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Ethnobotanical survey of medicinal plants used in treating human and livestock health problems in Mandura Woreda of Benishangul Gumuz, Ethiopia

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ABSTRACT

Traditional uses of medicinal plants developed in different cultural and ethnic people throughout the world. Understanding how to use these medicinal plants and treatment of health problems is crucial for advancement of modern preventive and curative system of ailments. Thus, the present ethnobotanical survey was conducted to investigate the indigenous uses of medicinal plants for the treatment of human and livestock health problems. This is because of lack of scientific investigation on indigenous knowledge associated with medicinal plants in the study area. A total of 108 households from six administrative units (Kebeles) of which 25 key informants were selected systematically and other informants were sampled randomly in transect walk. An ethnobotanical data was collected using open and closed semi structured interview and all medicinal plants were collected in the natural habitats and homegardens. An ethnobotanical data were analyzed using R-software package to determine knowledge variation among social groups using analysis of variance. Informant consensus factor, paired comparison and folk taxonomy were also used as analytical tools to understand perception of local people on medicinal plants. A total of 60 medicinal plants distributed in 29 families were identified and recorded of which Asteraceae (10.0%) accounted first followed by Fabaceae (8.3%). Combretaceae, Euphorbiaceae and Lamiaceae (6.7%) were equally dominated in the area. Out of these, 83.3% of plants have ethnomedicinal uses of treating human ailments while the rest were used to treat both human and livestock. These medicinal plants were used to treat a total of 48 ailments. Major consumption parts for medicinal uses were roots (39%) followed by leaves (21.4%) and frequently prepared in fresh form (72%). Remedy preparations were mainly crushing and squeezing (33.3%), maceration (15.8%) and diluting (13.2%) in single forms administrated orally (80.2%) and externally (19.8%). In conclusion, local communities of the study area have potentially promising medicinal plants for the treatment of health problems. Thus, it is advisable that uses of ethnomedicinal plants should be confirmed conducting experimental and phytochemical studies to maximize the safety and effectiveness of these plants and witness to develop modern drug development.

Keywords: Ethnobotany, health problems, human, livestock, medicinal plants, treatments.

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INTRODUCTION

Ethiopia has a long history on the use of traditional medicine to combat diseases (Pankhurst, 1965). The ways are also as diverse as the different cultures existing in the country. Traditional medicine healing practice is not only concerned with curing of diseases but also with the protection and promotion of human physical, spiritual, social, mental and material wellbeing (Bishaw, 1991). The various traditional forms of therapy had been the only health care system available before introduction of biomedicine to the country in the early 1900s. The country's diverse medical traditions comprise a wide range of therapies including inoculation, thermal baths, cauterization, counter-irritation, bleeding, bone-setting, surgery, a range of spiritual and medico-religious treatments as well as the use of a wide variety of both animal and plant-derived remedies (OSSREA, 2002).

Traditional uses of medicinal plants developed in different cultural and ethnic people throughout the world (Cotton, 1996). However, the utilization and management of plants vary from culture to culture. Understanding how to use these medicinal plants for treatment of health problems is crucial for advancement of modern preventive and curative systems (Heinrich and Gibbons, 2001). Medicinal plants and knowledge of their uses provide a vital contribution to human and livestock health care needs since time immoral. More than 95% of traditional medical preparations in Ethiopia are of plant origin (Abebe, 1986). Long term study on the compilation of flora of Ethiopia accounts more than 6,000 species of higher plants, of which 10% are endemic to country level (Gebre Egziabher, 1991). Diverse geographic, climatic and edaphic factors favored the formation of different habitat and vegetation zones that medicinal plants are also components of these zones. The importance of medicinal plants to treat human and livestock ailments in most parts of Ethiopia has been stated by various studies (Asfaw, 2001; Sori et al., 2004; Giday et al., 2007; Tekelehaymanot and Giday, 2007; Yineger and Yewhalaw, 2007; Lulekal et al., 2008). Traditional medicine remains the main resource for a large majority of the people in the country for treating health problems. It also provides traditional medical consultancy including the consumption of the medicinal plants which has a much lower cost than modern medical attention (Getachew et al., 2001).

The country is also home to a diverse mix of ethnic, cultural and linguistic groups. This diverse combination of social and cultural backgrounds contributed much to the existence of rich indigenous knowledge, including managing and using medicinal plants against human and livestock ailments (Assefa et al., 2010). Like other communities of Ethiopia, people who live in Mandura Woreda have indigenous knowledge that developed through practice of medicinal plants to treat health problems. Though practicing of health care through medicinal plant uses take long time, exploration and analysis of this knowledge is still intact for in depth study. Therefore, this ethnobotanical survey was conducted in depth study for the first time to document indigenous knowledge of medicinal plants and analysis of ethnomedicinal uses in the local communities of Mandura Woreda of Ethiopia.

MATERIALS AND METHOD

Description of study area

The focus of study area was in ManduraWoreda that ranges the coordinates of 11°10'0" N to 10°50'0" N and 36°10'0" E to 36°30'0"E (Figure 1).

People, population and livelihood systems

The major ethnic groups of the area are Gumuz people. According to Central Statistical Agency of Ethiopia (CSA, 2007, unpublished), 40,746 peoples whom 21,241 male and 19,505 female are inhabitants in rural and urban area of woreda. The conventional (residents living in the same housing unit and have common cooking arrangements like eat their food together) and unconventional households (residents of collective quarters such as hotel/hostel and other collective quarters and homeless) of the woreda are also 9,463 and 39, respectively. People mainly depend on shifting cultivation, wild plant collection and consumption.

Climate and vegetation structure

The average rain fall of the region (more or less unimodal from April to October, sometimes with small peaks in January to February) is 1200 mm in the area around Assosa and reduced towards north and west to about 800 mm. The mean annual temperature varies from 20 to 35°C and the variation is as elsewhere, strongly correlated with latitude. Vegetation of western Ethiopia particularly Benshangul Gumuz Regional State is still nearly intact and has comparable vascular plant diversity to other floristic regions in Ethiopia. It has been characterized as separate vegetation and named undifferentiated woodland (Ethiopian Type) and characterized by broadleaved deciduous leaves. It has been interesting and partly unique flora and least botanically explored region (Demissew et al., 2005).

Research design and sampling methods

An ethnobotanical survey was conducted from May 2013 to June 2014 in three design phases. The reconnaissance survey was carried out during wet season and seventeen medicinal plants recorded. Medicinal plants collection in the field was gathered in the autumn with little rain available in the area and group discussions were organized after all data recorded.

Sampling method was chosen purposive method approach to select sample sites (six kebeles) in the woreda. A total of 108 informants with the ages of above 20 years of which 25 key informants were selected systematically based on their experience and recognition as expert (Martin, 1995) and others were randomly selected. Group discussion was performed with kebeles of having key informants about 5 to 10 peoples in the sample area for the management of data generated by informants.

