

Review

The dynamics of medicinal plants utilization practice nexus its health and economic role in Ethiopia: A review paper

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Medicinal plants play important roles in human and animals disease treatment. 1000 medicinal plant species are identified and reported in the Ethiopian Flora. They contribute and is more preferable for new drug development. Ethiopia has the potential to become an important source country, given the diversity of plants and the rich traditional knowledge regarding their use. The main sources of medicinal plants for utilizers are the wild forests. There is also cultivation practice of medicinal plants in home garden. About 80% of human and 90% of livestock population in Ethiopia depends on utilization of medicinal plants for primary health care. The knowledge transfer of medicinal plants in Ethiopia is largely oral. Most parts of medicinal plants commonly used are leaves and roots. Utilization of leaves for drug preparation is important for conservation of medicinal plants since harvesting leaves may not cause detrimental effect on the plants compared to the root or whole plant collections. Medicinal plants play a crucial role in health care needs in Ethiopia, because modern health care do not have adequate and equitable health service. Moreover, they depend on medicinal plants due to financial limitations related to rapid population growth and poor economic performance. In Ethiopia the market for essential oils of medicinal plants is very high and increasing in alarming rate. In the year 2011, 1,596.5 tons of essential oils of medicinal plants was imported and more than 30 million USD spent. Through increasing production potential and modernizing the sector of medicinal plants, they play a great role to substitute import and export. Medicinal plants have great potential to contribute to economic development and poverty alleviation in Ethiopia. Environmental degradation, deforestation, agricultural expansion over exploitation and population growth is the principal threats to medicinal plants in Ethiopia.

Key words: Medicinal plants, utilization, economic role.

INTRODUCTION

Medicinal plants still play important roles in the daily lives of people living in developing countries of Asia and Africa, including Ethiopia. Medicinal plants not only serve as complements or substitutes for modern medical

treatments, which are often inadequately available, but also enhance the health and security of local people. Thus, these plants play indispensable roles in daily life and are deeply connected to diverse social, cultural, and

economic events associated with life, aging, illness and death (JAICAF, 2008).

Globally, the estimate of medicinal plant species ranges from 35, 000 - 50, 000 species and out of this about 4000 - 6000 species have entered the world market of medicinal plants (Bekele, 2007). There are 6500 species of higher plants in Ethiopia, making the country one of the most diverse floristic regions in the world (Bekele, 2007). The plant kingdom is the most essential to human well-being in providing basic human needs. Human beings used plants for the purpose of disease control and prevention since time immemorial (Yirga et al., 2011). Medicinal plants are important for health care and remedy for diseases and injury. They are also used traditionally for foods and drinks (Bekele, 2007). Early humans acquired knowledge on the utilization of plants for disease prevention and curative purposes through many years' experience, careful observations and trial and error experiments (Martin, 1995).

The common use of medicinal plants has resulted in traditional health care becoming a profitable, multinational business. Billions of US dollars are spent annually on traditional medicine in many developed countries. In 2012, 32 billion dollars were spent in the United States of America on dietary supplements, an amount expected to increase to 60 billion dollars in 2021 (Samuel et al., 2015). The World Health Organization estimates that the global market of traditional medicine is approximately US \$83 billion annually (Robinson and Zhang, 2011). Traditional medicines also contribute to the development of pharmaceutical treatments by providing raw materials derived from plants like digitalis, alkaloids, morphine, quinine, and vinca. According to Samuel et al. (2015) one-third to one-half of pharmaceutical drugs was originally derived from plants. Traditional medicine has contributed and is more preferable for new drug development because Bioactive compounds derived from herbal medicines are more likely to have minimal toxicity, and a long history of clinical use suggests that herbal medicine may be clinically effective (Koehn and Carter, 2005).

About 80% of human and 90% of livestock population in Ethiopia depend on utilization of traditional medicines for primary health care on different types of health problems (Unnikrishnan, 2009; Berhane et al., 2014; Negero et al., 2015). This is because traditional medicines are easily affordable and there are limited modern health care centers (Yirga et al., 2011).

Additionally, according to Bekele (2007), the major reasons why medicinal plants are demanded in Ethiopia are due to culturally linked traditions, the trust the communities have in the medicinal values of traditional

medicine and relatively low cost in using them. Ethiopia has the potential to become an important source country, given the diversity of plants and the rich traditional knowledge regarding their use as medicine. Comprehensive documentation of traditionally written and oral literature pertaining to medicinal plants, herbal drugs, disease entity, drug formulation and dosage regimes need to be practiced.

