RESEARCH PAPER

Ethnobotanical Survey of Medicinal Plants Used by Local People in Hintalo Wajerat District, Northern Ethiopia

Siraj Mammo*and Azmeru Abraha

Biology Department, College of Natural and Computational Sciences, Ambo University
Corresponding author: E-mail: sirajmammo@gmal.com

Abstract

Indigenous people of different ethnic groups in Ethiopia are enormously reliant on traditional medicinal plants to fulfilling human and livestock healthcare needs and have been used over many centuries. This study was conducted to document different types of herbal medicinal plants used and the traditional knowledge held by the local people in Hintalo Wajerat District. The techniques used in ethnobotanical data collection were semi-structured interviews, field observations, guided field walks, and group discussions with informants. A descriptive statistical method was applied to analyze and summarize the data. In the present study, a total of forty plant species representing twenty seven families were identified and documented to treat 33 human ailments. The most dominant plant part that used to prepare remedies was 22 (55%), followed by root 7(17.5%). The most common method of preparation is crushing 10 (25%) and the route of administration was oral 23 (57.5%).Euphorbiaceae was the most dominant medicinal plant family reported with 5 species. The result of the study also revealed Cordia africana as the most preferred multipurpose plant. The major factor reported as a threat to medicinal plants was deforestation (65%) followed by overgrazing by livestock (15%). This study confirmed that plants are still valued for their medicinal uses in the study area and the local community has rich indigenous knowledge of herbal medicinal plants. Since the plant species in the district are under high pressure, the concerned body should apply complementary conservation measures for sustainable use of herbal resources and to prevent species from extinction.

Keywords: Herbal medicine; Human ailments; indigenous knowledge; emedies; Traditional healers

Introduction

Ethiopia is known for its great topographical diversity which contributed to the formation of different ecosystems characterized by variations in biodiversity. The country also has flora that is extremely rich in its diversity and encompasses of more than 6000 vascular plant species with 10% endemic (Ensermu & Sebsebe, 2014, Siraj et al, 2016). Ethiopia is a country endowed with a huge potential of medicinal plants and their uses that provide a wide contribution to the treatment of human and livestock aliments practices in different regions (Gidayet al., 2003). Ethiopia has an enormous traditional knowledge of medicinal plants and has developed various ways to fight diseases through it.

Indigenous people have accumulated local knowledge on plant resource and their uses that have been developed for millennia. Medicinal plants are plants which contain inherent active components tending to relieve pain or cure disease's (Chama, 2017). Studies on survey of herbal medicinal plants are often significantly important in revealing local essential plant species particularly for the discovery of

medicines for treatment of human and animal diseases (Teklehaymanot & Giday, 2007). Traditional herbal medicine practitioner consists of knowledge systems that have developed over generations within various societies before the era of modern medicine. These, knowledge mostly transmitted orally through communities, families and individuals (Amare, 1976). Herbal medicines are used across the globe as it is dependent on locally existing and available plant resources, which are simply accessible, simple to use and affordable (Kebebew & Mohamed, 2017). The uses of plant species as herbal medicine by local communities represent by far the prime human use in terms of number of species of the natural world (Hamilton, 2003).Herbal medicine is the oldest form of health care in the world and is used in the prevention, and treatment of physical and mental illnesses (Yuan et al, 2016).

The local communities in many developing countries depend on plant based medicines even today, Moreover; the modern system of health care is mainly dependent on plant based ingredients (Srithi, 2009). According to Sofowora et al.,(2013), the majority over 90% of traditional medicine remedies/ recipes/contain medicinal plants. In developing countries, medicinal plants are used as a primary means of tackling different human and livestock diseases. Medicinal plants have vital role in the healthcare system for the majority of the rural communities in developing countries, as the major source of medicine and there is no exception for Ethiopia (Moges & Moges., 2019). In Ethiopia, about 800 species of plants are used in the traditional health care system to treat nearly 300 mental and physical disorders (Awas & Demissew, 2009, Hanshaet al., 2020). According to Mahmud and Malik, (2012), the main reasons in preferring herbal medicine to the modern one is because of easy accessibility, efficacy and affordable in getting health services. In many regions of the globe particularly in developing countries, herbal medicinal plants have not been well studied, documented or tested.

Ethnobotanical research describes the plant parts used for medicine, whether flowers, roots, leaves, branches /stem, or whole plant and how they are used(Cotton, 1996). .The concept of ethnobotanical knowledge has originated from indigenous people, which has the potential to redress some of the inadequacy of contemporary Western knowledge (Martin, 1995; Berkes, 1999).