Data collection, analytical tool and identification methods

Ethnobotanical data were collected using open and closed semi-structured interview in their local language usually in a particular order. Paired comparison was shown to informants to understand the people perception on the efficacy of medicinal plants in the interviews that have been arranged in the sets of two and calculated by n (n-1)/2 where ‘n’ is number of medicinal plants (Martin, 1995). Field working was carried out to collect medicinal plants in the natural habitats and homegardens. Identification and nomenclature of plant specimens were performed based on flora of Ethiopia and Eritrea (Hedberg and Edwards, 1989; Hedberg and Edwards, 1995; Edwards et al., 1995; Edwards et al., 1997; Edwards et al., 2000; Hedberg et al., 2003; Hedberg et al., 2004; Hedberg et al., 2006) and deposited in the Biology Department, Assosa University.

Data analysis methods

Ethnobotanical data were analyzed using R-software packages and demonstrated in tables, graphs and charts. Knowledge variation among different social groups was calculated using analysis of

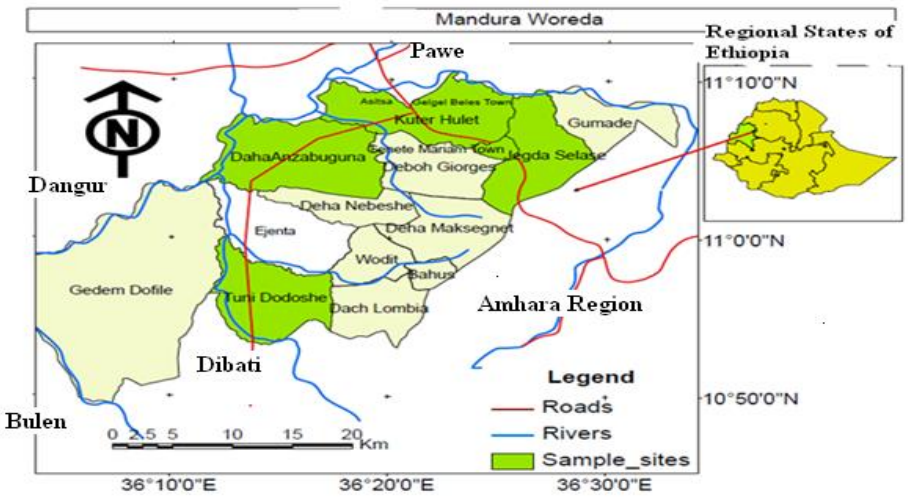

Figure 1. Map of study area.

variance (ANOVA) in R-software packages. The homogeneity of information was calculated by Informant Consensus Factors from eleven disease categories identified based on symptoms and causes of disease. It was calculated following Trotter and Logan (1986) as:

$$ICF = \frac{Nur - Nt}{Nur - 1}$$

Where,
Nur: is the number of use reports from informants for a particular plant-usage category and
Nt: is the number of species that are used for that plant usage category for all informants. Values range between 0 and 1, where ‘‘1’’ indicates the highest level of informant consensus.

RESULTS AND DISCUSSION

Ethnobotanical knowledge in various social groups

Ethnobotanical knowledge among different social groups reflected the knowledge status in the present and indicates future trends. Informants’ age ranges with minimum, average and maximum 21, 52 and 83, respectively. The analysis of using Pearson correlation coefficient (r) = 0.048 demonstrated positively correlated ethnobotanical knowledge with ages of informants. However, the statistical test of significance (alpha = 0.05, *P value* = 0.073) indicated that it was weak positive correlation. Recent study also suggested similarly that in their outcome as positively relationship (r = 0.18) between age of informant and ethnobotanical knowledge. This pointed out ethnobotanical knowledge slightly decline in young people due to uses of modern health care systems as Table 1 shows evidences. Analysis of variance on informants knowledge on the listing of medicinal plants showed that there was no significant variation (alpha = 0.05) between healers and other informants. However, the mean variation on listing of medicinal plants was observed between healers (n = 25, Mean = 7.20 ± 2.9) and other informants (n = 83, Mean = 2.68 ± 1.47). Scientific support in other investigators of Ethiopia also demonstrated that they have no significance variation of knowledge between key and other informant group. It was confirmed from present investigation that indigenous knowledge on medicinal plants was distributed among informants.

The gender participated in the survey are 36.1% female and 63.9% male. The analysis of variance demonstrated that difference was observed on the ethnobotanical knowledge between; male, n = 69, mean = 4.02 ± 2.8 and females (n = 39, mean = 3.2 ± 1.7) at alpha = 0.05 because of unequal distribution of knowledge. Similar results reflected in gender comparison of males and females, females were better at identifying medicinal plant species than males (Luitel et al., 2014). Some studies indicated that males reported more number of medicinal plants than females.

Diversity of medicinal plants and ethnomedicinal uses

The totals of sixty medicinal plants (Table 2) were discovered of which Asteraceae (10.0%), Fabaceae (8.3%) and Combretaceae, Euphorbiaceae and Lamiaceae (6.7% each) were widely used medicinal plants. The fact of the largest diverse uses of these families was due to the efficacy of medicinal uses. Similar to other studies carried out different parts of Ethiopia accounted that these families were reported to have the largest number of plant species used for medicinal purposes (Belayneh and Bussa, 2014). In the current investigation, most ethnomedicinal plant species

Table 1. ANOVA on listing of medicinal plants in different social groups.

Factors	Df	Sum Sq	Mean Sq	F value	Pr(>F)
As.factor (gender)	1	16.9	16.9	6.373	0.0131*
As.factor (informants-healers and others)	1	379.7	379.7	143.089	<2e-16***
As.factor (education)	8	43.6	5.46	2.177	0.047016 *
Residuals	105	278.6	2.7		
Signif. Codes: 0	'***' 0.001 '**'0.01 '*'0.05 ' .' 0.1 ' '1				

Table 2. List of medicinal plants and their ethno medicinal uses including other uses.

