STATUS OF MEDICO-CULTURAL COMMERCIAL PLANTS AT FICHE TOWN MARKET, ETHIOPIA

[*1]Abiyu Enyew, [2]Zemede Asfaw, [2]Ensermu Kelbessa, [1]Raja Nagappan

[1]Department of Biology, College of Natural and Computational Sciences, University of Gondar, P.O. Box 196, Gondar, Ethiopia

[2]Department of Plant Biology and Biodiversity Management, College of Natural Sciences, Addis Ababa University, P.O. Box 3434, Addis Ababa, Ethiopia

Abstract

The aim of the present study was documentation of marketable medicinal and cultural plants used by the local people at Fiche market of Ethiopia. In this survey, indigenous ethnobotanical knowledge and commercial medicinal plants were documented through discussion and semi-structured interviews from September to December 2013. The data collected from 90 local fresh herb sellers in the Fiche market were subjected to descriptive statistics, fidelity level, preference ranking and informants' consensus factor analysis. From this study 48 commercial medicinal and cultural plants belongs to 30 families and 43 genera were documented. Among the documented medicinal plants, 58.3% were harvested from wild environment, 14.6% from cultivated land and the remaining 27.1% from semi-cultivated lands. Among the plant species, family Lamiaceae was the dominant (18.5%) followed by Asteraceae, Euphorbiaceae, polygonaceae and Solanaceae sharing equal (6.3%) contribution. From the total medico-cultural floras sold at the market, 41.5% were leaves followed by roots (27.1%). Most of the plants purchased from the market were used to prepare remedy for oral administration (39.5%) and dermal application (29.2%). The highest informant consensus factor of 0.94 was calculated for dermatological diseases and spiritual diseases (0.83). Irrespective of diseases, fidelity level of *Rosmarinus officinalis* and *Datura stramonium* was calculated 100% and 98%, respectively. The preference ranking of medico-cultural plants for the treatment of diarrhea, *Cucumis fucifolius* and *Leonotis ocymifolia* stood first and second respectively.

Keywords: Fiche Market, Drug Sellers, Medico-Cultural Plants, Indigenous Knowledge, Ethnobotany

Introduction

Traditionally medicinal plants and herbs used as a source of medicine are given importance in recent ethnomedicine. The floral diversity is storage center for natural sources of drugs gaining great interests in pharmaceutical industries due to consumers' demands on plant-based medicines. In developed countries like America, 25%-40% of their medicines were derived from plants. For example, the global value of medicinal plants trade estimated to be over 60 billion US$[1]. The amount of pharmaceutical plants imported by Hong Kong was 77, 250 tonnes, Germany was 42, 800 tonnes and France was 15, 950 tonnes; medicinal plants imported by Europe from international market was

Author for Correspondence:

Abiyu Enyew,
Department of Biology,
College of Natural and Computational Sciences,
University of Gondar, P.O. Box 196, Gondar, Ethiopia
Email: abiyu.enyew@uog.edu.et

estimated to be 132,000 tonnes of which 60% originated from Africa[2]. Macia *et al.*[3] recorded 129 species of marketed medicinal plants in La Paz and El Alto cities in the Bolivian Andes. According to Nguyen[4], market places are resources center for ethnobotanical information due to interaction between vendors and consumers. In addition, market places are ready to buy medicinal and cultural plants for the consumers and the place to obtain qualitative and quantitative data related to cultural, social and economic value of medicinal plants[5, 6, 7].

In Ethiopia, investigations on medicinal plants and their uses is one of the most primary human concerns and have practiced by many cultures for several years. Traditionally, many ethnic groups in the rural villages of Ethiopia are using many medicinal plants for remedial preparations for various ailments but very few are documented[8, 9, 10, 11]. Generally, Ethiopian people are more concern and confidence in traditional medicine than western medicine[12, 13, 14, 15]. Most of the ethnobotanical studies and documentations were mainly based on field works by obtaining information from the traditional healers. However, the documentation on commercial herbal medicine or trade of medicinal plants in Ethiopia is limited. In Fiche district of Ethiopia, many traditional healers are providing remedies for human and livestock health problems. There are many special annual and cultural medicinal plants sold at Fiche town market. Hence, this study was aimed first time to document locally important marketable and cultural plant species at Fiche market of Ethiopia.