In Ethiopia, indigenous communities of different ethnic groups have used plants as a source of medicine and have shown remarkable and effective medicinal values. In the country 80% of the population rely on about 800 species of plants in the traditional health care system, to treat about300 physical and mental disorders, and remains to be the major resource of treatment (Teklehaymanot, 2009). Moreover, it is not widely used as it could be because the skills are fragile and not written in the form of document so, it is easily forgotten and as most of the medicinal plants knowledge in the hands of people and kept as a secret (Werner, 2001). Like many of the developing countries, medicinal plants have not been well studied and documented in Ethiopia.

Herbal medical practitioners tend to hide the identity of plants used for different ailments for fear of patronage should the patient learn to cure himself. Indigenous knowledge on remedies in many countries including Ethiopia, pass from one generation to the other verbally with great secrecy(Janssen, 1981), such secrete and crude transfer makes ethnomedicinal knowledge vulnerable to distortion and in most cases, some of the lore is lost at each point of transfer(Amare, 1976). The documentation of the traditional medicinal plants used by the people for some ailments of human and domestic animals in Ethiopia is limited compared to the extent of variety of cultures and the diversity of the terrain (Teklehaymanot, 2009). Efforts that have been made so far to document the associated traditional knowledge

and conserve medicinal plants in the country are not as they should be (Giday et al, 2009). Traditionally, plants have been extremely used in many societies, and are prevalent in African communities who lived in harmony with the natural resources for centuries without bringing any detrimental effect on the survival of the biodiversity (Bussmann, 2006). However, the survival and existence of indigenous people and their long-term accumulated knowledge faces challenges because of modernization, genetic erosion of plant and animal resources, low recognition to their knowledge and varied culture, loss of biodiversity (Almaz, 2001; Bussmann, 2006). Traditional people all over the world, through their indigenous knowledge know which plant species are threatened and get priority management Aumeeruddy &Shengji, 2003). The reason behind the current loss of herbal medicinal plants in Ethiopia is due to natural and anthropogenic factors that have led to the loss of essential indigenous knowledge associated with the plants.

In different parts of Tigray, medicinal plants have been used as herbal medicine to treat different human diseases(Kidane et al., 2018) and the people who live in these areas have traditional knowledge on use of medicinal plant species. In Tigray Regional State, like other regions of Ethiopia medicinal plants have not been well studied and documented. Most of the information is still in the hands of the traditional healers (Yirga, 2010)and knowledge of healers is either lost or passed to the next generation by the word of mouth (Chama, 2017, Yirga, 2010)..Therefore, the present study was conduct to document the indigenous knowledge and medicinal plants species used by traditional healers to treat different human ailments in the study area. The study focuses in identifying the part of plant used for medicinal purposes, their mode of preparation and ingredients added, route of application and diseases treated.

Materials and methods

Description of the study area

Hintalo Wajerat District is one of the 52 districts found in Tigray Regional State, Ethiopia. And it is found in Southeast Zone of Tigray and has 22 kebeles and of which Freweyni, Gonka and Hintalokebeles were where the study was carried out. The district is found 748km and 35km far from the capital city of Ethiopia (Addis Ababa) and capital city of Tigray Regional State (Mekelle) respectively (Ruo et al., 2018).The district covers an area of 193,309 hectares with an estimated population of 181,274.The study area is bordered on the south by the Southern zone, on the west by Samre district, on the north by Enderta district, and on the east by the Afar Regional State. The district is located 50Km away from Mekelle, capital city of Tigray Regional State, to the south direction in the main road of Mekelle-Addis-Ababa (Figure.1).

The study area has an average altitude of 2425 m above sea level, The mean minimum, mean maximum and mean average monthly temperature of the District is 8.7, 26.8, 17.75C0respectively (NMSAE,2018). There is only one rainy season in Tigray, falling between the months of June and August. The amount of rainfall of the study area is variable; and on average about 634.88 mm of which more than 70 % the rainfall occurs in the month of July and August followed by a long dry season. HintaloWajerat Office of Planning and finance (2018), indicated that the total area of Hintalo Wajerat District is about 58.121 km2. The land form is a mountainous with clay soil. Majority of the local people depend on agricultural practices. The people in the study area mainly cultivate Barely, Wheat, Teff, Bean, Pea, Maize and Sorghum, and rear domestic animals.
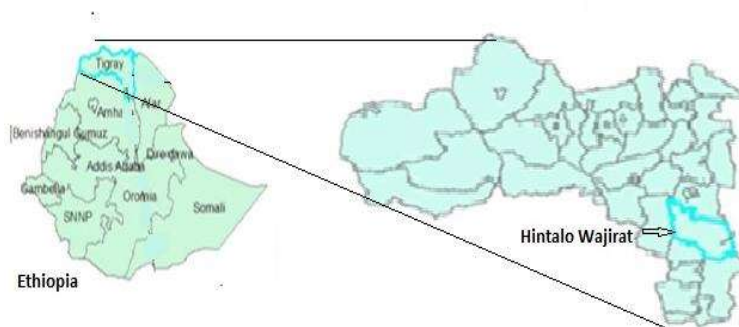
Figure 1 map of the study area Source: Taye Amssalu, 2005

Selection of study Kebeles and informants

Ethnobotanical data were collected between December, 2017 to April, 2018 from three kebeles that were purposively selected with the help of elders and local authorities of the District based on better availability of traditional healers and knowledgeable people. Based on recommendations from the elders and local authorities, 51 Informant healers were purposely selected to gather the relevant data.

