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Ethnobotanical Study of Medicinal Plants Used by Indigenous People in Ticho District, Arsi Zone, Oromia Regional State, Ethiopia

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ABSTRACT

A cross-sectional study was conducted from December 2022 to February 2023 in Ticho District, Arsi Zone, Oromia, Ethiopia. An ethnobotanical survey of medicinal plants was conducted to document and investigate medicinal plants used to treat human and livestock ailments before people's knowledge of traditional medicinal plant use vanishes. Ethnobotanical data was collected using semi-structured interviews, field observation, group discussion, guided field work, and market surveys. In this study, 82 informants participated in collecting ethnobotanical data of which, 56 general informants were selected by systematic random sampling, whereas twenty six key informants were selected purposively. Descriptive statistics and other ethnobotanical indices such as preference ranking, informant consensus, and direct matrix ranking were employed to quantify and analyze the collected data. The study revealed that 78 medicinal plant species belonging to 77 genera and 47 families were identified to treat human and livestock ailments. Family Fabaceae has contributed the highest number of medicinal plant species 7 (9%), followed by Asteraceae 5 (6%). The majority of these plants, 64(81%) were used to treat human ailments followed by 12(15.2%) were used to treat livestock ailments alone. Most medicinal plants of species 48 (61.5%) were collected from the wild. Herbs constituted the largest growth form 28 species (35.9%) followed by shrubs 25 species (32%). The leaf was the most commonly used plant part, accounting for 38 (48.6%), followed by root 14(17.95%), and bark. Oral administration was the more common route (61.5%), followed by the topical route (32%). The analysis of direct matrix ranking showed that *Ficus sycomorus* and *Podocarpus falcatus* are the most widely used multi-purpose plant species by the local community. It is possible to conclude that plants are still valued for their medicinal uses in the Ticho district and the local community has rich indigenous knowledge of herbal medicinal plant uses. However, the availability of medicinal plants is at risk due to various activities such as agricultural expansion, construction use, firewood production, and charcoal production. Therefore, the concerned body should apply in-situ and ex-situ conservation strategies for the sustainable use of herbal resources and to prevent species from extinction.7 families were identified to treat human and livestock ailments. Family Fabaceae has contributed the highest number of medicinal plant species 7 (9%), followed by Asteraceae 5 (6%). The majority of these plants, 64(81%) were used to treat human ailments followed by 12(15.2%) were used to treat livestock ailments alone. Most medicinal plants of species 48 (61.5%) were collected from the wild. Herbs constituted the largest growth form 28 species (35.9%) followed by shrubs 25 species (32%). The leaf was the most commonly used plant part, accounting for 38 (48.6%), followed by root 14(17.95%), and bark. Oral administration was the more common route (61.5%), followed by the topical route (32%). The analysis of direct matrix ranking showed that *Ficus sycomorus* and *Podocarpus falcatus* are the most widely used multi-purpose plant species by the local community. It is possible to conclude that plants are still valued for their medicinal uses in the Ticho district and the local community has rich indigenous knowledge of herbal medicinal plant uses. However, the availability of medicinal plants is at risk due to various activities such as agricultural expansion, construction use, firewood production, and charcoal production. Therefore, the concerned body should apply in-situ and ex-situ conservation strategies for the sustainable use of herbal resources and to prevent species from extinction.

Keywords: Ethnobotany, Human and Livestock ailments, Indigenous knowledge, Preference Ranking, Traditional Medicine

INTRODUCTION

Indigenous people have a special understanding of the plant resources they rely on for food, medicine, and other purposes [1]. Indigenous peoples have developed knowledge on the use and management of plants in their vicinity throughout time [2]. As a result of human contact with their environment and the distinctive culture and religion of a community, local-specific knowledge of that community develops. Ethnobotany investigates this relationship between the environment (plants) and the residents of a certain community.

Traditional medicine is defined as the total of all knowledge and practice, whether explicable or not, used in the diagnosis, prevention, and elimination of physical, mental, or social imbalances, and relying exclusively on practical experience and observation handed down from generation to generation, whether verbally or in writing [3]. Traditional medicine has been practiced for thousands of years and remained popular globally due to the significant contributions made to human health by its practitioners, notably as primary healthcare providers at the community level [4].

Traditional healers have been using different plants to treat humans and other domesticated animals for thousands of years worldwide as major therapeutic sources [5]. Traditional medicine particularly, herbal medicinal products are the primary healthcare source for the large population living in the majority of the rural areas of developing countries [6]. Medicinal plants are also known for having essential oils which are sources of beneficial chemical compounds that have potential applications in food, medicine, cosmetics, and the agriculture industry [7, 8]. Many medicinal plants are used as medicine due to their antimicrobial properties, which are a result of the compounds synthesized in the secondary metabolism of the plant [9]. The main portions of current drugs are extracted from medicinal plants and have a chemical origin [8].

The majority population of Ethiopia 80% has relied on traditional medicine as a major provider of health care [10]. In Ethiopia, the majority of the rural community especially in remote rural areas depend on traditional medicinal plants due to their poor economic potential to afford modern medication and a limited number of modern health facilities [11]. Furthermore, easy availability and affordability are the main reasons for using traditional herbal medicine [12]. In Ethiopia, in addition to human disease treatment by traditional herbal medicine, the local communities are reliant on herbal medicine to manage their domestic animal diseases.