No.	Scientific name, family and voucher no.	Local name (Gumuz or Amh)	Parts used	Usf	Ailments treated	Ra	Cp	Preparation, application and dosage	Others uses/effects
1	*Abelmoschus esculenta* (L.) Moench. (Malvaceae) GMR-11	Endeha	Fruit	Hu	Gastritis	Oral	Dried or fresh	Crushed, cooked with wot and eaten with injera (cooking)	Edible fruits
			Fruit	Hu	Loss of appetites	Oral	Fresh	Ripen fruits are eaten directly (chewing)	
2	*Albizia malacophylla* (A. Rich.) Walp. (Fabaceae) GMR-38	Asshua	Stem bark	Hu	Trachoma	Eye	Fresh	Stem bark is crushed, soaked in water and washing the eye (maceration)	Firewood, charcoal, construction
			Root	Hu	Sunstroke	Oral	Fresh	Root is crushed, squeezed with water and one cup is taken (crushing and squeezing)	
			Leaf	Chik	Coccidosis	Oral	Fresh	Leaves are crushed, squeezed with water and given to drink (crushing and squeezing)	
3	*Amaranthus hydridus* L. (Amaranthaceae)	Ekechechilie	Whole plant	Hu	Aneuemia	Oral	Fresh	Whole parts are crushed, cooked in wot and eaten (cooking)	Edible leafy vegetable
4	*Ampelocissus schimperiana* (Hochst. ex A. Rich.) Planch. (Vitaceae) GMR-34	Antsigna	Root	Hu	Boils	Skin	Fresh	Roots are crushed, mixed with butter and creamed on wound (creaming)	Edible parts of roots
5	*Anoigissus leiocarpa* (A. DC.) Guill.& Perr. (Combretaceae) GMR-08	Sigaa	Fruit	Hu	Diarrhea	Oral	Dried	Fruits are crushed, diluted in water and one cup is taken (diluting)	Edible fruits, construction, firewood and charcoal
			Stem bark	Hu	Retain placenta	Oral	Dried	Stem bark is crushed, diluted in water and one cup is taken(diluting)	
6	*Bunchera hispida* (Bunch. Ham. Ex .D.Don) (Scrophulariaeace) GMR-07	Antatisa	Root	Hu	Stomach ache	Oral	Fresh	Root is crushed, squeezed and one cup of water juice is given or chewing of root (chewing)	Dryness of croplands
7	*Breonadia salicina* (Vahl) Heppehr& Wood (Rubiaceae) GMR-20	Tunga	Root	Hu	Vomiting	Oral	Fresh or dry	Root is crushed, squeezed with water and one cup is taken (crushing and squeezing)	Construction, firewood and charcoal

Table 2. Continues.

8	*Carissa spinarum* L. (Apocynaceae) GMR-16	Sikhua (Agam, Amh)	Root	Hu	Evil eye & devil sickness	Oral	Fresh	Roots are crushed with garlic and squeezed with water and one cup is taken (crushing and squeezing)	Edible fruits, firewood
			Root	Hu	Diarrhea	Oral	Fresh	Roots are crushed, squeezed with water and one cup is taken (crushing and squeezing)	
9	*Cissampelos mucronata A. Rich* (Menispermaceae) GMR-06	Siyapewa	Root	Hu	Children (Milk feeding) diarrhea	Oral	Dried or fresh	Root is crushed, squeezed with water and one cup of watery juice is given (crushing and squeezing)	-
			Root		Piles	Anal	Fresh	Root is crushed, squeezed with water and one cup of watery juice is given (crushing and squeezing)	
10	*Clematis simensis* Fresen (Rananculaceae) GMR-30	Jibija (Azoareg, Amh)	Leaf	Hu	Malaria and headache	Nose	Fresh	Squeezing of leaves and small amount is dropped on the nose (squeezing)	-
11	*Clerodendrum umbellatum* Poir (Lamiaceae) GMR-45	Odzige	Root	Hu	Gonorrhea	Oral	Fresh	Root is crushed, squeezed with water and one cup is taken (crushing and squeezing)	Fruits and flowers used for dying (coloring of materials)
12	*Combretum collinum* Fresen. (Combretaceae) GMR-09	Abasteya (hafa)	Leaf	Hu	Gardia and amoeba	Oral	Fresh	Chewing of leaves (chewing)	Firewood, construction
			Fruits	Hu	Delay of delivery	Oral	Dried/ fresh	Fruits are crushed, diluted in water and 1/2 cup is taken (diluting)	
			Root	Hu	Retain placenta	Oral	Fresh	Root is crushed, squeezed with water and one cup is taken (crushing &squeezing)	
13	*Compretun paniculatum Vent.* (Combretaceae) GMR-33	Guha	Shoot	Hu	Trachoma	Eye	Fresh	Watery juice of shoot is dropped on the eye (dropping)	Firewood
14	*Cordia africana* Lam.(Boraginaceae) GMR-60	Banja (Wanza,Amh)	Stem bark	Hu	Trachoma	Eye	Fresh	Stem bark is crushed, boiled , cooled and washing the eye (decoction)	Construction, firewood edible fruits
			Root bark	Hu	Stomach ache	Oral	Fresh	Root bark is crushed, squeezed with water and given to drink (crushing and squeezing)	
			Root bark	Hu/goat	Children (milk feeding) diarrhea	Oral	Fresh	Root bark is crushed, squeezed with water and given to drink (crushing and squeezing)	
15	*Croton machrostachus Del* (Euphorbiaceae) GMR-27	Barwa (Bisana,Amh)	Shoot	Hu	Wound	Skin	Fresh	Shoot is squeezed and dropped water juice to the wound (dropping)	Charcoal, construction and firewood
			Root	Hu	Snake bite	Oral	Fresh	Root is crushed, squeezed with water and few amount taken orally (crushing & squeezing)	
			Stem bark	Hu	Giardia and amoeba	Oral	Dried	Stem bark is crushed, diluted in water and one cup is taken (diluting)	
16	*Cynoglossum Coeruleum* Hochst. ex A.DC. in DC (Boraginaceae) GMR14	Gimichi (Amh,Shemigeg)	Leaf	Hu	Sunstroke	Skin	Fresh	Leaves are squeezed with water, creamed on injured part (creaming)	-
			Root	Hu	Dysentery	Oral	Fresh	Root is crushed, squeezed and one cup is taken (crushing & squeezing)	

Table 2. Continues.