Ethnobotanical data collection

A reconnaissance survey was first carried out to have an overview of the demographic, socio-economic and bio-physical conditions of the study area following Zenebe et al., (2012). The techniques employed in collecting ethnobotanical data were semi-structured interview, focus group discussion, field observation or guided field walks. These ethnobotanical techniques were employed to obtain medicinal plants of the locality, indigenous knowledge of healers, use, conservation and threats of the medicinal plants.

An interview was made with each traditional healer about the knowledge and use of medicinal plant species used to treat human aliments in the study area. Interviews were based on semi-structured checklist of topics consisting 18 questions prepared beforehand

using Tigrigna (the local language of the community). Information regarding local name of medicinal plant, part(s) used, methods of gathering and preparation, disease treated, dosage used, route of administration, ingredients added, degree of management wild/cultivated were recorded. During survey, informants asked to mention or list the kinds of plants used as traditional medicine in the study area. The number of times a particular species mentioned by each informant was recorded. Sample plants of each medicinal plant species captured using photo camera during the field visits and allotted collection numbers.

Plant identification

Voucher specimens were collected for each plant species encountered with the exception of some very common cultivated plants, which were identified on the field. The collected plant specimens were pressed properly and then dried, and identified using the published volumes of the Flora of Ethiopia and Eritrea II-VIII and by comparing with authentic herbarium specimens and finally confirmed by taxonomist in Mekele University.

Ethnobotanical data analysis

The most useful ethnobotanical information gathered from the local healers during data collection were analyzed both qualitatively and quantitatively. Ethnobotanical information collected from the semi-structured interviews and field observation was computed by

preference ranking and direct matrix ranking following Martin (1995).

Direct matrix and preference ranking

Direct matrix ranking was exercised for seven commonly reported multipurpose medicinal plants in order to assess their relative importance to local people (Martin 1995).A group of six selected key informants were asked to assign use values for six plant species, based on their perceived level of usefulness using a numerical scale from 0 to five (0 = not used, 1 = least used , 2 = less used, 3 = good, 4 = very good and 5 = best) to each use category. Use categories in the comparison include medicine, fruit, fodder, fuel wood, construction, shade and fence.

Preference ranking exercise was conducted following Martin, (1995) by seven key informants on five medicinal plants used to treat tuberculosis in the District.

Results and discussion

Socio Demographic Characteristics of Respondents

The informants interviewed were in the age class of 23 to 65, but the majority of informants' age ranged among 43 to 65. In the present study, out of 51herbal medicine practicing informants, 36 (70.6%) males and 15 (29.4%) females were involved. The majority of the healers were illiterate 40 (78.4) and at most only able to read and write (4) while few (4) attended up to standard eight and the rest 3 had completed grade 12. The maximum number of years, that the traditional healers experienced ranges from 7 to 35.

The study revealed that informants above the age of 40 years had relatively better knowledge of medicinal plants as compared to the younger ones from 23 to 40 years old. During interviews and field visits, informants above 40 years of age were found to be very conversant on how to collect plants and process them. Besides, older informants had stronger belief in the curative effect of the medicinal plants as compared to the younger generation on medicinal plants reported and diseases treated.

The analysis of comparison of educational status revealed that, illiterate informants possessed much knowledge of traditional medicine than educated informants, which is an indicative of impact of modern education. This is in line with the study made by Oladele et al., 2011, which states, the highest percentage of younger generation had less knowledge of herbal medicine practice as they more exposed to modern education and life style. This may shows the impact of modernization on medicinal plant use and transfer of the associated knowledge to the younger generation.

Source of healing knowledge

The local people of the study area had traditionally accumulated knowledge on the use of traditional medicinal plants. According to the survey, knowledge transfer of medicinal plants follows vertical transfer to the most selected family members orally with great secrecy. The results of the interview revealed that majority of the informants obtained their knowledge of herbal medicine along the family line verbally, which accounts 30 (58.8%), followed by religious institutions 13(25.5%), by trial and error 6 (11.8%) and friends 2 (4%) (Table 1).This study is in line with a study of Reta, (2013), in which family were cited as source of knowledge. The majority of the informants 58.8% were willing to transfer their knowledge of herbal medicine along the family line verbally, while, other informants reported that they had no interest to transfer their knowledge at all.