In rural areas, traditional medical knowledge is largely available and is passed down orally among families or small communities. As a result, they are likely to be lost and dramatically altered when groups relocate to towns or other areas because cultural systems are so dynamic [13]. Nowadays, high population pressure and its associated effects, such as the increased need for settlement, agricultural land, fuel wood, house construction, and income generation, have resulted in a severe reduction of medicinal plant populations throughout their range.

In Ethiopia for many centuries, herbal medicine has been used traditionally to contest various human and livestock ailments. The majority of the population that lives in rural areas and the poor people in urban areas rely mainly on traditional medicines to meet their primary healthcare needs. In most scenarios, traditional knowledge in Ethiopia is passed verbally from generation to generation and valuable information can be lost whenever a traditional medical practitioner passes without conveying his traditional medicinal plant knowledge. In addition, the loss of valuable medicinal plants due to population pressure, agricultural expansion, and deforestation is widely reported by different workers [14]. As a result, the need to perform ethnobotanical research and document the medicinal plants and the associated indigenous knowledge must be an urgent task [15]. Like in other areas of Ethiopia, people in Ticho district use traditional plants to heal diseases, but there is no ethnobotanical research or work to document the medicinal plants in Ticho District. Therefore, this study aimed to document the medicinal plants used in Ticho District, Arsi Zone, Ethiopia. The novelty of this study is that the study area has never been studied from an ethnobotanical investigation perspective and the identified medicinal plant species of the study area were subjected to comprehensive quantitative analysis to figure out elite plants for medicinal purposes.

METHODS

Description of Study Area

The study was conducted in Ticho District, Arsi Zone, Oromia, Ethiopia. It is 252 km from the capital city, Addis Ababa. Ticho District is found at 7.39^{o} to 7.51^{o} N latitude and l39.23^{o} to 39.39^{o}E longitude and is surrounded by different districts of the Arsi Zone. These are in North Robe Didaa, in South Shirka District, in East Robe Didaa and Shirka, and in West Digalu Tijo District (Figure 1).

The topography of this district includes highlands, lowlands, and mountains. The altitude of the districts ranged from 1200 to 3300 meters above sea level, and the mean annual temperature ranged from 15^{o}C-25^{o}C. The average

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annual total rainfall is 880-1,110 mm, which is characterized by high rainfall in the highlands that slightly decrease towards the lowlands [16].

The population size of the district is over 75,000 people, among these 37,304 were males and 38,227 were females. The Majority of the human population in the district (91%) live in rural areas and depend primarily on agriculture [17].

The district has remnants of Indigenous vegetation such as *Juniperus procera, Podocarpus falcatus, Olea africana, Hagenia abyssinia,* and other indigenous species are observed scattered here and there. Thus, like other parts of the country, the natural vegetation of the area has been the victim of the influence of man and its domestic animals. The remnant tree species in the study district witnessed the land cover and land use change that occurred because of the impact of human activities [16].

