrile illness, wound, malaria and dysentery respectively. The FL of *Gnidia involucrata* and *Clausena anistata* was calculated 80% and 75% respectively for the treatment of malaria and coccidiosis.

Table No. 03: Fidelity value of medicinal plants for frequently reported diseases

Disease treated	Ethnomedicinal plants	Ni	N	FL (%)
Coccidiosis	<i>Justicia schimperiana</i>	31	57	54
	<i>Clausena anistata</i>	12	16	75
Gastritis	<i>Aloe macrocarpa</i>	7	21	33
	<i>Acacia pilipisia</i>	3	3	100
Tonsillitis	<i>Rhamnus prinoides</i>	4	11	37
	<i>Plumbago zeylanica</i>	8	13	62
Febrile illness	<i>Ocimum lamiiifolium</i>	11	11	100
	<i>Cynoglossum coeruleum</i>	35	35	100
Giardia	<i>Vernonia amygdalinia</i>	6	17	35
	<i>Calpurnia aurea</i>	9	18	50
Wound	<i>Rhus vulgaris</i>	12	16	75
	<i>Acanthus polystachius</i>	7	13	54
	<i>Ficus carica</i>	19	19	100
	<i>Dodonaea angustifolia</i>	10	21	48
Malaria	<i>Clerodendrum myricoides</i>	4	4	100
	<i>Justicia schimperiana</i>	18	57	32
Dysentery	<i>Gnidia involucrata</i>	4	5	80
	<i>Verbena officinalis</i>	6	6	100
Tuberculosis	<i>Rhus vulgaris</i>	4	16	25
	<i>Cucumis ficifolius</i>	3	7	43
	<i>Rumex abyssinica</i>	2	5	40

Conservation status of ethnomedicinal plants

Currently some of the domesticated ethnomedicinal plants in the study area include *Prunus persica*, *Myrtus communis* and *Rhamnus prinoides*. In addition, the practitioners were started to cultivate wild plants like *Withania somnifera*, *Solanecio*

gigas, *Solanum dasyphyllum*, *Verbena officinalis*, *Plumbago zeylanica* and *Clerodendrum myricoides* by realizing their medicinal values. In addition to medicinal values, the plants were harvested for the multiple uses like firewood, construction, charcoal, forage, fencing and agricultural expansion. Due to

these factors, the availability of medicinal plants in the study area was started declining.

Discussion

In this documentation, traditional practitioners from the study area used 107 medicinal plants for the treatment of 67 various human and livestock ailments (Table 1). A total 52 families were confirmed based on Flora of Ethiopia and Eritrea in which Asteraceae was the dominant (11.2%) followed by Solanaceae (7.4%). This may be due to the seeds of most Asteraceae species are winged and this may help dispersal of wide areas through wind and established everywhere. Another possible reason for the preference of wide use by the traditional healers may be related to availability, widespread distribution and curing capacity. Most medicinal plants (78.5%) were cited for the treatment of human diseases. In many part of Ethiopia, ethnobotanical investigators observed that local communities giving priority for human healthcare than livestock^{15, 23, 24}. It may be due to inadequate modern healthcare centers in the study area till traditional healers are using local plants for the welfare of human health.

In the study area, the majority (41.1%) of the medicinal plants like *Brucea antidyenterica*, *Clerodendrum myricoides*, *Clusia lanceolata*, *Dodonaea angustifolia*, *Embelia schimperi*, *Gardenia ternifolia*, *Grewia ferruginea*, etc. were shrubs used for the treatment of various diseases. This may be due to the fact that the tolerance capacities of shrubs are greater than herbs. The herbs may be flourished well during the rainy season and this documentation was carried out during dry season. To support with this present findings, many earlier reports described that shrubs were the widely used medicinal plants in their study area^{12, 14, 25, 26, 27}. In our study area, the second dominant plants (36.5%) practiced by the healers were herbs. In other researchers recorded herbs were commonly used medicinal plants in their study area^{15, 24, 28}. This may be associated with seasonal variation of the study because the herbs are growing well mainly in rainy season. In the study area, most medicinal plants (85%) were collected from wild areas like farmlands, grazing lands, roadsides, upland forests and riverine side forests compared to homegardens. This may be due to most medicinal plants are adapted well and available plenty in wild areas as a result, people

may not so interest to grow all the medicinal plants in the homegardens and *ex-situ* conservation was given less attention. According to Tesfaye Awas and Zemedede Asfaw¹¹, Ermias Lulekal *et al.*²⁷ and Abiyu Enyew *et al.*¹⁵, wild areas are rich storehouse for medicinal plants.

In the study area, medicinal plants like *Embelia schimperi*, *Justicia schimperiana*, *Cynoglossum coeruleum*, *Glinus lotoides*, etc were commonly and widely used. This may be associated with the healing potential and their accessibility. In addition, it may be associated with broad spectrum application and popularization among the communities for the treatment of multiple diseases. Medicinal plants like *Solanecio gigas*, *Echinops kebericho*, *Laggera tomentosa*, *Plectocephalus varians*, *Millettia ferruginea* and *Cyphostemma molle* are endemic to Ethiopia. Even though these species are endemic, they were very rare in the study area due to overexploitation of root parts for different remedial and other purposes.