Table 1.Source of healing knowledge in the study area

Source	Frequency	Percent (%)
Family	30	58.8
Religion	13	25.5
Trial and error	6	11.8
Friends	2	4

There are various ways of looking at the use of traditional medication and the interrelationships among humans. According to Melese (2001), plants are the major source of livelihood for the rural people of developing countries meaning that, no-plants-no-life. The informants from the local community stated that¸ indigenous knowledge about plants use has been a matter of survival to them, which agree with a report by Grenier, (1998). The knowledge is stored in indigenous social daily values that govern their being.

In the district the knowledge or information on the medicinal plants, was found in unwritten form and is considered as a secret. The result also revealed that members of the healers belonging to the age group above 40 years reported many medicinal plants while, those belonging to the age group between 23 and 40 years reported few medicinal plants. The result of this study showed that as people become older, their knowledge of traditional medicine becomes better. This is in line with a report of Giday, (2010) and Birhanu et al, (2015), which stated medicinal plant knowledge increases as age increases due to accumulation of knowledge through experience.

Medicinal plant species with their diversity and category

A total of 40 medicinal plant species belong to 27 families were collected and identified for treating 33 human ailments. Analysis of growth forms of these medicinal plants reveals that herbs constitute the largest category. The analysis of growth forms revealed that, herbs were represented by 14 species (35%), followed by trees and shrubs each represented by 12 (30%) and climbers were represented by 2 species (5%)(Figure2). Similar to this finding, a relatively higher number of herbs were previously reported elsewhere in Ethiopia; western Ethiopia (Debela, 2001; Tizazu, 2005;Amberberet al., 2014).The record of the highest number of herbs medicinal plant species in the study may be due to their relative abundance and accessibility in nearby areas as compared to other life forms.
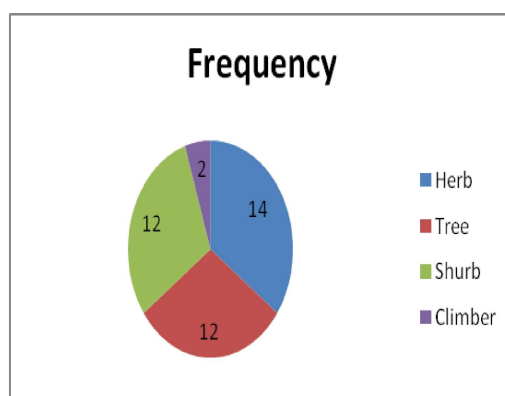

Figure 2.Habit of medicinal plants

In terms of family distribution in study area, Euphorbiaceae was the most dominant medicinal plant family reported with 5(12.5%)

species, followed by Solanaceae, Fabaaceae and Lamiaceae each with 3(7.5 %)species, Rutaceae, Polygonaceae and Moraceae 2(5%) species where as, the other remaining families were mono type species. Euphorbiaceae was also reported by other authors as the most dominantly used plant species to treated diseases (Jima &Megersa, 2018; Yinegeret al., 2008). This finding contradicts the results of other studies that were conducted in different parts of Ethiopia(Gebre, 2005; Gidayet al, 2009; Teklehaymanot et al., 2009; Gebrezgabiheret al., 2013;Birhanuet al, 2015). Majority of the medicinal plants 85% in Hintalo-Wajerat District were harvested from the wild. This result is in line with that of other studies reported elsewhere in Ethiopia (Giday & Ameni, 2003; Giday, 2001;Yinegeret al., 2008, Bekaloet al.,2009, Yirga, 2010).

Diseases treated by using traditional medicine

In the studyarea different ailments were recorded (Table 2). The indigenous communities were using traditional medicine to treat 33 human diseases. The local healers of the study area reported thatEucalyptus globules Lab ill,Verbena officinalisL, Rutachalepensis L, RumexnervosusVahl,Silenemacrosolen

Steud. ex A. Rich were the most usable plant species.

Parts of medicinal plant used to treat human aliments

The plant parts used widely to treat human include leaves, roots, seeds, bark, fruits stems, and exudates (Figure 3). Leaves and root were the most commonly used plant parts in the preparation of remedies in the study District. The local healers of the study area mainly used leaves to prepare remedies20 (50%), followed by root 8(20%), seeds 3 (7.5%), bark, 2(5%), fruit3 (7.5%), stem 2 (5%), exudates2 (5%)(Figure 3).Many communities elsewhere in Ethiopia predominantly use leaves in the preparation of remedies, more frequently as compared to other parts of plants and this finding is in line with other studies made in elsewhere by (Abera, 2003; Giday &Ameni, 2003; Wassihun et al., 2003; Kala, 2005; Tadesse et al., 2005; Teshome, 2005; Ignacimuthu et al., 2006; Getaneh and Girma, 2014; Regassa et al., 2017). However, the findings of Hunde et al., 2006 and Teklehaymanot &Giday, (2007).indicated that traditional medicinal preparations mainly involve the use of roots.