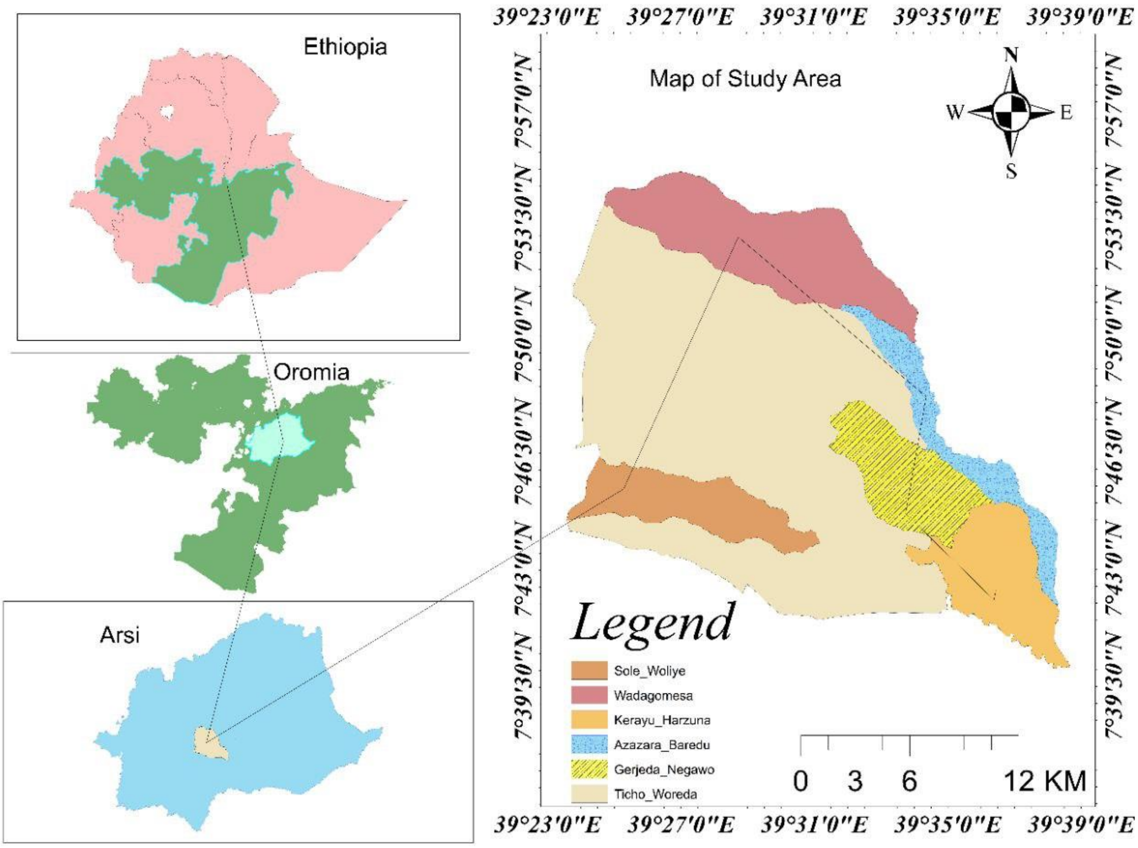

Fig. 1 Map of the study area

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Site Selection

A total of five *Kebeles* (Sole Waliye, Wadago Misa, Gerge Dana Gawo, Kereyu Harzuna, and Azazara Baredu) were purposively selected based on recommendations from elders, local authorities, availability of traditional medicine practitioners.

Selection of Informants

Informants were selected by purposive and random sampling techniques following [18] and [2]. A total of 82 informants, 56 general informants (37 males and 19 females) were selected randomly whereas 26 key informants (18 males and 8 females) were selected purposively from the selected five *kebeles*. Information about healers was obtained from each sampled *Kebele* health office, local authorities, and knowledgeable elders.

Ethnobotanical data Collection

Semi-structured Interview

A semi-structured interview was employed to obtain indigenous knowledge of the local community on the use of medicinal plants in the locality. Semi-structured interviews were prepared following [19]. Some questions were determined beforehand, and others arose during the course of the conversation. Most of the questions were focused on the availability, distribution and threats of medicinal plants in Ticho district. All 82 respondents participated in this interview since they could provide significant information for the investigation of medicinal plants.

Group Discussion

Experiences are the best guides to informal way of gathering information [19]. One focus group discussion was conducted in each sampled *kebeles* with governmental officials, key informants, and guiding questions prepared beforehand. Information obtained during the discussion was carefully recorded and interpreted as indicated in [19].

Guided Field Walk

A guided field walk was conducted where medicinal plants were found to make note of their habit, habitat, and appearance. When guided field walks were undertaken, seeing, feeling, smelling, and tasting of the medicinal plant under question were made. Traditional healers who guided the field walk helped in identifying the medicinal plants they encountered in the field by providing their local names and medicinal uses. Consequently, voucher specimens were collected, and recordings that explain the medicinal plant were made at their location spot. Voucher specimen collection by guided field walk took place in the wild and in the home gardens of the study area.

Identification of a Botanical Specimen

Medicinal plant specimens were collected in the study area based on the information provided by informants and numbered, pressed, and dried for identification. The source and collection number were listed. Primary identification was done in the field using the local name Afan Oromo. Unidentified specimen identification was done according to Flora of Ethiopia and Eritrea, such as [20].

Ranking of Most Important Medicinal Plants

Preference Ranking

According to [19], preference ranking is a simple analytical tool, which involves asking people to think of five to seven items and then arrange those items according to a given criteria such as personal preference, perceived importance in the communities, the list of plant resources that people feel are becoming increasingly rare in their communal forests. Therefore, in this study, seven medicinal plant species (*Hagenia abyssnica, Embelia schimper, Echinops kebericho, Allium sativum, Brassica oleracea, Glinus lotoidess and Cucurbita pepo*) were selected from the list of useful plants that were reported as the most important medicinal plants used in treating specific disease and presented to those randomly selected 10 key informants to rank according to their degree of importance. Each rank was given a value of (1, 2, 3...), with the most important items given the highest value, while the least important items were assigned 1. Then, the number was summed and ranked.

Direct Matrix Ranking

Six multipurpose plant species commonly reported by informants were selected out of the total useful plants collected, and the diverse use of these plants was listed for key informants to order them by considering several attributes at a time. Five key informants were selected to rank six medicinal plants used as herbal medicine in the Ticho district following [19] and [2] to compare the multipurpose use of these plants. Direct matrix ranking was conducted considering multiple uses of medicinal plants such as their use as fuel wood, furniture, edible as fruit oil, or food, Shade, charcoal, and construction. The set of six useful plants was presented to those randomly selected 10 key informants to rank according to their multiple uses. Then, each chosen key informant was asked to assign a value to each species (5=most valuable, 4=very good, 3=good, 2=less used, 1=least valuable, and 0=not used). The values of each species were summed up and ranked.

Informant Consensus

The informant consensus value was calculated based on the free listing data collected during interviews, which were then summarized in tabular form by Phillips [21]. The level of agreement between information provided by various informants was assessed using the Informants' Consensus Factor (ICF) formula [22].