Materials and Methods
Description of the study area
The marketable medicinal plants survey was conducted at Fiche town market, North Shewa Zone of Oromia Regional state, Ethiopia. The Fiche town is classified as Dega (Ethiopian highlands) and most of its environment, West, South and North East is Dega kebeles whereas; the North East part of Fiche is Weynadega (midlands). It is delimited by the geographical coordinates of 38°43'E–38°45'E and 9°45'N–9°49'N (Fig. No. 01) and has an elevation point of 2700 m.a.s.l.
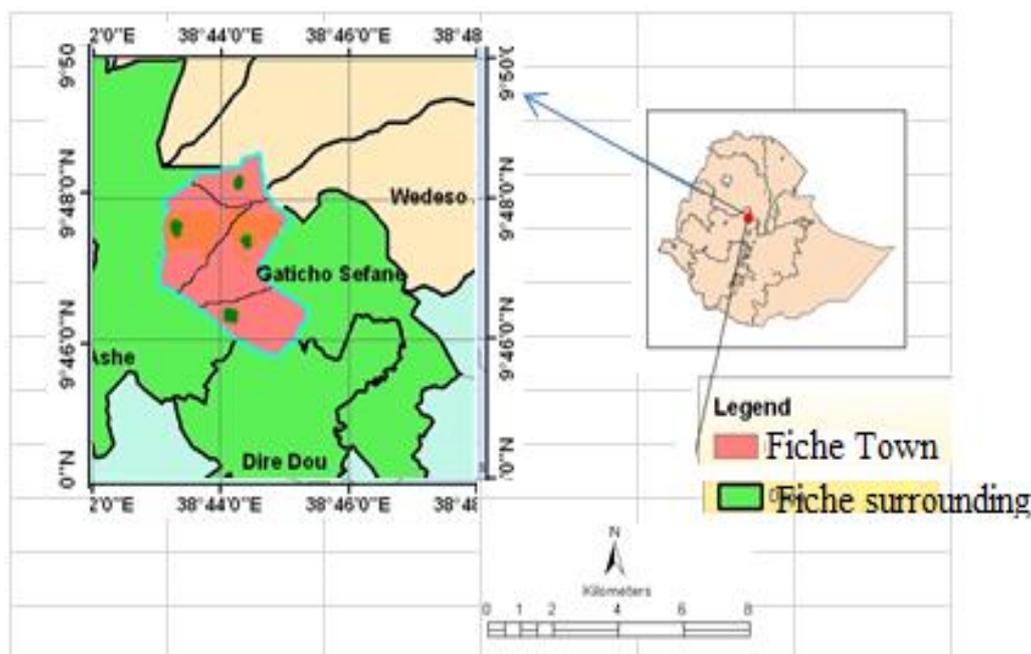

Fig. No. 01: Map of the study area

Meteorological details
According to traditional agro-climatic zonation of Ethiopia, Dega is the predominant agro-climatic zone received heavy rainfall during the main rainy season from June to August. In general, rainfall of the study area is bimodal type (Fig. No. 02) based on five years meteorological data obtained from Fiche town weather station. According to five years data of Meteorological Service Agency of Ethiopia indicates mean annual rainfall of 1139 mm and temperature of 14.4^0C.
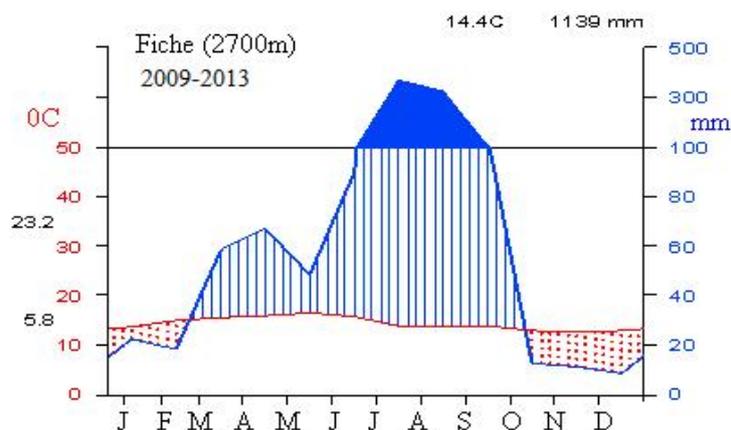
Fig. No. 02: Climadiagram of the study area from 2009-2013 at Fiche weather station