Table 2.List of medicinal plants used to treat human diseases

Scientific name	Local name	Family	Habit	Source	Condition	Parts	Disease	Route of Administration	Method of preparation
Acacia etbaicaSchweinf.	Seraw	Fabaceae	T	W	Fr	S	Haemorrhoids	D	burn and place it on the affected part
Croton macrostachyusHochst. ex Delile	Tmbako	Euphorbiaceae	T	W	Dr/Fr	L	Rabies	O	leaves are crushed /squeezed and a cup of juice taken with honey
AchyranthesasperaL.	Mochale	Amaranthaceae	H	W	Fr	L	Tonsillitis	D	squeeze & put in head of child
Allium sativumRoscoe	Tsaedashngurti	Alliaceae	H	Cu	Fr	Se	cough	O	chew and swallow
Aloe megalacanthaBark	Ere	Aloaceae	Sh	W	Fr	Ex	Malaria	O	exudates, mixed with honey, is taken orally with coffee cup for three days
AlysicarpusferrugineusHochst. &Steud. ex A. Rich.	Hambohambo	Fabaceae	H	W	Fr	R	Jaundice	O	Exudates smeared on woundchew for five days
Azadirachtaindica A. Juss.	Limo	Melliaceae	T	W	Fr	L	Malaria	O	crush leaves, filter and drunk the juice
Beciumgrandiflorum (Lam.) Pic.Serm.	Tebeb	Lamiaceae	Sh	W	Fr	R	Black spider bite/Fire burn	O & D	chew and swallow the fluid
BosciasalicifoliaOliv	Sasa	Capparidaceae	Sh	W	Fr	L	Ear infection	E	leaves are crushed, squeezed and liquid filtered with clean cotton and three drops are applied on infected ear
Calotropisprocera (Aiton) W.T. Aiton	Gindae	Apocynaceae	Sh	W	Fr	L	Wound	D	crush and squeeze, rub affected part
ChenopodiummuraleL	HamliKib'o	Chenopodiaceous	H	W	Fr	L	Dandruff	D	squeeze & cover affected area
Citrus sinesis (L.) Osbeck	Woyni	Rutaceae	Sh	Cu	Fr	F	Diabetes	O	juicing and drink
Commicarpuspedunculosus (A. Rich.) Cufod.	Eznianchewa	Nyctaginaceae	H	W	Fr	L	Leshimaniasis	D	squeeze and rub affected part
CordiaafricanaLam.	Awhi	Boragenaceae	T	W	Fr	L	Febrile illness	O	leaves are crushed, squeezed and liquid taken with coffee
CucumisficifoliusRich	Romborambo	Cucurbitaceae	C	W	Fr	R	Toothache and vomiting	O	Chew part with the diseased teeth and drink the fluid