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RESULTS

Diversity of Traditional Medicinal Plants in the Ticho District

The people in the study area use diverse plant species for medicinal purposes to treat human and livestock ailments. A total of 78 medicinal plant species categorized into 77 genera and 47 families were gathered and documented (Table 1). These medicinal plants were used to treat human and livestock ailments (Table 1).

The study showed that the types of ailments treated by medicinal plants included human ailments, livestock, ailments and both human and livestock ailments. It found that 63(80.8%) were used to treat human ailments, 12(15.4%) livestock ailments and 3(3.8%) both human and livestock ailments (Table 1).

The study revealed that the number of plant species contributed varied from family to family. The Fabaceae family has contributed the highest medicinal plant species 7 (9%), followed by the Asteraceae at 5 (6%); and two families Solanaceae and Rutaceae 4 (5%) each represented 5 (5.4%). The remaining families are placed according to the species they contain (Table 2).

Among the medicinal plants collected in this study, 49 (62.8%) were in collected from wild habitat, and 29 (37.2%). Concerning growth forms, herbs, shrubs, trees, climbers and grass constitute. The current findings show that the most widely used medicinal plants habit in the study area are herbs followed by shrubs, trees, climbers and grass constituting 35.85%, 32%, 17.22%, 9% and 1%, respectively. The study showed that leaves and roots are the most commonly used parts of medicinal plants in treating human and livestock ailments. It was found that leaf was the dominant part 38 (48.6%), followed by root 14 (17.95%), seed 13 (16.66%), bark 8 (10.15%), stem 3 (3.84%), fruit, and bulb were 2 (1.35%) (Fig. 2)

Knowledge of local Healers on Preparation of Remedies and Routes of Administration

The local healers employed several methods of preparing traditional medicines from plants. The highest method of medicinal plant preparation used in the study area for treatment of human and livestock disease was by pounding 38(48.7%) followed by crushing 34(43.6) and smoking 5(6.4) species and other forms of preparation are also indicated (Figure 3).

The major routes of administration in the study area were reported to be oral, topical, and nasal. Oral administration was the most cited route 48(61.5%), followed by the Topical route25 (32%) while the rest 5 (6.5%) were nasal route (figure 4).

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Table 1 List of Ethnomedicinal Plants Used by Local Communities in the study area