17	*Cyperus sp. L.* (Cyperaceae) GMR-05	Minzhua	Rhizomes	Hu	Snake bite	Oral	Fresh	Rhizomes are crushed with garlic, diluted in water and one cup is taken (diluting)	-
18	*Dioscorea bulbifera* L. (Dioscoreaea) GMR-59	Yachiwa	Leaf and seed	Hu/catt	Lactation failure	Oral	Dried or fresh	Both leaves and seeds are crushed, soaked in water and one bottle is given (maceration)	Edible tubers roots during famine after detoxification
19	*Dioscorea alata* L. (Dioscoreaceae) GMR-19	Boka (awuna)	Tuber	Hu	Stomach ache	Oral	Fresh	Tuber is crushed, soaked in water and one cup is taken (maceration)	Edible tubers
20	*Echinops sp. L.* (Asteraceae) GMR-54	Asitana	Root	Hu	Devil sickness	Nose	Dried/ fresh	Fumigates of root either fresh or dry condition (fumigates)	-
			Root	Hu	Headache	Oral	Dried or fresh	Root is crushed, diluted in water and one cup is taken (diluting)	
			Root	Hu	Malaria	Nose	Dried or fresh	Fumigates of root either fresh or dry condition (fumigating)	
21	*Ficus sycomorus* L (Moraceae) GMR-46	Fuqa	Root bark	Hu	Common cold	Oral	Dried or fresh	Root bark is crushed, squeezed with water and one cup is taken (squeezing)	Edible fruits, firewood, construction
			Stem bark	Hu	Snake & scorpion sting	Oral	Fresh	Stem bark is chewed and sucking juices (sucking)	
			Root	Hu	Blotting	Oral	Fresh	Root is crushed, soaked in water and one cup is taken (maceration)	
			Root	Hu	Children (milk feeding) diarrhea	Oral	Fresh	Root is crushed, soaked in water and one cup is taken (maceration)	
22	*Fuelugge virosa* (Willd.) Voigt. (Euphorbiaceae) GMR-03	Weela(astehua)	Root	Hu	Snake bites	Oral	Fresh	Roots are crushed, squeezed and one cup is taken (crushing& squeezing) but not given for pregnancy woman since it causes abortion	Firewood and construction
			Root	Hu	Diarrhea	Oral	Fresh	Roots are crushed, squeezed and one cup is taken (crushing and squeezing)	
			Leaf	Hu	Snake bite	Oral	Fresh	Leaves are crushed, squeezed with water and few can be taken (crushing and squeezing)	
23	*Gardenia ternifolia* Schum. &Thonn. (Rubiaceae) GMR-31	Kota (Gambilo, Amh)	Stem bark	Hu	Leg paralysis in child	Skin	Dried /fresh	Stem bark is crushed, soaked in water and washing the leg (maceration)	Edible fruits, flowers used as spices, firewood
			Shoot	Hu	Tooth bleeding	Oral	Fresh	Chewing of shoot	
24	*Grewa mollis* A.Juss. (Tiliaceae) GMR-39	Gediya	Stem bark	Hu	Constipation	Oral	Fresh	Stem bark is soaked in water, filter and one cup is taken (maceration)	Firewood, construction
			Stem bark	Hu/catt	Retain placenta	Oral	Fresh	Stem bark is soaked in water and one cup is taken (maceration)	
25	*Hygrophilia schulli* (Hamilt.) M.R. & S.M. (Acanthaceae) GMR-40	Keditsa	Root	Hu	Common cold	Oral	Fresh	Chewing of roots	-
			Root	Hu	Dry cough	Oral	Dried/fresh	Fumigates of root either fresh or dry condition (fumigating)	
26	*Indigofera arrecta* Hochst. ex A. Rich (Fabaceae) GMR-56	Jepewa	Root	Hu	Discharges of menstruation	Oral	Fresh	Root is chewed or squeezed and one cup is taken (chewing)	-
			Root	Hu	Aphrodisiac	Oral	Fresh	Root is chewed or squeezed and one cup is taken (chewing)	

Table 2. Continues.

27	*Jasminum* sp. L. (Oleaceae) GMR-15	Mima (mimiya)	Leaf/root	Hu	Vomiting Or diarrhea	Oral	Dried or fresh	Leaves or roots are crushed, squeezed with water and 1/2 of cup water juice is taken (crushing and squeezing)	
28	*Justicia ladanoides* Lam. (Acanthaceae) GMR-01	Kakma	Leaf	Hu	Malaria	Oral	Fresh	Leaf is cooked and eaten or chewing of leaf directly (cooking/chewing)	Whole parts edible as roasted
			Leaf	Hu	Headache	Oral	Fresh	Leaf is cooked and eaten or chewing of leaf directly (cooking/chewing)	
			Whole plant	Hu	Stomach ache	Oral	Fresh	Whole parts are crushed, cooked in wot and eaten (cooking)	
			Leaf	Chik	Coccidosis	Oral	Dried	Leaves are crushed, diluted in water and given open container to drink (diluting)	
29	*Kigelia africana* (Lam.) Benth. Bignonaceae GMR-52	Endehua	Fruits	Hu	Infertility in female	Oral	Dried	Fruits are crushed, soaked in water and one bottle taken in morning (maceration)	Firewood, construction
30	*Lagenaria siceraria* (Molina) Standl. (Cucurbitaceae) GMR 46	Kibo (kill,Amh)	Leaf	Hu	Scabies	Skin	Fresh	Leaves are squeezed and watery juices are creamed on the injured one (creaming)	Containers
31	*Laggera crispata*(Vahl) Heppe& Wood (Asteraceae) GMR-21	Gezbha	Root	Hu	Hepatitis	Oral	Fresh	Root is crushed, squeezed with water and one cup is taken until recovery (crushing and squeezing)	-
32	*Lannea fruticosa (A.Rich.) Engl* (Anacardaiceae) GMR-18	Azgyee	Root	Hu	Stabbing pain	Oral	Fresh	Root is crushed, squeezed with water and one cup is taken (crushing & squeezing)	Firewood, construction
			Root	Hu	Aphrodisiac	Oral	Dried	Root is crushed, soaked in water, filter and one cup is taken (maceration)	
33	*Lonchocarpuslaxiflofus* Guill. &Perr. (Fabaceae) GMR-37	Beewa	Stem bark	Hu	Infertility in female	Oral	Fresh	Stem bark is crushed, soaked in water, filtering and one cup is drunk (maceration)	Firewood, construction and Flowers used as spice
			Root	Hu	Dysentery	Oral	Fresh	Root is crushed, squeezed with water and one cup is taken (crushing and squeezing)	
34	*Mentha longifolia* (L.) Hudson (Lamiaceae) GMR-22	Omosiya	Leaf	Hu	Insect repellent like mosquitoes	Skin	Fresh	Leaves are crushed, squeezed with water and creamed the faces (creaming)	
			Leaf	Catt	Leech infestation	Oral	Dried or fresh	Leaves are crushed, squeezed and one bottle is given to drink (crushing and squeezing)	
35	*Momordica foetida* Schum (Cucurbitaceae) GMR-13	Bedaa (kurahareg,Amh)	Leaf	Hu	Stomach ache	Oral	Fresh	Chewing of roots and sucking water juices/ cooking of leaves and eating (cooking/chewing)	
			Leaf	Goat	Diarrhea	Oral	Fresh	Leaves are crushed, squeezed with water and one bottle is given (crushing and squeezing)	
36	*Nicandra physaloides* (L) Gaerdn (Solanaceae) GMR-29	Obosiya	Fruits	Hu	Halitosis	Oral	Fresh	Fruits are directly eaten (chewing)	Edible fruits

Table 2. Continues.