Scientific name	Local name	Family	Habit	W/Cu	Fr/Dr	Part	Disease	Route	Preparation/usage
Daturastramonium L.	Mestenagr	Solanaceae	H	W	Fr	L	Tetanus	D	leaves are crushed, mixed with butter, heated and smeared on affected area before covering it with clean cotton cloth
Dodoniaangustifolia.Lf.	Tahses	Sapindaceae	T	W	Fr	L	Herpes zoster/ almazbalachira	D	burn, powder, add fresh butter then rub affected part
Dovyalisabyssinica A. Rich.) Warb.	Mengolhats	Flacourticeae	Sh	W	Fr	F	Abdominal pain	O	chew and swallow the fluid
Eucalyptus globulusLabill f	Tsaedabaharza	Myrtaceae	T	Cu	Dr/Fr	L	Body infection	D	Heating & rash the skin
Euphorbia candelabrum Trémaux ex Kotschy	Kolkal	Euphorbiaceae	T	W	Fr	Ex	Tuberculosis	O	drinking the liquid
Euphorbia tirucallii L.	Kinchib	Euphorbiaceae	Sh	W	Fr	L	Wart	D	cut(bleeding) rub the affected part
Ficuspalmata.Forssk.	Beles	Moraceae	T	W	Fr	L	Haemorrhoids	D	crash & rub affected part
Ficusvasta.Forssk.	Daero	Moraceae	T	W	Fr	Ba	Ascariasis	O	crush and drink it with honey
Linumusitatissimum L.	Entatie/telba	Linaceae	H	Cu	Dr	Se	Placental retention	O	seeds roasted on iron sheet and grinding into powder, then cooked in the presence of honey and taken for a month before delivery
Meriandradianthera Roth. ex. Roem. &Schult.)Briq.	Mesaguh	Lamiaceae	T	W	Fr	L	Blood pressure	O	leaves are boiled in water and solution taken daily for a month by cup of tea until improvement
Otostegiaintegrifólia Benth	Chiendog	Lamiaceae	Sh	W	Dr	L	Insecticide &Fleas	N	smoke for insictscide and a bunch of branch was burned and fumigated the room for 3–5 consecutive hours for Fleas
Phytolaccadodecandra L' Herit	Shebti	Pytolaceae	Sh	W	Dr	L F R	Rabies, Abortion, Itchy, abdominal pain	O	Dried root of the plant is powdered and mixed with local alcohol and a cup of solution drunk daily for twelve days. vomiting is its side effect and ,therefore ,restricted to children and pregnant women
RicinusCommunisL.	Engule	Euphorbiaceae	Sh	W	Dr	F	Amoebiasis	O	crushed seeds are mixed with water and taken with a cup of tea once
Rumexabyssinicus Jacq.	Mekmako	Polygonaceae	H	W	Dr	R	Tuberculosis	O	chewing the root
Rumexnervosus Vahl.	Hahot	Polygonaceae	Sh	W	Fr	L	Skin rash	D	leaves are crushed and paste rubbed on affected area
Rutachalepensis L.	Chena adam	Rutaceae	H	Cu	Fr	L	Cough	O	leaves boiled in milk are taken orally
Silenemacrosolen.Steu	Saerisaero	Caryophyllaceae	H	W	Dr	L	Snake repulsion	N	Place it on fire for fumigation smoking

Ex A. Rich									
Solanummarginatum Lin n. f.	Engule(abyi)	Solanaceae	Sh	W	Dr	Se	Tuberculosis	O	dried, crushed and added into milk or coffee and solution taken every morning for 21 days
SolanummariginatumL.f.	Alalmokelbi	Solanaceae	H	W	Fr	L	Hepatitis	O	squeeze and drink the liquid
Terminaliabrownie**Frese n.**	weyni	Combretaceae	T	W	Fr	Ba	Hepatitis	O	bark is boiled then drinking the decoction
Tragiacinerea (Pax) Gilbert &Radcl. Smith	Shashito	Euphorbiaceae	C	W	Dr	R	Impotence	O	roots are grounded and taken orally with local soup for week
Verbascumsinaiticum B enth.	Terneka	Scrophulariaceae	H	W	Fr	R	Tuberculosis	O	squeeze add butter/milk
Verbena officinalisL.	Atush	Verbenaceae	H	W	Fr	R	Tonsillitis	O	chew & swallow fluid
Vernoniaamygdalina Del.	Grawa	Asteraceae	T	W	Fr	L	Leg problem	D	leaf squeezed & rash the skin
ViciafabaL.	Ater	Fabaceae	H	Cu	Dr	Se	wound	D	powder & cover affected area for 5-7 consecutive days at the interval of one day

Notice H=herb, Sh=Shurb,T=Tree, O=Oral, D= Dermal,N= Nasal, E=Ear= Dr=dry, Fr- fresh,Cu= cultivated, W=Wild, Se= seed, L=leaf, Fruit, Ba=bark, ex=exudates, R=root=,S=stem

Preparation and mode of administration of remedies

The result of the study indicated that, the majority of medicinal plants were used in fresh form 29 (72.5%), followed by 9 (22.5%) dried form and 2 (5.0%) fresh or dry (table 3). This indicates that local community can pick the plant part any time of the year from their vicinity. Similar finding were reported elsewhere (Giday et al., 2003; Giday and Ameni, 2003; Bussmann& Sharon, 2006; Ignacimuthu et al., 2006).
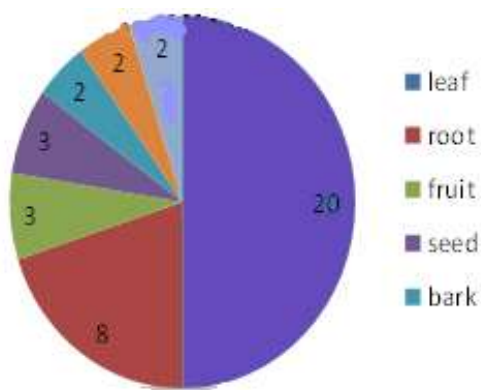