Materials and data collection methods

The ethnomedicinal information on plants were collected from the Fiche market from September 10, 2013 to December 20, 2013. Ethical clearance about the purpose of the study before starting data collection was made with local herbal drug sellers to obtain original information about the medicinal plants. In addition, Convention on Biological Diversity (CBD) on indigenous knowledge and Ethiopian Access and Benefit Sharing (ABS) law were strictly followed as guiding principles. The primary ethnobotanical data were gathered from direct market survey and discussing with herbal drug sellers. Oral interview, free sharing of information between the researchers and drug seller herbalists, group and individual focused discussions were conducted. The identities of collected medico-cultural plants were confirmed by using taxonomic keys in the Floras of Ethiopia. After confirmation, plant specimens were preserved and deposited at the National Herbarium of Addis Ababa University, Ethiopia.

Selection of Informants

For the data collection 90 informants were selected randomly through the transect market survey, of which 18 were licensed healers. Most of the medicinal plants sellers (89%) were rural dwellers and the remaining (11%) from urban side inhabitants. Among the 90 informants, 76 were women and 14 were men. During the survey period, each informant was contacted at least twice in order to collect original information as recommended by Alexiades[16].

Data Analysis

Descriptive statistical analysis and others like informant consensus factor (ICF), fidelity level

(*FL*) index and preference ranking were used for data analysis. Informant consensus factor was calculated as the formula recommended by Trotter and Logan[17].

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

Where,

Nur: number of use-reports for a particular use category

Nt: number of taxa used for a particular use category by all informants

The fidelity level (*FL*) index was calculated according to the formula of Friedman *et al.*[18]

$$FL = \frac{Ip}{Iu} \times 100$$

Where,

Ip: number of informants who independently indicated the use of a species for the same major ailment

Iu: total number of informants who mentioned the plant for any major ailment

Results

Recorded marketable medicinal plants

From the market survey conducted at Fiche market 48 fresh medico-cultural plant species were recorded with their botanical and family name, parts used, mode of administration and ailments treated (Table No. 01). In general, apart from the recorded plants, seeds, fruits and bulbs of *Allium sativum, Capsicum annuum, Coriandrum sativum, Curcuma longa, Lepidium sativum, Linum usitatissimum, Nigella sativa, Ocimum basilicum, Ruta chalepensis* and *Zingiber officinale* were frequently sold plants at the market. Among the recorded 48 species, 40 species (83.3%) were used for the treatment of human diseases whereas, three

species (6.3%) were used to treat livestock diseases and five species (10.4%) were used to treat both humans and livestock diseases.

Special annual medicinal plants marketing day (Fig. No. 03)

Besides the availability of medicinal plants on the usual market days, TIKIMT 17th (October 28) is a special medico-cultural plants marketing day to the local community. In this day, each year, many medicinal plants uprooted and sold at Fiche market for their cultural and medical values. The local communities strongly believe that, any plant harvested on this day is certain to have high medicinal value than plants harvested on other days. These plants used to keep the family healthy for one year if they kept under the roof of a house and smoked sometimes. As a result, many medicinal plants were carried on the backs of women to the Fiche market. In the case of North East of Fiche, herbal plants were highly harvested for cultural use besides their medicinal values. The crude herbal medicinal plants recorded from the Fiche town market are reported in Table No. 01.

Fig. No. 03: Medicinal plants sold at Fiche market

Taxonomic diversity of plants

In terms diversity, collected ethnomedico-cultural plant species were belongs to 30 families and 43 genera. Among the families, Lamiaceae was the most dominant that contained nine species (18.5%) under seven genera followed by Asteraceae, Euphorbiaceae, Polygonaceae and Solanaceae having three species each (6.3%). The third dominant families were Fabaceae and Oleaceae (4.2%) containing two species under two genera each. The remaining 23 families account about 2.1% each having one species under one genus (Table No. 01). Among the species, 28 (58.3%) were harvested from wild places while seven (14.6%) were from cultivated lands and the remaining 13 (27.1%) from semi-cultivated areas.