Demands for medicinal plants in rural parts Ethiopia for human, livestock and plant health, where people do not have access to modern medical services, are increasing due to cultural acceptability of medicinal plants. But medicinal plants and associated knowledge are disappearing at an alarming rate. Despite the wide utilization practice of medicinal plants, the information about their health and economic role in Ethiopia has not been well summarized and documented. Thus, the objective of this paper is to review medicinal plants production, documentation and utilization practices in relation to health and economic role in Ethiopia.

STATUS OF MEDICINAL PLANTS IN ETHIOPIA

Approximately 6,500 higher plant species were obtained in Ethiopia. Of these, 12% are endemic; hence one of the six plant biodiversity rich countries of Africa (UNEP, 1995; Kassaye et al., 2006). The diversity is also considerable in the lower plants, but exact estimates of these have to be made. The genetic diversity contained in the various biotic make up is also high, thus making the country a critical diversity hot spot for plants (Endashaw, 2007). Ethiopia is one of the two world's 25 biodiversity rich area hot spots. Which is the eastern Afromontane Biodiversity Hotspot and the Horn of Africa-Biodiversity Hot Spot (National Herbarium, 2004; Ermias, 2005; Haile, 2005 and Endashaw, 2007). These hotspots house most of the useful wild biodiversity, particularly that of medicinal plants (Thulin, 2004).

Globally, the estimate of medicinal plant species ranges from 35,000 - 50,000 species; and out of this, about 4000 - 6000 species have entered the world market of medicinal plants. However, only about one hundred species have been used as a source of modern drugs (Edwards, 2001). The traditional medicinal plant industry is one of the few industries that have escaped large scale commercialization by both foreign and domestic interest; and consequently it remained as a largely informal industry with virtually no official trade industries in Ethiopia. In developed countries, it is only recently that tremendous interest in bioprospecting, with pharmaceutical companies and universities is moving forward (Endashaw, 2007).

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In Ethiopia, ethno veterinary medicine is also highly practiced by different local communities. The coverage is very high and the National Health Research document emphasized the importance of traditional practices and recommended research undertakings (Endashaw, 2007). In Ethiopia, medicinal plants are widely cultivated and utilized. According to EIAR (2016) a total of 134,541.97 ha areas are covered by herbs and aromatic plants in Oromia region, Amhara and SNNPRS. A large number of medicinal plants was documented and widely used to treat various human and livestock ailments in various parts of the country. However, these resources are under threat due to different reasons. For instance, *Brucea antidysenterica*, *Cordia africana*, *Cucumis ficifolius*, *Euphorbia abyssinica*, *Hagenia abyssinica*, *Ficus sur*, *Olea europaea* subsp. *cuspidata*, *Podocarpus falcatus*, *Millettia ferruginea*, *Myrica salicifolia* and *Withania somnifera*, are highly threatened (Asmamaw and Achamyeleh, 2018; Nigussie et al., 2018).

In Ethiopia, except for a few cases where a few food crops with medicinal value are cultivated, there is no organized cultivation of plant species for medicinal purposes. The reason for this is that the quantities of medicinal plants traded are very small, and there is no organized large-scale value for addition and processing. However, there is a potential in the future for increased demand for some of the species (Bekele, 2007). According to EIAR (2016), more than 80 indigenous and exotic species are conserved in its botanical garden. To develop and enhance production, processing, marketing and utilization technologies of Medicinal Plants, Ethiopian Institute of Agricultural Research, established the Wondo Genet Agricultural Research Centre. Despite availability of diverse favorable climate, ecology, topographic conditions and existence of a conducive investment climate for the development of medicinal plants, this subsector is far from realizing the country's expectations. This is mainly due to prevailing constraints, such as lack of high yielding and quality competitive varieties, unavailability of sufficient horticultural management practices, limited knowledge about pest and disease management, limited level of awareness creation about the sector, limited technologies on post-harvest processing and quality assurance issues, limited information and knowledge about the available genetic resource potentials for proper exploitation, limited knowledge and information on Good Agricultural Practices (GAP) and Good Manufacturing Practices (GMP), and limited effort made for development of the whole value chain integration of the herbs and medicinal plants subsector (EIAR, 2016).