Scientific name	Family	Local name	Disease treated	Organisms used for	Preparation mode	Route	Voucher number
Acacia abyssinica Hochst. ex Benth. var. macroloba Schweinf.	Fabaceae	Laaftoo	Goiter	Human	fresh	Oral	MK46
Acokanthera schimperi (A. DC.) Schweinf.	Apocynaceae	Qaraaruu	Leprosy	Human	Crushing	Topical	MK 26
Allium sativum L.	Alliaceae	Qullubbiiadii	stomach ache	Human	Crushing	Oral	MK 40
Aloe monticola Reynolds.	Aloceae	Hargiisa	Anthrax	Livestocks	Pounding	Oral	MK 3
Artemisia abyssinica	Asteraceae	Harrittii	Evil eye	Human	Crushing	Topical	MK 75
Brassica oleracea var. capitata L.	Brassicaceae	Gomannaabasha	Stomach burn	Human	crushing	Oral	MK 34
Cairica papaya L.	Caricaceae	Papaya	Jaundice	Human	Pounding	Oral	MK 56
Calparnia aurea (Ait.) Benth	Fabaceae	Ceekaata	Ectoparasite	Human	fresh	Topical	MK 50
Carissa spinarum L.	Apocynaceae	Hagamsaa	Evil sprit	human	pounding	Topical	MK 72
Catha edulis/vahl/ Forssk.	Celastraceae	Caatii	Urine Retention	Human and Livestocks	Pounding	Oral	MK 15
Citrus aurantifolia	Rutaceae	Lomii	Tooth	Human	fresh	Oral	MK 53
Clerdendrum myricoides Hochst	Lamiaceae	Maraasisa	Evil spirit	Human	Smoking	Topical	MK 47
Coffea arabica L.	Rubaceae	Buna	Wound	Human	crushing	Topical	MK 28
Cordia africana Lam	Borginaceae	Waddessa	Gastric ulcer	Human	fresh	Oral	MK 36
Crinum ornatum (L.f. ex Aiton) Bury	Amaryllidaceae	Shunkurtii wara-beessa	Rheumatism	Human	Crushing	Topical	MK 5
Croton macrostchus Hochst. ex Delile	Euphorbiaeae	Bakkanissa	Evil sprit	Human	pounding	Topical	MK 58
Cucurbita pepo L.	Cucurbitaceae	Dabaaqula	stomach ache	Human	Crushing and mix-ing with water	Oral	MK 1
Cyathula cylindrical Mog	Amaranthceae	Maxane	Nasal bleeding	Human	Crushing	Nasal	MK 78
Cynodon nemfuensis Vanderyst	Poaceae	Coqorsaagurracha	Tonsillitis	Human	fresh	Oral	MK 38
Cyprus fischerianus A.Rich	Cyperaceae	Qunni	Cough	Human	Crushing	Oral	MK 43
Datura stramonuim L.	Solanaceae	Banjii	Cough	Human	Pounding	Oral	MK 2
Dodonaea angustifolia	Sapindaceae	Ittacha	Malaria	Human	Pound	Oral	MK 17
Dovyalis abyssinica L.f.	Flacourtaceae	Keshimoo	Rheumatic pain	Human	Smoke	Topical	MK 6
Echinops kebaricho Mesfin	Asteraceae	Qabarichoo	stomach ache	Human	Smoking	Topical	MK 30
Ehretia cymosaThonn	Borginaceae	Ulaagaa	Toothache	Human	Crushing	Oral	MK 4
Ekebergia capensis Sparrm	Meliaceae	Sombo	Leach	Human	Pounding	nasal	MK7
Embelia schimperi Vatke	Myrsinaceae	Hanqu	stomachache	Human	crushing	Oral	MK 21
Ensete ventricosum (Welwitsch) Cheesman.	Musaceae	warqee	Stomachache	Human	Crushing	Oral	MK 11
Erythrina brucei Schweinf	Fabaceae	Walleena	Eye problems	Livestocks	fresh	Topical	MK 9
Eucalyptus globulus Labill	Myrtaceae	Bergamooadii	Influenza	Human	pounding	Oral	MK 12
Ficus sycomorus L.	Moraceae	Oda	Hepatitis	Human	Crushing	Oral	MK 27
Ficus vasta forssk	Moraceae	Qilxuu	Loose of weight	Livestocks	pounding	Oral	MK 13
Gladiolus candidus	Iridaceae	Milasgulgli	Skin cancer	Human	Crushing	Topical	MK 20
Glinus lotoides L	Molluginaceae	Mataaharre	Tape worm	Human	Pounding	Oral	MK 23
*Hagenia abyssinica (*Bruce) J.F. Gmel.	Rosceae	Kosso	stomaache	Human	Pounding and mix-ing with honey	Oral	MK 14
Helianthus annulus L.	Asteraceae	Suufii	Anthrax	Livestocks	Crushing	Oral	MK 19
Hordeum vulgare	Poaceae	Garbu	Bloat	Livestocks	Crushing	Oral	MK 22
Ipomoea cairica L.	Convolvullaceae	Galeekalaala	Warts	Human	Crushing	Topical	MK 62
Juniperus procera Hochst ex Ends	Cuppressaceae	Gaatraa	Toothache	Human	pounding	Oral	MK 44
Justica schimperiana Hochst.	Acanthaeae	Sansal	Lice	Human and Livestocks	fresh	Topical	MK 25
Lagenaria siceraria Molina	Cucurbitaceae	Buqee	Evil eye	Human and Livestocks	Smoking	Oral	MK 63
Laggera tomentosa (A.Rich.) Sch.Bip. ex Oliv. & Hiern	Asteraceae	Ajoo	Allergic	human	Pounding	Topical	MK 29
Lepidium sativum L	Brassicaceae	Shunfaa	Internal parasite	Human	Crushing	Oral	MK 31
Linumu sitatissmum L.	Linaceae	Talba	Amoebisis	Human	Pounding	Oral	MK 42
Lippia adoensis var. koseret sebsebew	Verbanaceae	Sukayii	Intestinal parasites	Human	Crushing	Oral	MK 57
Lycopersicon esculentum mill	Solanaceae	Timaatimii	Spider Poison	Human	fresh	Topical	MK 32
Maesa lanceolata Forssk	Myrsinaceae	Abayi	Toothache	Human	Crushing	Oral	MK 60