Plant parts used and application of remedies

The market survey revealed that most remedies were prepared from leaves (41.5%), roots (27.1%) followed by roots and leaves together (12.5%). Most of the prepared remedies (39.5%) were given orally followed by topical application (29.2%) based on the type of diseases treated (Table No. 01).

Ranking of marketable medico-cultural plants

The ranking of marketable medico-cultural plants were calculated for different diseases and preference ranking of four plants used to treat diarrhea is depicted in Fig. No. 04. Among the four plant species reported to treat diarrhea, *Cucumis ficifolius* was given first choice followed by *Leonotis ocymifolia.*

Informant consensus factor (ICF) for frequently reported disease categories was calculated and reported in Table No. 02. The highest ICF value of 0.94 was linked with dermatological diseases, which includes dandruff, skin lesion, swelling, ringworm, scabies, wound and eczema. The lowest ICF value of 0.71 was associated with organ-targeted diseases like heart failure, toothache, pneumonia and malaria.

Table No. 01: List of marketed herbal medicinal plants at Fiche Market

| Botanical names	Family names	Cultivation status	Diseases treated	Parts used	Routes of application
Achyranthes aspera L.	Amaranthaceae	Both	Pneumonia, Bleeding	Whole	Dermal
Asparagus flagellaris (Kunth) Baker	Asparagaceae	Wild	Syphilis, Gonorrhea	Root	Dermal
Bersama abyssinica Fresen.	Melianthaceae	Wild	Ascariasis, Skin lesion	Leaf	Dermal and oral
Brucea antidysenterica J. F. Mill.	Simaroubaceae	Wild	Leprosy, Eczema, vulgaris	Leaf	Dermal
Buddleja polystachya Fresen	Loganiaceae	Both	Tonsillitis, Scabies	Leaf	Oral and dermal
Calpurnia aurea (Ait.) Benth.	Fabaceae	Wild	Diarrhea, wound	Leaf and root	Oral and dermal
Capparis tomentosa A. Rich.	Capparaceae	Wild	Epidemic, Evil eye	Root	Oral
Carissa spinarum L.	Apocynaceae	Wild	Snake bite, Evil eye	Root	Oral
Clematis simensis Fresen.	Ranunculaceae	Wild	Swelling, Hemorrhoids, leach infection	Leaf	Dermal and nasal
Clerodendrum myricoides (Hochst.) Vatke	Lamiaceae	Wild	Pneumonia, Malaria, psychiatric	Leaf, root and seed	Oral
Clutia abyssinica Jaub. & Spach.	Euphorbiaceae	Both	Itching, toothache	Root	Oral
Croton macrostachyus Del.	Euphorbiaceae	Both	Heart failure, Ring worm	Bark	Oral and dermal
Cucumis ficifolius A. Rich.	Cucurbitaceae	Wild	Diarrhea, Evil eye	Root	Oral
Datura stramonium L.	Solanaceae	Both	Toothache, Dandruff	Seed and leaf	Dermal
Dodonaea angustifolia L.f.	Sapindaceae	Wild	Rabies, tape worm	Root and leaf	Oral
Dovyalis abyssinica (A. Rich.) Warb.	Flacourtiaceae	Wild	Hemorrhoids, Cancer	Fruit	Dermal and oral
Echinops kebercho Mesfin	Asteraceae	Both	Epidemic, Asthma	Root	Dermal and oral
Eucalyptus globulus Labill.	Myrtaceae	Cultivated	Cough, Febrile illness	Leaf	Oral and dermal
Euclea racemosa Murr.	Ebenaceae	Wild	Scorpion bite, Toothache	Root	Oral
Euphorbia abyssinica G. F. Gmel.	Euphorbiaceae	Both	Jaundice, Wart	Root	Oral and dermal
Jasminum grandiflorum L.	Oleaceae	Wild	Swelling, Evil eye	Root	Dermal and oral
Justicia schimperiana (Hochst.ex Nees) T. Anders.	Acanthaceae	Cultivated	Wound, Coccidiosis	Leaf and root	Oral
Leonotis ocymifolia (Burm. f.) Iwarsson	Lamiaceae	Both	Diarrhea, Snake biting	Leaf and root	Oral and dermal
Lippia adoensis L.	Verbenaceae	Both	Cough, Eczema	Leaf	Oral and dermal
Maytenus arbutifolia (A. Rich.) Wilczek	Celastraceae	Wild	Wound	Leaf	Dermal
Myrsine africana L.	Myrsinaceae	Wild	Cancer, Taeniasis	Fruit	Oral
Ocimum basilicum L.	Lamiaceae	Cultivated	Febrile illness	Leaf	Oral
Ocimum lamiifolium Hochst. ex Benth.	Lamiaceae	Both	Wound, Headache	Leaf	Dermal and oral
Olea europaea (Wall. ex G. Don) Cif.	Oleaceae	Cultivated	Eye infection, Tonsillitis	Leaf	Dermal and dermal
Osyris quadripartita Decn.	Santalaceae	Wild	Diarrhea, Eye infection	Leaf	Oral and dermal
Otostegia integrifolia Benth.	Lamiaceae	Cultivated	Abdominal pain, malaria	Root and leaf	Oral
Otostegia fruticosa (Forssk.) Schweinf.ex Penzig	Lamiaceae	Both	Asthma, Febrile illness	Leaf	Oral
Phytolacca dodecandra L'Hérit	Phytolaccaceae	Wild	Rabies, Leach infection	Root and leaf	Oral and nasal
Rosa abyssinica Lindley	Rosaceae	Wild	Tape worm, Stomachache	leaf	Oral