Figure 3. Parts of medicinal plants used

Table 3. Condition of preparation of the remedies

Plant condition	Percentage
Fresh	72.5
Dry	22.5
Fresh or Dry	5

The most widely used methods of medicinal plant preparation were through crushing, 10(25%), squeezing, 9 (22.5%), chewing, 5 (12.5%),powder, 4(10%) burning, 4 (10%), boiling,3 (7.5%),smoking, juicing and bleeding each2 (5%) (Fig.4).Similar results were also reported elsewhere (Tamene, 2000; Fisseha, 2007). Most of the medicinal plants used to treat ailments were mixed with other ingredients. The other ingredients were used to increase

medicinal value of the remedies, reduce adverse effects such as vomiting and diarrhea, and enhance the efficacy and healing condition. The most commonly used additive by the healers was water, milk, butter, honey, coffee and tea. Informants of the study area reported that, some of medicinal plants need additional ingredients for aliment. The informants reported that, among 40 traditional medicinal plants 14 medicinal plants needs ingredients like, honey, coffee, water, butter, milk and among them, 2 (14.28%) are prepared with milk, 2 (14.28%) with butter, 2 (14.28%) with coffee, 2 (14.28%) with water, 4 (28.57%) with honey,1 (7.14%) local alcohol and 1 (7.14%) milk/ coffee. Most of the medicine prepared and mixed with ingredients administrated by oral 12 (85.71%) and 2 (14.29%) dermal.

Ethnobotanical studies conducted in different parts of the country reported similar results (Abdurrahman, 2010;Teshome, 2005; Getaneh & Girma, 2014).
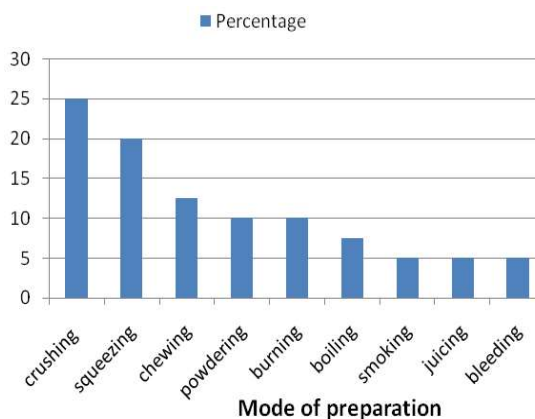

Figure 4.Traditional medicinal plant preparation in the study

The most frequently used route of administration is oral ingestion, which accounts for 23 (57.5%) followed by dermal 13 (32.5%) (Table 4).The oral route was most frequently used amd reported in many studies elsewhere (Giday et al., 2003; Macíaet al.,2005; Bekalo et al.,2009), This result is contrary to the study made by Teklay et al., (2013), in which dermal route of administration is the most frequently used.

Table: 4.Route of administration of traditional medicinal plants

Administration	Number of species	Percentage
Oral	23	57.5
Dermal	13	32.5
Nasal	2	5
Ear	1	2.5
Oral / dermal	1	2.5

Dosage and measurements of medicinal plants

Traditional medicinal plant practitioners of the study area used different measurement unit and duration to determine the dosage of medicine. Local units for instance, half cup, and full cup, finger length for bark, root and stem are used (table 5). Numbers of different parts of plants such as leaves, seeds, and fruits, shoot tip also used to estimate and fix the amount of dosage. The full dose determination varied from healer to healer, and the dose given depends on age, physical strength and health conditions. This finding indicated lack of precision and standardization as the main drawback for recognition of the traditional practice and it is line with the study made by (Sofowora, 1982; Abebe, 1993, Yirga, 2010).

Table 5.Common units of measurements of dosage used by local healers

Prepared remedies	Units (measurements)
Root	Finger length
Seed	Number
Leaf	Number
Powder	Tea spoon
Liquid	Cup

Direct matrix and preference ranking

Direct matrix ranking was performed (Table 4) following the method of Martin, (1995) to medicinal plant species for their multipurpose use and to relate this to the extent of its utilization versus its dominance.

Result of direct matrix ranking conducted by nine key informants on six selected multipurpose medicinal plants showed that *Cordia africana* as the most preferred multipurpose plant, followed by *Eucalyptus globules, Dodonia angustifolia. Lf., Croton macrostachyus Hochst.exDelileand Vernonia amygdalinaDel* (Table 6). Showing multipurpose roles and the most preferred and extensively exploited by the local community.

Similar studies were carried out elsewhere in other parts of Ethiopia like in GantaAfeshum District, Eastern Zone of Tigray, Northern Ethiopia (Kidane et al., 2018) and Goma Wereda, Jima Zone of Oromia Region, Ethiopia, by (Etana, 2010) in which both used the method of direct matrix ranking and revealed that *Cordia africana* was the most preferred and first ranked multipurpose plant species.