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Maytenus senegalensis Lam	Celastraceae	Kombolcha	Skin infection	Human	Pounding	Topical	MK 55
Melia azedarach L.	Meliaceae	Nimi	Diarrhea	Human	Fresh	Oral	MK 33
Mellitia ferruginea Hochst	Fabaceae	Birbirra	Fish poison	Livestocks	Crushing	Oral	MK 54
Moringa stenopetala (Baker f.) Cufod.	Moringaceae	Shiferaw	Snake bite	Livestocks	Fresh	Oral	MK 35
Nicotina tabacum L.	Solanaceae	Tambo	Allergic	Human	Crushing	Topical	MK 37
Ocimum gratissum. L	Lamiaceae	Damakase	Common cold	Livestocks	Pounding and mix-ing with butter	Oral	MK 39
Olea capensis L.	Oleaceae	Woira	Eye infection	Human	Crushing	Topical(applied to the eye)	MK 8
Oxalis corniculata L.	Oxalidaceae	Sidisa	Urine of bat	Human	pounding	Topical	MK 45
Phytolacca dodecandra L'Hér.	Phytolacceae	Indode	Stomachache	Human	Chewing	Oral	MK 49
Podocarrpus falcatus (Thunb.) Endl.	Podocarpaceae	Birbirsa	Internal Parasite	Human	pounding	Oral	MK 59
Psidium guajava L	Myrtaceae	Zayituna	Toothache	Human	Crushing	Oral	MK 51
Ranunclus multifidus Forssk	Ranunculaceae	Misinga	Urine of bat	Livestocks	Crushing	Topical	MK 52
Rhamus prinoides L.	Rhammaceae	Geshoo	Leech	Livestocks	Pounding	Nasal	MK 76
Ricinuscommunis L.	Euphorbiaeae	Qobbo	Tuberculosis	Human	fresh	Topical	MK 73
Rosa abyssinica Lindley	Rosaceae	Goraa	Ascariasis	human	Pounding	Oral	MK 74
Rumex nepalensis Spreng	Poygonaceae	Shabee	Internal Parasites	Human	fresh	Oral	MK 71
Ruta chalepensis L.	Rutaceae	Tenadam	Toothache	Human	pounding	Oral	MK 77
Salvia nilotica Jac.	Lamiaceae	Bokkoluu	Mich	Human	fresh	Oral	MK 69
Scheffera abyssinica (Hochst. ex A.Rich.) Harm	Araliaceae	Harfatu	Toothache	Livestocks	crushing	Oral	MK 70
Senna italic Mill.	Fabaceae	Fitii	toothache	human	crushing	Oral	MK 18
Sida schimiperiana Hochst	Malvaceae	Harmella	Evil eye	Human	Smoking	Topical	MK 61
Solanum marginum L	Solanaceae	Hiddi	Stomaache	Human	Crushing	Oral	MK 66
Stephania abyssinica (Quart.-Dill. & A.Rich.) Walp.	Menisprmaceae	Galeehantutaa	Herpes	Human	Pounding	Topical	MK 64
Teclea nobilis Del	Rutaceae	Hadheesa	Trips	Human	Pounding	Oral	MK 16
Toddalia asiatica (L) Lam.	Rutaceae	Harangama	Evil eye	Human	crushing	Topical	MK 24
Trichilia dregeana Sond	Meliaceae	Anunu	Skin cancer	Human	pounding	Oral	MK 65
Trigonella foenum-gracum L	Fabaceae	Abish	Urine retention	Human	Pounding	Oral	MK 68
Urtica simensis steudel	Urticaceae	Dobbii	Gonorrhea	Human	Pounding	Topical	MK 67
Vernonia amygdalina Del.	Asteraceae	Ebicha	Cleaning stomach	Livestocks	Pounding and mixed with salt	Oral	MK 41
Vicia faba L.	Fabaceae	Baaqelaa	Stomachache	Human	crushing	Topical	MK 45
Zingiber officinale Roscoe	Zingiberaceae	Zinjibila	Common cold	Human	Crushing	Oral	MK 10

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Table 2 Contribution of medicinal plant species by each family and genera

Name of family	Number of species	%	Number of genera	%
Fabaceae	7	9	7	9
Asteraceae	5	6	5	6.5
Solanace	4	5	4	5
Rutaceae	4	5	4	5
Melaceae	3	3.8	3	3.89
Lamiaceae	3	3.8	3	3.89
11 family	2	28	10(2)	27
30 family	1	38	31	40

Habitat, Habit and Plant Parts used to Treat Various Ailments

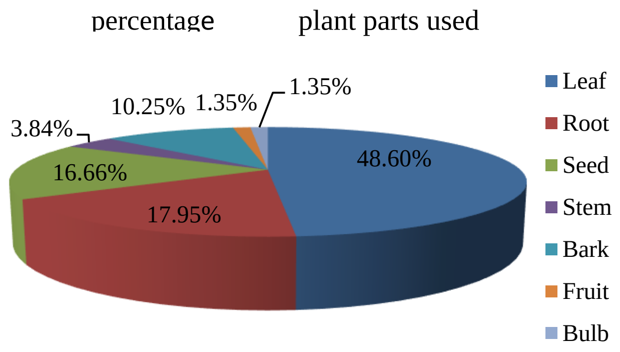

Fig. 2 Plant part(s) used for medicine

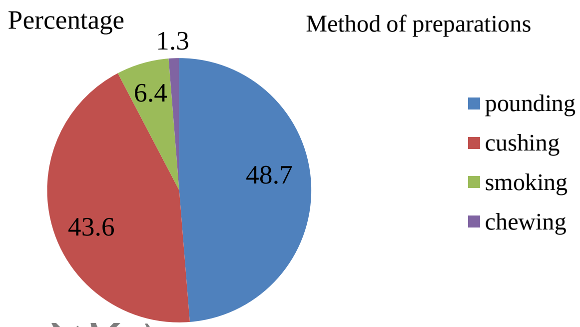

Fig. 3 Preparation method of medicinal plants

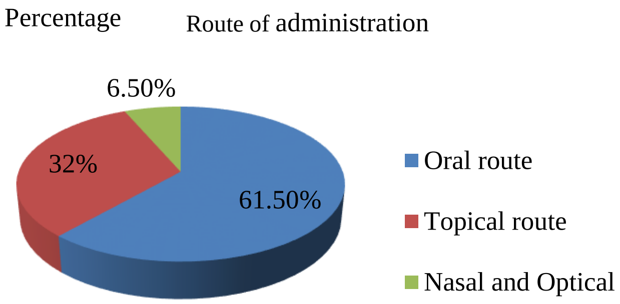

Fig. 4 Routes of administration

Ranking of Most Important Medicinal Plants

Preference Ranking

From the total 78 medicinal plants collected in the study area, the use of some medicinal plants to treat human diseases was frequently reported, while the use of others was less reported, in this perspective, ten key informants were selected out of the 26 key informants and asked to compare seven medicinal plants based on their previous knowledge and experience of medicinal plants for the treatment of stomach problems by assigning a score of ten for the most effective medicinal plants and one for the least effective medicinal plants. The degree of agreement on ranking the most preferred seven medicinal plants used in treating stomachache disease among the local medicinal plants was conducted. The result of the preference ranking indicated that *Hagenia abyssnca*, *Embelia schimper*, *Echinops kebericho* were the most preferable and widely used medicinal plants to treat stomach ache problems (Table 3).