37	*Ocimum canium Sims* (Lamiaceae) GMR-23	Biyangua	Inflorescences	Hu	Malaria	Oral	Fresh	Flowers are cooked with shorba and eaten with injera before infection (cooking)	
38	*Ocimum gratissimum* L (Lamiaceae) GMR-24	Gizaya	Leaf	Hu	Insect repellent like mosquitoes	Skin	Fresh	Leaves are crushed, squeezed and creamed faces and hands during night (creaming)	
39	*Piliostigma thonninigi* (Schum.) Milne-Redh. (Fabaceae) GMR-10	Micha	Shoot	Hu	Wound & lip dryness	Skin	Fresh	Shoot is squeezed and creaming water juice to the wound (creaming)	
40	*Portulaca sp.*(Portulacaceae) GMR-25	Beela (kemma)	Whole plant	Hu	Gastritis	Oral	Fresh	Whole parts are crushed, cooked in wot and eaten (cooking)	Whole parts edible as roasted
			Stem	Hu	Stomach ache	Oral	Fresh	Chewing of stem	
41	*Pterocarpus lucens* Guill. &Perr. (Fabaceae) GMR-41	Chaya	Shoot	Hu	Dysentery	Oral	Fresh	Shoots are crushed, squeezed and one cup is taken (crushing and squeezing)	Firewood, charcoal, construction
			Stem bark	Hu	Common cold	Oral	Fresh	Stem bark is crushed, soaked in water, filtering and drinking (maceration)	
			Root	Hu	Snake bite	Oral	Fresh	Root is crushed, squeezed with water and one cup is taken (crushing and squeezing)	
42	*Ricinus communis* L. (Euphorbicaeae) GMR-47	Qusha (Kachima, Amh)	Leaf	Hu	Ear lesion	Ear	Fresh	Leaves are squeezed with water and juice is dropped into ear (dropping)	
43	*Saba comorensis* (Boj.) Pichon (Apocynaceae) GMR28	Huyaa	Fruits	Hu	Tapeworm&Ascaris	Oral	Fresh	Fruit are eaten directly (chewing)	Edible fruits
44	*Sarcocephalus latifolius* (J. E. Smith) E. A. Bruce. (Rubiaceae) GMR-02	Abguda	Leaf	Hu	Swollen spots on the head of child	Oral	Dried or fresh	Leaves are crushed and diluted in water and one cup of water juice is given (diluting)	Edible fruits
45	*Solanum dasyphyllum,* Schumach (Solanaceae) GMR-35	Ankwa (Gebreembuy,Amh)	Root	Hu	Dysentery &Rheutematic	Oral	Fresh	Root is crushed, squeezed with water and one cup is taken (crushing and squeezing)	
			Root	Hu	Gonorrhea	Oral	Fresh	Root is crushed, squeezed with water and one cup is taken (crushing and squeezing)	
			Fruits	Hu	Wound	Skin	Fresh	Watery juice of fruits is dropped on the wound (dropping)	
46	*Solanum nigrum* L. (Solanaceae) GMR-12	Obrasiya (Awut,Amh)	Leaf	Hu	Swelling of finger tips	Skin	Dried or fresh	Leaves are crushed with common been, creamed and tied on the finger (creaming)	Edible fruits after ripen and leafy parts edible after roasted
47	*Sorgum bicolor* (L.) Moench (Poaceae) GMR-51	Bovie (Mashila, Amh)	Seed	Hu	Retain placenta	Oral	Dried	Malt seeds are crushed with table salt, diluted and one bottle is taken (diluting)	Edible fruits
			Seed		Scorpion sting	Oral	Dried	Malt seeds are crushed with seeds of Finger millets, diluted and one cup is taken (diluting)	

Table 2. Continues.

48	*Sterosperminum kunithanium* Cham. (Bignoniaceae) GMR-49	Odanjuwa (Zana,Amh)	Root	Hu	Diarrhea	Oral	Dried/ fresh	Root is crushed, diluted in water and one cup is taken (diluting)	Firewood and construction
49	*Syzygium guineenses* (Willd.) (Myrtaceae) GMR-50	Diwa (Dokima,Amh)	Stem bark	Hu	Diarrhea	Oral	Fresh	Stem bark is crushed, squeezed with water and taken orally (crushing and squeezing)	Edible fruits
50	*Tecomastans* (L.) Juss (Bignonaceae) GMR-32	Odnjo or Obraya	Stem bark	Hu	Dysentery	Oral	Dried or fresh	Stem bark is crushed, soaked in water, filter and one cup is taken (maceration)	Firewood, construction
			Root	Hu	Evil eye	Oral	Fresh	Root is crushed, diluted in water and one cup is taken (diluting)	
			Root	Hu	Amoebaisis&Gardiasis	Oral	Dried /fresh	Root is crushed, diluted in water and one cup is taken(diluting)	
51	*Termnalia schimperiana* Hochst (Combretaceae) GMR-44	Biguha	Leaf	Catt	Epidemic	Skin	Fresh	Leaves are crushed, diluted in water and spraying (diluting)	Firewood, constructio, fumigants of houses
			Root	Hu	Common cold	Oral	Fresh	Root is crushed, squeezed with water and one cup is taken (crushing and squeezing)	
			Stem bark	Hu	Diarrhea	Oral	Dried	Bark is crushed, diluted in water and taken orally (diluting)	
52	*Tragiadoydes* M.Gilbert (Euphorbiaceae) GMR-04	Obdaajiya	Root	Hu	Common cold	Oral	Fresh	The root is chewed and sucking juice (chewing)	
53	*Trichodesma zeylanicum* (Burm.f.) R.Br., (Boraginaceae) GMR55	Jgewusha	Leaf	Hu	Sunstroke	Oral	Fresh	Leaves are crushed, squeezed and one cup is taken (crushing and squeezing)	
			Root	Hu	Infertility in female	Oral	Fresh	Roots are crushed with garlic, boiled and one cup is taken (decoction)	
54	*Unidentified* GMR-59	Jikwa	Tuber	Hu	Tonsillitis	Oral	Dried or fresh	Tuber is crushed, squeezed with water and one cup is taken (crushing and squeezing)	
					Stabbing pain	Oral	Fresh	Tuber is crushed, squeezed with water and one cup is taken (crushing and squeezing)	
					Rheutematic	Oral	Fresh	Tuber is crushed, squeezed with water and one cup is taken (crushing and squeezing)	
					Boils	Skin	Dried or fresh	Tuber is crushed, squeezed with water and one cup is taken (crushing and squeezing)	
					Swelling & goiter	Oral	Fresh	Tuber is crushed, squeezed with water and one cup is taken (crushing and squeezing)	
55	*Vernonia adonesis*Sch. Rip .ex Walp (Asteraceae) GMR-57	Pepa meta (Raskimir, Amh)	Root	Hu	Backbone pain	Oral	Dried/ fresh	Root is crushed, soaked in water and one cup is taken (maceration)	Edible seeds
			Root	Hu	Snake bite	Oral	Fresh	Root is crushed, soaked in water and one cup is taken (maceration)	
			Root	Hu	Sexual dysfunction	Oral	Fresh	Root is crushed, soaked in water and one cup is taken (maceration)	
			Leaf	Hu	Circumcision	Skin	Fresh	Leaf is squeezed and creamed on the skin (creaming)	

Table 2. Continues.