Traditional practitioners in the study area mostly used leaves (29.8%) for preparation of remedies followed by roots (Fig. 2). The preference of leaves for remedial preparation is due to safety to use and make sure the plants sustainability and to prevent extinction. Abiyu Enyew *et al.*¹⁵ also suggested that, leaves are easily renewal part and their utilization may not put medicinal plants at risk of extinction. Some other researchers also observed that, leaves were commonly used plant parts for remedial preparation in their study area^{23, 24}. Most traditional remedies (50.3%) were prepared by using fresh materials. This may be related to the availability of active compounds in fresh materials compared to dried one. Abiyu Enyew *et al.*¹⁵ also suggested that, biologically active principles in fresh leaves may degrade up on drying. To support the present findings, many ethnobotanical investigators reported that most remedies were prepared from fresh plant materials^{23, 28}. In the study area, common preparation methods of remedies was extracting juice by squeezing (24.9%) followed by powdering (16.6%). Preparing remedies by squeezing is advantageous over using decoction since heat may affect the active principles of the remedies¹⁵. Following the preparation methods, remedies were administered mostly (55.4%) through oral followed by topical (26.9%) application (Fig. 4) based on the nature of

diseases. It is obviously true that dysentery, gastritis, helminthes, malaria, pneumonia were some of the commonly encountered internal diseases in the study area²⁹. To improve the quality of ethnomedicine and also acceptability by the patient, remedies were mixed with water, sugar, butter, milk, honey, tea or coffee and given for drinking, chewing or eating (Table 1). On the other hand, to control the infection of ectoparasites and dermatological problems, remedies were given in the form of paste to apply on infected parts of the body. The highest direct matrix ranking (83.3%) was calculated for *Cordia africana* followed by *Ficus sur* (80%) respectively. As the direct matrix ranking value gets high, the plants have used for multiple application and vice versa.

The highest (0.85) ICF value of frequently reported diseases was associated to dermatological diseases (Table 2), which includes scabies, dandruff, ringworm, eczema, herpes zoster, wound, boils and leprosy. About 29 plant species were cited for the treatment of this diseases category. According to MWHO²⁹, skin diseases were reported to be one of the top ten diseases. The dominance of dermatological problems may be associated with inadequate sanitation in the study area. *Ficus carica* was one of the reported medicinal plants for the treatment of wound from this disease category and the FL value of this plant was 100%. Another plant cited for wound was *Rhus vulgaris* with FL of 75%. The second highest (0.84) ICF value was associated with gastrointestinal and parasitic infections which includes stomachache, gastritis, diarrhea, dysentery, tapeworm, ascariasis, hook worm, giardia, amoeba and typhoid.

Among 24 plant species cited for the treatment of this disease category, *Calpurnia aurea* was mentioned for amoebiasis with FL value of 50%. The FL value of *Acacia pilipisia*, *Ocimum lamifolium*, *Clerodendrum myricoides* and *Verbena officinalis* were calculated 100% for the treatment of tonsillitis, febrile illness, malaria and dysentery respectively (Table 3). In our study, the value of ICF ranges from 0.43 to 0.85 (Table 2). The higher value indicates the exchange of information between informants and the lowest value indicates that keep a secret of medicinal plants use. The FL value of frequently reported diseases was ranged from 25% to 100%. The variation of FL value of medicinal plants was

related to their frequent application for different diseases control. If a plant is used for the treatment of several diseases, it will have low FL value and vice versa¹⁵.

In the study area, indigenous people were highly depended upon plant resources for multiple applications that threatened diversity of medicinal plants. The plants used other than medicinal purpose may put at risk of extinction because of over exploitation³⁰. The principal threats reported for medicinal plants in Ethiopia were deforestation, agricultural expansion, over exploitation and population growth^{5, 31, 32}. Some of the medicinal plants like *Prunus persica*, *Myrtus communis*, *Solanecio gigas*, *Echinops kebericho*, *Laggera tomentosa* were given importance to grow in homegardens. However, some of the plants like *Clerodendrum myricoides*, *Gnidia involucrata*, *Merremia pterygocaulos*, *Periploca linearifolia*, *Steganotaenia araliacea* and *Withania somnifera* were rare species in the study area. Cultivation of medicinal plants in homegardens has multiple uses⁵. It is important as much as possible, to avoid harvesting root parts of the plants than other parts. Preparing remedies from plant roots and barks lead to the threatening cause of medicinal plants³³. The conservation status of medicinal plants in the study area is still limited and it needs proper attention to conserve medicinal plants particularly rare plants for the welfare of future generation in a sustainable manner.

Conclusion

Mecha Wereda has diverse medicinal plants that are practiced in crude form for the treatment of various human and livestock ailments by the local communities. The wild areas were the most sources of ethnomedicinal plants compared to homegardens. From various threats of the medicinal plants, agricultural expansion was the most visible one. Conservation effort in the study area is meager and the associated indigenous knowledge system is getting ride off. Hence, awareness about the need for *in-situ* and *ex-situ* conservation of medicinal plants should be created among the local communities and rare species should be given conservation priority. Further phytochemical investigation on most promising medicinal plants practiced by the traditional healers may help to discover new novel drugs in future.

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