Table 3 A paired comparison of 7 medicinal plant species used in treating stomachache as responded by 10 informants

Family	*R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	Total	Rank
Hagenia abyssnca	8	8	9	10	9	9	10	9	9	10	91	1
Embelia schimper	10	8	10	8	7	7	9	7	9	8	83	2
Echinops kebericho	8	7	6	8	6	8	10	6	8	7	74	3
Allium sativum	5	6	4	7	6	6	7	5	5	7	58	4
Brassica olevacea	4	5	5	6	7	4	5	6	7	4	53	5
Glinus lotides	8	4	5	5	6	5	4	5	4	3	45	6
Cucurbita pepo	4	3	5	3	4	4	5	4	3	2	37	7

*R=Respondent.

Direct Matrix Ranking

The people in the study area highly relied on naturally growing plant species for various purposes such as fuel wood, Furniture, charcoal, shade, construction and Edible as fruit oil, or food (Table 4). Direct matrix ranking was done to compare the multipurpose use of medicinal plants. Six multipurpose plant species commonly reported by informants were selected out of the total useful plants collected and use diversity of these plants was listed for key informants to order them by considering several attributes at a time. Each selected key informants were requested to assign use values (5 = best, 4 = very good, 3 = good, 2 = less used, 1 = least used). *Ficus sycomorus was* ranked first *multipurpose followed by Podocarpus falcatus Olea capensis ranked 3rd* as having multipurpose by the key informants.

Table 4 Direct ranking of 6 medicinal plants those having multi-purpose as responded by 10 informants

	species					
species use categories	*Calparnia aurea*	*Olea capensis*	*Mellitia ferruginea*	*Ficus sycomorus*	*Teclea nobilis*	*Podocarpus falcatus*
Fuelwood	5	5	3	4	4	5
Furniture	*3*	5	4	5	4	5
Charcoal	3	2	3	4	4	4
Shade	*3*	4	4	4	4	5
construction	3	4	4	5	1	5
Edible as fruit oil, or food	1	5	1	5	3	2
Total	18	25	19	27	20	26
Rank	5	3	6	1	4	2

Informant Consensus

Of the 78 medicinal plants collected during the study period in the study area, the use of some medicinal plants to treat human diseases was frequently reported, while the use of others was less reported. Some medicinal plants are informed by more than 17 informants; their reliability has been gained by consulting informants more than at least twice. Accordingly, *Allium sativum* is the first-ranked species, followed by *Salvia nilotica*. So some medicinal plants are more consistent (Table 5).

The medicinal plants in the study area were threatened by natural and human made factors. During the discussion with the informants, various factors were considered as main threats for medicinal plants which were recorded in

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the study area Agricultural expansion was ranked as the first threat, followed by fuel and scarcity of rain (Table 6). This was due to the high rate of population growth.

Table 5 Informant consensus of top 8 medicinal plants

Plant specie	Number of citations	% of citation	Rank
Allium sativum	42	51.2%	1
Salvia nilotica	38	46	2
Echinops kebaricho	33	40%	3
Citrus aurantifolia	26	31.7%	4
Croton macrostchus	22	26.8%	5
Carissa spinarum	20	24%	6
Dodonaea angustifolia	17	20.7	7
Lippia adoensis	18	21.9	8

Threats of Medicinal Plants and Conservation Practices in the Study Area

Table 6 Threats of the medicinal plants

Major threats	Respondents										Score	Rank
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10		
Agriculture	5	5	3	5	5	4	5	3	5	4	44	1st
Grazing	2	3	4	3	4	2	2	4	2	4	30	5th
Construction	4	4	3	5	4	4	4	4	5	4	41	2nd
Firewood	3	4	5	3	3	5	5	3	4	3	38	3rd
Charcoal	3	2	4	3	3	4	3	2	4	3	31	4th

R=Respondents

DISCUSSIONS

The study area has several medicinal plants that are used for human and animal ailments. In the current study, 78 medicinal plant species were identified. This is equivalent to the 73 medicinal plants reported in Zuway Dugda but greater than the 49 medicinal plant species in Gimbi District [23, 24]. Less than the 131 plant species reported by [25] in Ada District.

Family Fabaceae contributed the highest number of plant species 7 (9%) followed by Asteraceae which were 5 (7%) and Solanaceae 4(5%). Other studies in the country by [26] in Dera district, [27] Artuma Fursi district, [28] in Dilla Zuria Woreda [29] in Adwa district, [30] Hawasa city, [31] Ankober District, and [32], Berta ethnic group in Assosa zone showed Fabaceae as the highest rich plant family and in other countries, [33] in Pernambuco, Northeastern Brazil and [34] in Zambia. This study also agrees with the works of [35, 36]. This implies that the Fabaceae were the most common family used in medicine in our country[37]. Asteraceae is the 2nd family commonly used in the study area and other studies conducted in other parts of Ethiopia like Gechi District, Zuway Dugda District, and Gura Damole District also reported Asteraceae as a commonly used medicinal plant species [24, 38, 39].