56	*Vernonia amygdalina* Del (Asteracaea) GMR-58	Tatiza (Girawa,Amh)	Root	Hu	Backbone pain	Oral	Fresh	Root is crushed, squeezed with water and one cup is taken (crushing and squeezing)	
			Leaf	Chik	Coccidosis	Oral	Dried or fresh	Leaf is crushed or squeezed with water and give on open container (crushing and squeezing)	
57	*Vernonia auriculifera* Hiem (Asteracaea) GMR-42	Aegidim	Root	Hu	Diarrhea	Oral	Fresh	Root is crushed, squeezed and one cup is taken (crushing and squeezing)	
58	*Xanthium strumarium L.* (Asteraceae) GMR-56	Ejemta	Leaf	Chik	Coccidosis	Oral	Fresh	Leaves are squeezed and watery juices is given to drink (squeezing)	
			Leaf	Hu	Tinea versicolor	Skin	Fresh	Leaves are squeezed and watery juices is creamed on the skin (creaming)	
			Leaf	Hu	Wound	Skin	Fresh	Leaves are squeezed and watery juices is creamed on the skin (creaming)	
59	*Ximenia americana* L. (Olacaceae) GMR-17	Feya (Enquy,Amh)	Fruits	Hu	Tapeworm	Oral	Fresh	Ripen fruits are directly eaten (chewing)	Edible fruits
			Root	Hu	Diarrhea	Oral	Fresh	Crushing root and squeezing with water given for milk feeding (crushing and squeezing)	
			Root	Hu	Stomach ache	Oral	Dried/fresh	Root is crushed, soaked in water and one cup is taken (maceration)	
60	*Ziziphus maurtinina* Lam. (Rhamnacae) GMR-36	Sirra	Stem bark	Hu	diarrhea	Oral	Fresh	Stem bark is crushed, soaked in water, filter and one cup is given (maceration)	Edible fruits

Key: GMR = Getaneh's Mandura Research, Hu = human, chik = chicken, catt = cattle; usf = used for, ra = routine of administration, Cp = conditions of preparation, Amh = Amharic.

belonging to under the same family such as Asteraceae, Lamiaceae, Fabaceae, Euphorbiaceae and Combretaceae have diagnostic features in medicinal application (Table 1). Ethnomedicinal uses of medicinal plants accounted 83.3% employed for the treatment of human ailments and the rest were used to treat both human and livestock ailments. This result showed similarities with other study conducted in Ethiopia that local communities focused on use of medicinal plants for the treatment of human ailments than livestock (Belayneh and Bussa, 2014). The majority of remedies with water additive were prepared in a single plant species for the treatments of a wide range of diseases from simple headache to organ disorders of liver (Table 2).

Growth habit of medicinal plants

Medicinal plants showed their variations in the growth habits. They comprise herbs (19 species, 31.7%), tree (17 species, 28.3%), shrub (13 species, 21.7%), and climbers (11 species, 18.3%) respectively. These variations observed maily because of environmental conditions combining with resource availability that determining the distribution of plant species occupying a particular region. Similar studies pointed out those herbaceous medicinal plants were major sources of traditional medication (Teklehaymanot and Giday, 2007). The high usage of seasonal herbs in this study could be an indication of old transmission of traditional knowledge among informants.

Gathering parts, conditions of preparation and administration of remedies

Medicinal plant parts used

The result of the survey showed that various parts of medicinal plants resources were employed to prepare remedies by local practitioners. Figure 2 illustrated that the most frequently used plant parts for remedies preparation were roots (39.0%), leaves (21.4%) and stem bark (13.8%). This may be because of presence of more active biological ingredients in these plant parts. Early studied also determined that roots were most preferred used parts for medication than others (Teklehaymanot and Giday, 2007; Lulekal, et al., 2008; Birhane et al., 2010; Tolossa et al., 2013).

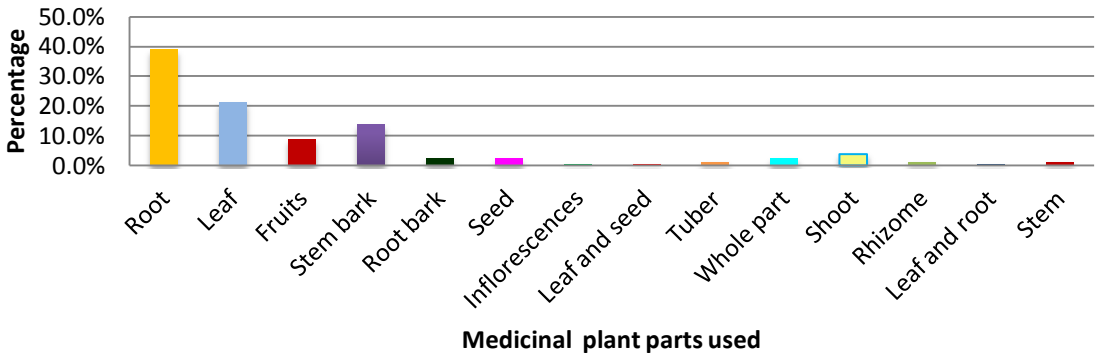

Figure 2. Parts of medicinal plants used.

Conditions of preparation of remedy

The results also showed that medicinal plants were prepared in the homemade remedies mainly in fresh form (72%) followed by fresh/dry (20%) and dry (8%). It agreed with other studies of conducted in Ethiopia (Yineger and Yewhalaw, 2007) which also explained that fresh remedies were the largest medical application for the treatment of ailment. The recurrent use of freshly harvested medicinal plant materials in the area was reported to be related to the notion of attaining high efficacy using active ingredients of fresh plant parts which may be lost some active ingredients on drying or heating. On the other hand, preparing of remedies either dry or both dry and fresh was for making medication available during shortage of plants in their surrounding but comparatively fresh remedies were more recommend by indigenous people to heal ailments of human and livestock.

Preparation methods of remedies

The local people employed several methods in order to prepare medicines from medicinal plants. However, crushing and squeezing (33.3%), maceration (15.8%), diluting (13.2%), chewing (10.5%) and creaming or ointment (8.8%) were the most frequently used methods of medicine preparation. The smallest means of preparation of medicinal remedy involves sucking of juices (0.9%) (Figure 3). Findings showed that the majority of documented medicinal plants were used in treatment in a single plant preparation and most additive for the preparation was water.

Route of administration of remedies

The method of preparation of plant remedies involves various administrations. The remedies were prepared and administrated in different body parts. The most frequently root of administration of remedies were internally through oral (80.2%) (Figure 4). The analysis shows similarity with the studies of Teklehaymanot and Giday (2007) and Yineger and Yewhalaw (2007) that oral administration was the largest one. The internal administration of medicinal remedies indicated that internal ailments were also more prevalence than external injuries. This used in orally-administered preparations ensuring the safety of medicinal plants to take internally.