Informants' preference on medicinal plants used to treat tuberculosis

The informants' simple preference ranking for 5 medicinal plants that was used to treat Tuberculosis in Hintalo Wajerat District is shown in (Table 7). The result of ranking indicated that Verbascumsinaiticum Benth scored the highest mark and subsequently it was graded first, where as Euphorbia candelabrum Trémaux ex Kotschy, Solanum marginatum Linn. f., Rumex abyssinicusJacq.,RicinusCommunisL. scored second to the fifth rank, respectively, for the efficient treatment of tuberculosis.

Table 6. Direct matrix ranking exercise on five multiple purpose medicinal plants

Species use categories	Cordia africanaLam.	Croton macrostachyusHochst.ex.Delile	Eucalyptus globules Labill	Acacia etbaica Schweinf.	Vernonia Amygdalina Del.	Dodonia angustifolia. Lf.
Charcoal	3	5	1	5	3	4
Fuel wood	5	4	5	4	4	5
Construction	4	4	5	3	4	4
Medicine	3	4	5	3	4	4
Shade	5	2	5	4	2	3
Edible Fruit/food	5	0	0	0	0	0
Furinture	4	4	4	2		4
Total	29	23	25	21	17	24
Rank	1st	4th	2nd	5th	6th	3rd

Table 7. Preference ranking by seven respondents to medicinal plants used for treating tuberculosis in Hintalo Wajerat District,Tigray,Northen Ethiopia

Lists of medicinal plants	Informants								
	R1	R2	R3	R4	R5	R6	R7	Total	Rank
Solanummarginatum Linn. f.	5	3	4	4	3	4	5	28	3rd
Verbascumsinaiticum Benth.	5	6	5	5	4	4	5	34	1st
Rumex abyssinicusJacq.	4	3	4	4	3	3	5	26	4th
Euphorbia candelabrum Trémaux ex Kotschy	3	4	4	4	5	5	5	30	2nd
RicinusCommunisL.	4	2	4	4	4	3	4	25	5th

Threats of medicinal plants and conservation practices in the study area

Medicinal plants are at increasing threat from destruction of their habitats (firewood collection, agricultural activities, collecting plants for construction, urbanization, overgrazing by domestic animals) and over-harvesting. Like other parts of Ethiopia, the vegetation of the study area is threatened by several factors. In HintaloWajerat District various factors were considered as main threats for medicinal plants which were recorded during the discussion with the informants. Accordingly, the major factors reported were deforestation (65%), overgrazing (15%), for construction (13%) and source of fuel (7%). Informants frequently cited deforestation became as the most threatening factor on medicinal plants and this is line report made by other researchers Giday, (2001) and Mesfin et al., (2009).

People of the study area know the benefits of conserving medicinal plants. However, the effort of conserving medicinal plants is very restricted. This study revealed that many of the informants who have knowledge on traditional medicine usage give priority to the immediate use of the medicinal plants than to its sustainable future uses, as a result, their harvesting style is destructive. Most of plant species reported in the study area 34 (85%) were collected from the wild while, the remaining part, 6(15%) were collected from the home garden. The result of this finding is in line with the general patterns seen in most medicinal plants inventory studies such as that of Tamene, (2000) and Abera, (2014). It was found that only6(15%) of the medicinal plant species were obtained from the homegarden, this shows most of the herbalists are not ready to grow medicinal plants in their home garden for future sustainable use, this is in agreement with other studies conducted elsewhere in the country Abdurhman, (2010), Giday et al., (2003) and Yineger et al., (2008).

Conclusion

The traditional health care practice of the local community in the study area is mainly dependent on medicinal plants collected from the wild. Plant species are the potential sources of medicine in primary healthcare systems of the local community in Hintalo Wajerat district. In the present study, forty plant species of medicinal importance, used to treat thirty three human diseases were recorded and documented. This study also showed that plants are still valued for their medicinal purposes in study area.

The majority of Medicinal plants are applied orally via drinking its juice, eating its root, barks, stem, leaf, seed, fruit, where as others used dermal by applying on the affected part of human body. Each plant and plant part has its own preparation method and route of administration. The most common method of preparation is crushing 10 (25%) and the route of administration was oral 23 (57.5%). It is possible to conclude that older traditional healers had greater knowledge and use of ethnomedicinal plant species compared to the younger traditional healers. Medicinal plants were suffering from the threats of deforestation, overgrazing by livestock, collection of plant material for firewood and construction. Despite this fact, there is little effort in the District to cultivate or mange medicinal plants. Thus awareness is needed be raised among local people on sustainable utilization and management of the plant resources.

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Conflict of interest

The authors declare no conflict of interest related to this paper

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