Regarding the source of medicinal plant species, wild environments yielded more medicinal plant species than home gardens. Some traditional medicinal plants were obtained from home gardens. The study conducted in another place in Ethiopia also revealed a similar concept [40, 41]. This may be due to the secret behind the collection of the medicinal plant, which is easy to hide if it is collected from the wild habit[42].

The growth forms of medicinal plants used to treat human and livestock ailments included herbs, shrubs, and trees. A high usage of herbs could be an indication of their abundance since the area receives a relatively high amount of rain that fosters the flourishing of herbs. This result was in agreement with [26, 35, 43-45] reports that herbs were the most commonly used medicinal plants. However, some studies conducted elsewhere showed that other growth forms were the most widely used medicinal plants. The study conducted by [36] showed that trees were the dominant growth forms used to treat livestock ailments.

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The study showed that the parts of medicinal plants used to treat human and livestock ailments included leaf, root, seed, stem, bark, fruit, and bulbs. The leaf was the dominant plant part used in the present study. The use of leaves in the preparation of remedies could partly be due to the relative ease of finding these plant parts and the presence of bioactive compounds. Additionally, using leaves limits the threat of medicinal plants. Similar results were reported from other studies on medicinal plants by [46] in the Guduru district, and [26] in the Dera district that showed the leaf was the most commonly used plant part.

The local healers employed several methods of preparation of traditional medicines from plants. Pounding and crushing were the most commonly used methods of traditional medicine preparation in the study area. This result was in line with [47] and [48] in which pounding and crushing were reported as the most common methods of traditional medicine preparations.

The informants' responses from group discussions indicate that there were variations in dosages of remedies, units of measurement of remedies, duration, and time that were prescribed for the same kind of health problems. The major factors that determined the amount to be given were age, physical fitness, stage of illness, pregnancy, and the presence or absence of any disease other than the disease to be treated. This result is in line with that of [49] in Alemsaga Forest.

The major routes of administration in the study area were reported to be oral, followed by topical routes of administration in treating human and livestock ailments. This result was in line with [50] and [51]. This was due to the oral route is a simple route of administration for treating ailments.

Traditional healers of the study area use different plants for the same ailments. But, when all plants are available at the same time they prefer one over the other. *Hagenia abyssinica* and *Embelia schimper* scored the highest point and ranked first followed by *Echinops kebericho* among seven medicinal plants used for stomachache. However, the study conducted by [52] revealed that *Withania somnifera* was ranked 1st followed by *Rumex nepalensis* for the treatment of stomachache.

Direct matrix ranking was done to compare the multipurpose use of medicinal plants. *Ficus sycomorus and Podocarrpus falcatus* were ranked first and second respectively followed by *Olea capensis*es having multipurpose medicinal plants. However, the study conducted by [53], indicated that *Acacia sieberiana*, *Cordia africana*, and *Eucalyptus globulus* ranked 1st to 3rd. In addition to medicinal purposes, those plants have many uses for housing, timber production, fencing, firewood, spices and charcoal.

The medicinal plants in the study area were threatened by natural and human-made factors. Agricultural expansion was ranked to be the first threat followed by construction. This was in line with the study conducted by [26], [54] and [55], [48] and [27] in Dera district, Berbere District and Bule Hora District, Hintalo District, Artuma Fursi district, respectively, also reported agricultural expansion as a major threat to medicinal plants. This was due to high population growth necessitated land for farming.

CONCLUSION

The result of the study revealed that traditional medicinal plants are extensively used for primary healthcare treatment of various human and livestock diseases in the Ticho district. This indicating the local communities had the highest indigenous knowledge of how to use, prepare and administer the traditional medicinal plants in the study district. The study recorded 77 species of medicinal plants belonging to 45 families. In this study, Fabaceae, Asteraceae, and Solanaceae are the three families with the highest percentage of medicinal plants in the Ticho district. The majority of the medicinal plants were used to treat human ailments. The main source of the medicinal plants was from the wild and herbs constituted the largest growth form followed by shrubs. The widely used plant part was the leaf followed by the root and bark. Oral administration was the dominant route of medicinal plant administration followed by the topical route. Direct matrix ranking showed that *Ficus sycomorus and Podocarpus falcatus* were the most multipurpose medicinal plants by the local community. Medicinal plants were threatened by different human activities, hence, to prevent medicinal plant species from extinction and for sustainable use of herbal resources the concerned body should apply in-situ and ex-situ conservation strategies.

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Declarations

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Authors' contributions

MKB designed the study, collected the data, and interpreted and analyzed data. SM identified the plants. MKB, TBB and SM wrote the manuscript. TBB modified the manuscript. All authors read and approved the full manuscript.

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Declarations

Availability of Data and Materials

All data generated or analyzed during this study was included in this manuscript for publication.

Conflict of Interest

The authors declare no conflict of interest related to this paper.

Consent for Publication

The authors have agreed to submit and approved the manuscript for submission.

Ethics Approval and Consent to Participate

The study was conducted in accordance with the Declaration of Helsinki

Competing Interests

The authors declare that they have no competing interests.

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