Folk naming of medicinal plant and its implication

Some folk classification of medicinal plants showed that the local people give the name of medicinal plants with emphases to medicinal purposes. Medicinal plants like 'Beella' (*Portulaca* sp.) mean, Bee = plant, ella = stomach, together mean 'gives relief of stomach health problems; 'Ejesetina' (*Echinops* sp.) mean, Eje = wood, setina = devil, together 'Devil wood'; Ejemita (*Xanthium strumarium)*, Eje = wood, mita = chiken, together 'chiken wood' which means used to treat chickens' coccidosis. 'Yamichi' (*Cynoglossum coeruleum)* means plants used to treat health problems of 'Mich' means sunstroke. Ejehua (*Vernonia adoensis)*, Eje = wood and hua = snake means 'snake wood'. These perceptions of folk naming of plants were adopted from indigenous medicinal practices to prevent and cure of their health problems. To support this scientific, other study in Kafficho people of Ethiopia were classified medicinal plants by using the disease treated.

Informant consensus factors

In the present ethnobotanical analysis of ICF provides a measure of reliability for any given claim providing reliable evidence. The medical classification were employed to categorize aliments well known by herbal experts into 11 usage categories' of medical condition groupings that impact a system of the body (Cook, 1995). Similarly, the present results categorized 11 major health

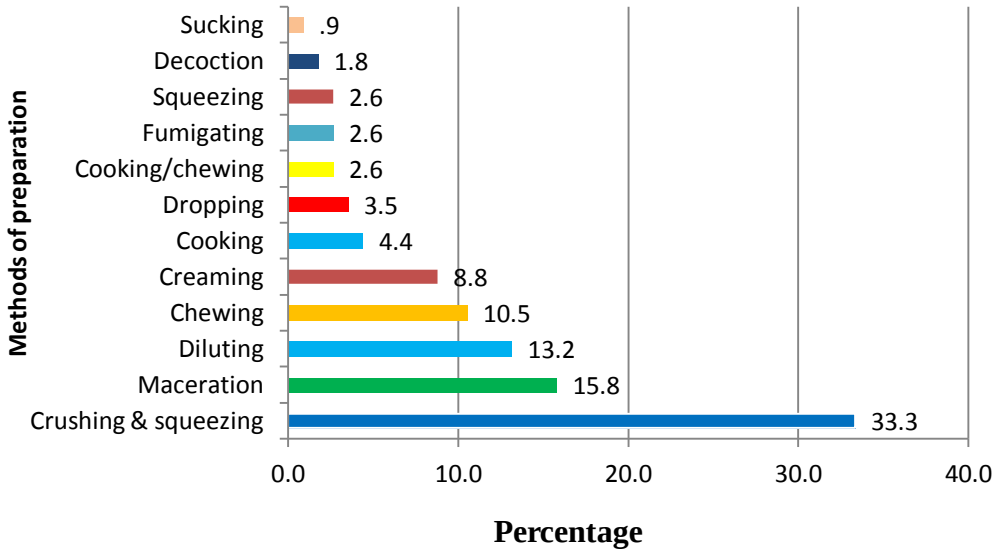

Figure 3. Methods of preparation of remedies.

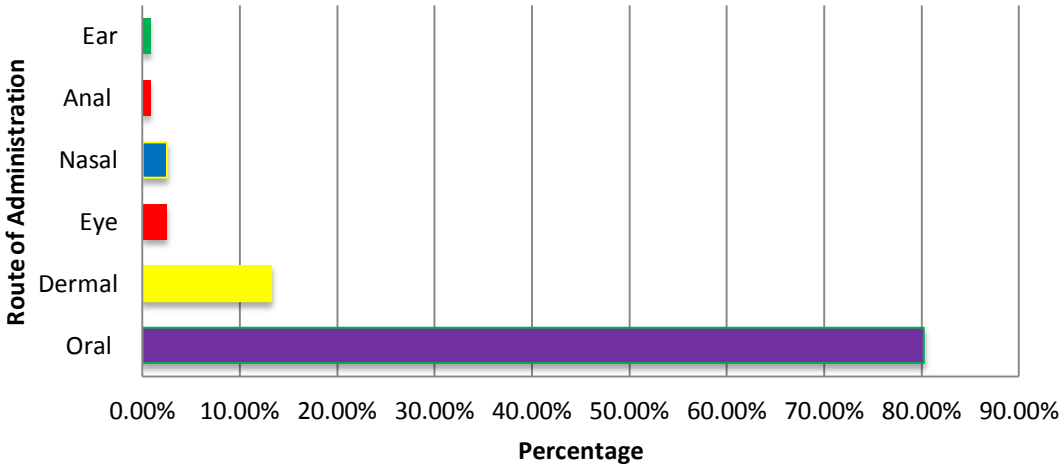

Figure 4. Routine of administration of prepared remedy.

problems based on their medical conditions (Table 3). High value of ICF indicates the agreement of selection of medicinal plants between informants, whereas a low value indicates disagreement. This homogeneity test revealed that reported medicinal plants have potentially healing properties.

Efficacy of medicinal plants

To understand local people's perception on medicinal plants, five medicinal plants were presented to ten key informants to make pair comparison for the most frequently occurring disease and more plants cited to treat dysentery as seen in Table 4.

Table 4 illustrated that indigenous people used plants not only for simple treatment but also they try to identify the effective medicinal plants to treat particular ailments. It revealed that use of *T. stans* as traditional medicine have similarity experimental analysis of ethanol and methanol extract of *T. stans* which have active phytochemicals to inhibit plant and animal pathogenic bacteria and fungi (Govindappa et al., 2011). The fact of local preferring of effective medicinal plants confirmed that in some cases direct links between a local and biomedical use exists (Heinrich and Gibbons, 2001).

Conservation and sustainability of medicinal plants

Some of the factors that would enhance sustainable use and conservation of medicinal plants include growing of

Table 3. Informant consensuses factors.

Categories of health problems	Specific ailment	MP used (Nt) observed	No. of use citation (Nu) (expected)	ICF= Nu-Nt/Nu-1
Throat and respiratory problems	Common cold, dry cough, tonsillitis	8	63	0.88
Reptile poison	Snake and scorpion bite	7	48	0.87
Nervous system and symptoms	Trachoma, ear lesion and headache	8	55	0.79
Emergency problems	Sunstroke, Devil sickness and evil eye	4	27	0.88
Chicken ailment	Coccidosis	3	10	0.77
Cattle, goat and sheep health problems	Diarrhea, delay of placenta, lactation failure	5	29	0.86
Blood parasites and insect repellent	Malaria and insect bites	6	25	0.79
Dermal infection and injury disease	Wound, wound on the head or finger, circumcision, scabies, boiling, Tinea versicolor	13	96	0.87
Gastrointestinal disorder and intestinal parasitic	Stomatisis, gastritis, constipation, loss of appetites, blotting, amoeba, Giardia, dysentery, stomach ache, intestinal helminthes, stabbing pain, hepatitis, vomiting, diarrhea	38	375	0.90
Skeletal and Joint Health Problems	Backbone, leg paralysis and rheumatoid arthritis	4	22	0.85
Uro-genital	Sex dysfunction, infertility of female, irregular menstruation, retain placenta, delay of deliver, lactation failure	15	61	0.76

Table 4. Pair wise comparison of five medicinal plants.