DIVERSITY AND CULTIVATION OF MEDICINAL PLANTS IN ETHIOPIA

Around 1000 identified medicinal plant species are reported in the Ethiopian Flora; however, others are still

not identified. About 300 of these species are frequently mentioned by different authors. Researchers estimated that about 60% of the flora to be medicinal and most sources give about 10% of the vascular flora to be medicinal (Bekele, 2007).

In Ethiopia, the greater concentration of medicinal plants is found in the south and southwestern parts of Ethiopia; following the concentration of biological and cultural diversity (Edwards, 2001). A study at the Bale Mountains National Park in the South East Ethiopia revealed that the area turned out to be a medicinal plant hotspot with 337 identified medicinal species of which 24 are endemic (Haile, 2005). The cultivated medicinal plants are mostly produced in home gardens either for medicinal or primary purposes. Medicinal plants of home gardens are known to the public as the knowledge about them is open or readily available to the public (Zemede, 1999, Feyyesa et al., 2015). Banjaw et al. (2016) carried out a study to assess the Aromatic and Medicinal Plants in Wondogenet Agricultural Research Center Botanical Garden, South Ethiopia. The results showed that twenty-seven plant families, having sixty-one plant species, were identified. The Lamiaceae family contains the greater number of species and is followed by the Asteraceae family.

Asnake et al. (2016) reported that a relative high diversity of plants (94 plant species) which are used to treat malaria came from the South Nations and Nationalities of People region. Assefa et al., (2014) conducted a research study to identify medicinal trees and shrubs, including documentation of local knowledge about their utilization and management in Benna Tsemay district of Southern Ethiopia. The result showed that medicinal trees and shrubs that they collected belonged to 15 families and 20 genera. The plant family with the largest number of trees and shrubs used for medicinal purposes was Fabaceae, which comprised 13% of the medicinal trees and shrubs identified. Similar results were presented by Haile and Delenashaw (2007).

In an ethnobotanical study conducted on medicinal plant species at Menjar shenkora area by Alemayehu et al. (2015), they showed that there was a good number (118) of medicinal plants, and there are people who have the indigenous botanical and medicinal knowledge of the plants to make their use more applicable. Among the plant families that contributed more medicinal species were the Asteraceae (9.3% of the total species), followed by Lamiaceae (8.5%), and Fabaceae (7.6%). This could be an indication that the study area consists of considerable diversity of plant species within these families in the same composition as the flora of the entire country, where these families are among the few with the highest number of species that are widely distributed both in terms of their geographical and habitat spans (Alemayehu et al., 2015).

Berhane et al. (2014) conducted their study to assess use and management of traditional medicinal plants by

Maale and Ari ethnic communities in southern Ethiopia and reported that a total of 128 medicinal plant species, belonging to 111 genera and 49 families, were used as herbal medicine by Maale and Ari communities. In a study conducted at Wolayita zone (Seta et al., 2013), a total of twenty-three plant species with medicinal value were recorded and included in nineteen genera and fourteen families. This accounts for 20.54% of the most useful plant species studied. Species of the family Asteraceae were the most used plants representing about 26.1% of all medicinal plants, followed by the family Lamiaceae (17.4 %). Majority of the medicinal plants were herbs (78.3%), tree species and shrubs accounted for 13.04 % and 8.70 % respectively. The most frequently used plant part in the study area is the leaf with 78.3% (Seta et al., 2013).

Abera (2014) reported that family Asteraceae was represented by 5 species followed by 4 species of Lamiaceae in Ghimbi district. Alemayehu et al., (2015) also reported that Lamiaceae and Solanaceae families were widely distributed in minjar shenkora district. Giday et al. (2006) also reported similar results. According to Zerabruk and Yirga (2011), a total of 26 species of medicinal plants were collected and identified for treating 36 human ailments at Gindberet district, Western Ethiopia. According to Alemayehu et al. (2015), traditional medicinal plants harvested in the study area were from home gardens, crop field and in agricultural margins or fields. Similar results were also reported by Megersa et al. (2013). According to Hunde et al. (2006), medicinal plants utilized by indigenous people of 'Boosat' are collected from the wild, few being under cultivation. They are distributed in woodlands, shrub lands, rocky hillsides, degraded woodlands, grazing and browsing lands, roadsides, in farmlands, farm borders and spiritually protected areas.