Table No. 01: List of marketed herbal medicinal plants at Fiche Market (contd.,)

Rosmarinus officinalis L.	Lamiaceae	Both	Toothache	Leaf	Oral
Rumex abyssinicus Jacq.	Polygonaceae	Wild	Goiter, Amoebiasis	Root	Oral
Rumex nepalensis Spreng.	Polygonaceae	Wild	Stomachache, Tonsillitis	Root	Oral
Rumex nervosus Vahl	Polygonaceae	Wild	Skin infection	Leaf	Dermal
Salvia schimperi Benth.	Lamiaceae	Wild	Coccidiosis	leaf	Oral
Senna singueana (Del.) Lock	Fabaceae	Wild	Snake biting, Evil eye, invoking sprit	Root	Dermal
Sida schimperiana Hochst. ex A. Rich.	Malvaceae	Wild	Eye infection, Wound	Leaf	Dermal
Solanum incanum L.	Solanaceae	Wild	Stomachache, Evil eye	Root and leaf	Oral and dermal
Thymus schimperi Ronniger	Lamiaceae	Cultivated	Diabetes	Whole	Oral
Verbascum sinaiticum Benth.	Scrophulariaceae	Wild	Snake biting, Swelling	Root	Oral
Vernonia amygdalina Del.	Asteraceae	Cultivated	Giardia, Amoebiasis	Leaf	Oral
Vernonia auriculifera Hiern.	Asteraceae	Wild	Eye infection, Wart	Leaf	Dermal
Withania somnifera (L.) Dunal in DC.	Solanaceae	Both	Evil eye, headache	Leaf and root	Dermal
Ziziphus spina-christi (L.) Desf.	Rhamnaceae	Wild	Dandruff, Snake repellent	leaf	Dermal

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

Diseases categories	Diseases included	N_t	N_{ur}	ICF
Spiritual diseases	Evil eye, invoking sprit, psychiatric	6	31	0.83
Gastro-intestinal diseases	Giardia, ascariasis, diarrhea, amoebiasis, tape worm	10	44	0.79
Dermatological disease	Dandruff, skin lesion, swelling, ringworm, scabies, wound, eczema	16	251	0.94
Organ targeted diseases	Heart failure, toothache, pneumonia, malaria, eye infection	13	59	0.71

Table No. 03: Fidelity value of frequently cited medico-cultural plants for frequently reported diseases