Medicinal species	Key informants (K_1 - K_{10})										Total	Rank
	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10		
Tecoma stans	5	2	4	4	5	4	3	2	2	4	34	A
Pterocarpus lucens	4	3	3	3	2	2	2	4	5	3	31	B
Lonchocarpus laxiflofus	3	2	1	4	4	3	4	2	4	2	29	C
Cynoglossum coeruleum	2	3	2	2	3	2	3	3	3	4	27	D
Solanum dasyphylum	3	1	4	3	2	3	2	1	2	3	24	E

1 = least, 2 = medium, 3 = good, 4 = very good, 5 = excellent and ten key informants were asked to compared these.

medicinal plants in the homegardens, setting forest priority area and keeping remnant marginal forests from destruction in their natural habitats. For such justification, the totals of 11.6% medicinal plants were collected in the homegardens. However, cultivation of medicinal plants in the homegardens was still insufficient and people have less awareness compared to wild plant resources. The trend of using more of herbaceous plants and starting of growing plants in their backyard like *Portulaca* sp., *Dioscorea alata* and *Abelmoschus esculenta* for the purposes of primarily food could be advantageous as it is easier to cultivate them when they are short in supply. Cultivation in the homegardens might be a viable alternative for those species that may be more prone to overexploitation. On the other hand, trees and shrubs was likely associated with woody vegetation type withstand long dry season and their abundance and year-round availability in areas is an opportunities to set forest priority in the area. This improves sustainable harvesting of wild plants as a use of plant biodiversity which potentially offers social benefits to local communities.

Harvesting practices by local communities in the wild

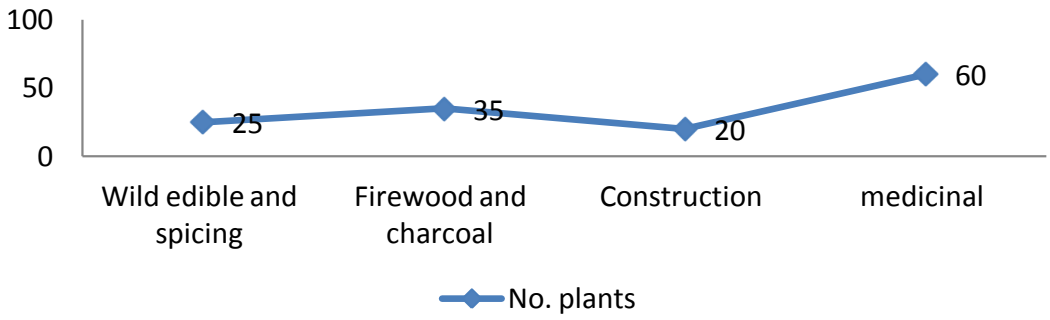

Figure 5. Use diversity of medicinal plants.

Figure 6. Vegetation burning during dry season of the study area (Photo taken by Getaneh Gebeyehu, 2013).

was very diverse including forests, riversides, grazing lands, cultivated land and mountains of which a total of 88.6% of medicinal plants were collected in the wild. It indicated that the indigenous people collected medicinal plants from major area of the natural habitats. Other investigators also indicated most medicinal plants were collected in the wild state (Yineger and Yewhalaw, 2007). This clearly indicated that most of the ethno medicinal plants were not yet cultivated by the traditional herbalist.

Threats to medicinal plants

The use diversity analysis in Figure 5 illustrated that the majority (75%) recorded medicinal plant species have multipurpose uses for more than one use categories. Such consumption of medicinal plants for multipurpose uses other than food and medicine includes firewood and charcoal (41.7%) and construction (33.3%) may pose threats to sustainability for the future. But the fact of that many plants have other uses lead to their over exploitation, threatening their continuous survival in the study area. Harvesting practice by human induced factors threaten the survival of medicinal plants for sustainable uses. Local harvesting modes was one of destructive parts of plants like roots (39.0%), stem barks (13.8%) and root barks may pose sustainable use.

Harvest of leaves generally reflected less of a threat than the bark or root parts (Sheldon et al., 1997). However, harvesting of the largest root parts of plants is the major threats for sustainability. Similarly result showed uses of roots and barks are most frequently damages of medicinal plants (Kairu et al., 2013). It is therefore given emphasis on the conservation of medicinal plants primarily valued for their root parts and intensively harvested for their bark.

Currently vegetation burning was another important threat to wild medicinal plants. Interview responses indicated that local community traditionally used to practice fire setting to clear vegetation for agricultural purposes. This major problem of medicinal plants deteriorated by human activities may pose threats to future sustainable use. Most informants perceived that vegetation burning could cause the severity of threaten factors of medicinal plants (Figure 6).

Most of the studies pointed out that the loss of medicinal plants as part of biodiversity is caused by deforestation, agricultural expansion and over

exploitation (Balemie et al., 2004). Recently vegetation burning is also major threats to medicinal plants in the study area.

CONCLUSION AND RECOMMENDATION

Local communities of the study area have potentially promising medicinal plants for the treatment of health problems. Use of medicinal plants to manage health problems indicated that people still utilized locally available medicinal plants for traditional medication practices. The identification of diverse plant species distributed in different families revives that people utilize plants for medicinal purposes not only concentrated in a certain families but also they investigated effective medicinal plants by looking various plant species in their surroundings.

The classification of use parts, condition of preparation, methods of preparation and different routine of administration revealed that indigenous users of medicinal plants were not only realizing of health problems but also they have understood how ethnomedicinal uses applied for the treatment of ailments. Thus, uses of ethnomedicinal plants should be confirmed conducting experimental and phytochemical studies to maximize the safety and effectiveness of these plants and witness to develop modern drug development.

Local people recognized plants not only medicinal purpose but also multipurpose uses for sources of food, firewood, construction and others. The wide sources of medicinal plants from the wild state reflected that local communities had less awareness for cultivation of medicinal plants in the backyard. Collection of abundant wild medicinal plants and food resources should be turned into cultivation and commercializing to promote rural development.

The major threats of medicinal plants were harvesting parts, multipurpose uses and vegetation burning raising serious questions for long-term availability of these plants, particularly of those harvested from the wild. From pragmatic perspectives, the most straight forward approach seems to establish forest priority setting for *in-situ* conservation and motivated healers to cultivate medicinal plants in their homegardens. To save the indigenous knowledge associated with medicinal plants, raising awareness in the people and form traditional healer association is mandatory.

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