In a study conducted in the central zone of Tigray (Yirga, 2010), twelve traditional healers were interviewed to gather information on the knowledge and use of medicinal plants used as a remedy for human ailments and it was reported that 16 plant species were commonly used to treat various human ailments. Most of these species (68.75%) were wild and harvested mainly for their leaves and the remedies were administered through oral and dermal methods. A different study (Pankhurst, 2001) indicated that, the main sources of medicinal plants are the wild forests. However, the increase in population growth rate would result in the intensification of agriculture in marginal areas that would lead to deforestation with a decrease in number, or major loss, of medicinal plants in the wild. According to the socioeconomic survey conducted by Abdulhamid et al. (2004), they showed that most of the respondents expressed willingness to cultivate medicinal plants. The shift from cereal cultivation to medicinal plants could support forest development by changing the livelihood systems from cereal cultivation to alternative income

generation schemes, including medicinal plant cultivation. Plantations of medicinal plants can be made in degraded areas. There are many medicinal plants in Ethiopia that have good properties for land rehabilitation and erosion control, which could be planted in different agro-ecological settings (Bekele, 2007).

Etana (2006) studied the use and conservation of traditional medicinal plants by indigenous people in Gimbi Woreda, Western Wollega. The result showed that 211 species (52%) were collected from home gardens and 168 from the wild, and 9 species were recorded in both areas, of which 85 (40.3%) are medicinal plants. From 52 plant species of the home garden, 30 species (57.7%) are associated with food service, followed by plants that are used for medicinal services, 23 species (44.2%); and among 168 plant species found in the wild, 62 (37%) are medicinal plants. The study conducted by Tadesse et al. (2005) in Seka Chekorsa, Jimma Zone, indicated that among the 39 medicinal plants collected for the treatment of 24 different kinds of diseases, most of them were collected from the wild, while very few are cultivated.

In a study conducted in Kaffa Zone by Tesfaye and Sebsebe, (2009), they reported that the medicinal plants are always cultivated on the upper slope of the home garden, specifically behind the house. The zone of medicinal plant cultivation and collection is always kept clean. Animal wastes or any other garbage are not damped in this zone. Weedy medicinal plants are also collected from this site, even when they occur throughout the garden. Kafficho people give four reasons for this: 1) to prevent contamination by discharge of animal waste in the lower slope of their house, 2) to protect them from livestock, 3) situate them out of human sight, and 4) ensure a continuous supply of medicine for the household. If medicinal plants are grown in a home-garden quarters with high soil nutrient, they grow faster, complete their life cycle within a relatively shorter period and then die; a situation not preferred by farmers. Instead, the farmers want the medicinal plants to remain longer in their gardens so as to ensure a prolonged harvest, and they achieve this by maintaining the plants even under stressed conditions that can subdue plant growth.

Mesfin et al. (2009) carried out a study to assess the ethnobotanical value of medicinal plants in Wonago Woreda, SNNPR, Ethiopia. The results showed that the conservation of medicinal plants in the study area was limited except in *Juniperous* and *Eucalyptus* dominated plantations, which were the only protected natural vegetation areas. Feyessa et al. (2015) assessed the medicinal plants use and conservation practices in Jimma Zone, South West Ethiopia, and they reported that 48.91% of the respondents explained that people cultivated medicinal plants; whereas, 37% collected from wild habitats and less than 20% obtained them from market or from their neighbors. This indicated that medicinal plants need more attention in production, and

Table 1. Source of medicinal plants in Jimma zone Seqa Chekorsa and Kersa woreda.

| Medicinal plant cultivation | Frequency | Percentage |
|-----------------------------|------------|------------|
| Cultivated | 112 | 48.91 |
| Collected at wild habit | 85 | 37.12 |
| Buy in market | 17 | 7.42 |
| From neighbors | 14 | 6.11 |
| Others | 1 | 0.44 |
| Total | 229 | |

Source: Feyyesa et al. (2015).

Table 2. Cultivation status of medicinal plants in Jimma zone Seqa Chekorsa and Kersa Woreda.

| Medicinal plant cultivation | Frequency | Percentage |
|-----------------------------|------------|------------|
| Cultivated | 114 | 59.69 |
| Collected at wild habit | 11 | 5.76 |
| Buy in market | 42 | 21.99 |
| From neighbors | 24 | 12.57 |
| Others | 0 | 0.00 |
| Total | 191 | 100 |

Source: Feyyesa et al. (2015).

accessibility to the community by minimizing an unstructured production approach. They also reported that 59.69, 5.79, 21.99 and 12.57% respondents commonly cultivate medicinal plants in home gardens, mixing with other crops, maintained in live fences, and in agroforestry respectively (Table 1).