Diseases	Medicinal plants	I_p	I_u	FL (%)
Diarrhea	*Calpurnia aurea*	8	15	53
	Cucumis ficifolius	30	34	82
	Leonotis ocymifolia	11	15	73
	Osyris quadripartita	2	4	50
Amoebiasis	*Rumex abyssinicus*	21	25	84
	Vernonia amygdalina	5	7	71
Dandruff	*Datura stramonium*	61	62	98
	Ziziphus spina-christi	7	12	58
Toothache	*Clutia abyssinica*	7	9	77
	Euclea racemosa	4	6	66
	Rosmarinus officinalis	3	3	100
Eye infection	*Olea europaea*	5	7	71
	Sida schimperiana	18	22	81
	Vernonia auriculifera	2	3	66
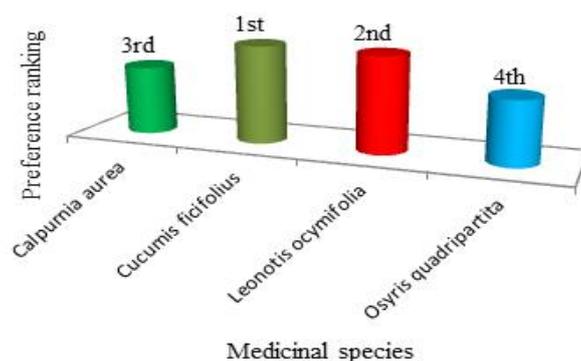
Fig. No. 04: Preference ranking of medicinal plants used to treat diarrhea

Fidelity level (*FL*) value of frequently cited medicinal plants for frequently reported diseases were calculated. The fidelity value of *Rosmarinus officinalis* was 100% for toothache followed by *Datura stramonium* (98%) for dandruff, *Rumex abyssinicus* (84%) for amoebiasis, *Cucumis ficifolius* (82%) for diarrhea and *Sida schimperiana* (81%) for eye infection. The remaining plants showed fidelity value of less than 80% (Table No. 03).

Indigenous knowledge transfer system

Among the 90 informants, (87.8%) acquired their indigenous knowledge of medico-cultural plants from their family members. The remaining 12.2% learnt from their neighbors and friends. Mostly, females (84.4%) were participated in buying, selling, preparation and handling of medico-cultural plants.

Discussion

Marketability of Medico-Cultural Plants

This market survey documented 48 fresh herbal drugs from Fiche market. TIKIMT 17th was a special annual medicinal plants marketing day which is called in Amharic, "ESTIFANOS", on which the local communities buy medicinal and cultural plants for a year by believing this day has strong curious capability. During this day, many cultural and medicinal plants were harvested from North East of Fiche town and brought to the market (Fig. No. 03). This may be most acute for the rural poor people, who have been relied on selling medicinal plants as a source of income. In spite of strong traditional religious beliefs on TIKIMT 17, but the scientific explanation may be during this time most of the plants fully matured and accumulate bioactive compounds. Later on plants become dry and bioactive compounds and their therapeutic power may reduce. Even though many medicinal plants are sold in local markets in Ethiopia, it is not well popularized in international markets. According to Desalegn Desissa[19], 45 plant species were recorded in the local market survey of Ethiopia and only known medicinal plant *Catha edulis* is exported. From the present study, 48 medico-cultural plants were recorded from Fiche market have a good indication for exporting medicinal plants. Because many countries in the world are showing interest to import bioactive medicinal plants and develop eco-friendly drugs[2].

Diversity of medicinal and cultural plants

The most dominant family recorded from the present study was Lamiaceae, which contains nine species (18.5%) under seven genera followed by Asteraceae, Euphorbiaceae, Polygonaceae and Solanaceae having three species each (6.3%). Several researchers observed that Lamiaceae was classified as the richest in species citations[20]. In a study of Bennett and Prance[21], families Lamiaceae and Asteraceae together, they represented 21% of surveyed plant species. Preference of Lamiaceae may be related to their biological activity and availability even in disturbed areas[22]. Another reason, Lamiaceae plants are mostly herbs contain biological active aromatic volatile compounds, which is effective in curing various diseases[23].

In the present market survey, most medicinal plants (58.3%) were collected from the natural habitats and 27.1% were from semi-cultivated areas. This may be due to natural habitat provides sufficient nutrients that favor for the growth of medicinal plants. Another possible reason may be there are no *ex-situ* conservations and less concern of conserving medicinal plants in homegardens by the local people of the study area. This result is consistent with other findings in which wild areas have many medicinal plants[24, 25, 26].

Plant parts used and applications of remedies

The most commonly used plant parts for herbal preparations in the area were leaves followed by roots and leaves and roots together respectively. It may be the reason that most of the bioactive principle is accumulate in the leaves. In addition, leaves are rejuvenation part of the plants that may not put medicinal plants at risk. Generally, in Ethiopia leaves are commonly used to treat various health problems followed by roots[27]. Most remedies (39.5%) were administered orally followed by topical application (29.2%) and both oral and dermal (29.2%). One species (2.1%) was used to give nasally and orally. Dermal application may have its advantage over oral application, because some medicinal plants may be toxic and cause for allergic.

Preferable medicinal plants

The highest informant consensus factor (ICF) of the medico-cultural plants was associated with problems of dermatological diseases including dandruff, ringworm, scabies, eczema and wound.

This may be due to prevalence of dermatological diseases in the study area and the topical applications of remedies are mostly acceptable. The ICF value is mainly associated with the exchange of information about the use of plants among informants[28].

Fidelity level index is important to quantify the value of a given species for a particular disease. The high *FL* indicates that, all use reports are using the species in the same way while low *FL* indicates for plants used for multiple ailments. In the present study, fidelity level (*FL*) index of *Rosmarinus officinalis* for toothache and *Datura stramonium* for dandruff was calculated 100% and 98% respectively. The *FL* of *Rumex abyssinicus* for treatment of amoebiasis, *Cucumis ficifolius* for diarrhea and *Sida schimperiana* for eye infection was 84%, 82% and 81% respectively. The fluctuation of fidelity level may be associated with curing capacity of bioactive principles accumulated in the plant species.

Indigenous knowledge transfer system

From this market survey, clearly demonstrated that most of indigenous knowledge (87.8%) on medicinal plants was transmitted orally along the family line and the remaining learn from their neighbors and friends. The continuity of the indigenous knowledge may be questionable due to the healers are unwilling to share medicinal plants knowledge with other local communities. In the study area, females were commonly manage the medicinal plants that are grown and cultivated in and around their homegardens, farming sites, buying and selling from market places. In the documentation of MacDonald *et al.*[29] also confirmed that the majority of medicinal plant traders were women. According to Patricia and Leda[30] males were mostly involved in bringing plants from forest areas and females are mostly involved in remedial preparation and process[31, 32]. It is obviously true that most of the time females are homemakers and they may not volunteer to go for forest areas. Most of the recorded medicinal plants were used to treat human diseases than livestock ailments. This may imply people give prior attention for human healthcare than livestock. The survey conducted by Mirutse Giday *et al.*[33] in Ethiopia also reported similar findings.

Conservation status of marketable plants

Although medicinal plants are used to cure various diseases, their availability has been affected by anthropogenic activities and natural factors like; land sliding, degradation and soil erosion. Similar observation was also pointed out by other researchers[26, 33, 34]. In order to conserve and supply medicinal plants, drug sellers had started to cultivate *Vernonia amygdalina, Thymus schimperi, Otostegia integrifolia, Olea europaea, Ocimum basilica* and *Justicia schimperiana* in their homegardens. This was similar to the observation made by Fisseha Mesfin *et al.*[35]. In addition, Doyu Armon Project was established to collect and cultivate wild medicinal plants in South East of Fiche town. This project was implemented in collaboration with Australian woman Elizabeth d'Avigdor from Southern Cross University and Mr. Lakew Gebeyehu from Fiche. In February 2012, ETSE-FEWUS formal association group was established with the cooperation of Fiche community members and local healers to conserve medicinal plants in north of Fiche town. By the request of first author and Elizabeth d'Avigdor, Fiche town administrator provided a piece of land for the group in which cultivation of different medicinal plants started.

Acknowledgements

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