Giday et al. (2006) also conducted a survey to assess medicinal plants in Shinasha, Agew-awi and Amhara peoples in Northwest Ethiopia and reported that major sources of medicinal plants were cultivated in home gardens. In a survey conducted in Hawzen district, Northern Ethiopia, 33 species of medicinal plants were collected and identified for treating 25 human ailments. Most (51.5%) of the traditional medicinal plants were collected from the wild; furthermore, leaves (65%) and roots (17%) were the most commonly used plant parts for herbal preparations. Most (85.7%) of the traditional medicinal plant preparations were used in fresh form. Oral, dermal and nasal were the routes of application of remedies. Squeezing, grinding, boiling, chewing, crushing and tying were the methods of remedy preparation.

In another study conducted in Seka Chekorsa, Jimma Zone, 39 (Tadesse et al., 2005) medicinal plants were collected and identified for the treatment of 24 different kinds of diseases. Thirty-three of them are used as polyherbal prescriptions and 20 are used as a single plant source to treat diseases. The study indicated that leaves are the most commonly used (58%), followed by roots (11%), complete plants and fruits (9%), stem and

bark (2.6%) and (1.3%), respectively. Most of the medicines are taken orally (77%), followed by external application (topically on skin-bandaging or ointment (15.8%) and nasal inhaling (7%) (Tadesse et al., 2005) (Table 2).

MEDICINAL PLANTS UTILIZATION PRACTICE AND PLANT PARTS USED

Before the end of the 19th century, Ethiopia had little knowledge of exercising the modern type of health care practices. People were dependent on natural resources and the various techniques that they had developed to enhance healthcare facilities. Traditional techniques and herbal remedies were widely used by traditional healthcare systems throughout the country. The delivery of the basics of health care services in Ethiopia was started towards the end of the 19th century (Kebede, 2010).

Modern health care has never been, and probably never, provide adequate and equitable health service anywhere in Africa, and Ethiopia in particular, due to financial limitations related to rapid population growth and poor economic performance. Thus, medicinal plants continue to be in high demand in the health care system as compared to the modern medicine (Hunde et al., 2006). Even in modern China alone, some 800 million people use around 5000 species of plants, medicinally.

The annual demand for plant material in China is around 700,000 tonne. A survey conducted by Bekele (2007) indicated that, a total of 56,410 tonne of medicinal plants were demanded by the consumers during the year 2005 in Ethiopia. Of these 42,260 tonne, 75% was traded through different marketing channels while 25% was not traded, i.e. collected and consumed by the consumers.

In Ethiopia, even if there are a large number of herbs and aromatic plant species ranging from 600-1000, it is very hardly possible to get the exact production areas covered by herbs and aromatic plants due to lack of comprehensive assessment studies for estimation of herbs and aromatic plant production potentials. Based on the available data from some parts of Oromia region, Amhara and SNNPRS, there is a total of 134,541.97 ha areas that are covered by herbs and aromatic plants (EIAR, 2016). Between 70 and 95% of citizens in most developing countries, especially those in Asia, Africa, Latin America and the Middle East, use traditional medicines, including traditional and herbal medicines, for the management of health and as primary health care to address their health-care needs and concerns (WHO, 2002).

In an ethnomedical household survey of the Berta ethnic group of Assosa Zone, Benishangul-Gumuz regional state, mid-west Ethiopia, plant roots were the most widely used plant part (46.4%), followed by seed (14.3%), leaf (12.2%), fruit (11.2%), bark (7.7%), and stem (3.6%); while the remaining 4.6%, a combination of one or more plant parts was used. Healers also reported the use of roots in 63.3%, seeds in 17.1% and leaves in 14.6% of the plants (Flatie et al., 2009).

In a similar study conducted on the People of 'Boosat' subdistrict, Central Eastern Ethiopia, fifty-two medicinal plant species were documented, which are used to treat 43 human diseases. The category of medicinal plant species includes shrubs (46%), herbs (25%), trees (19%), climbers (8%) and hemi parasites (2%). Roots (38%) and leaves (23%) are the most frequently used plant parts. The method of preparation is by crushing, pounding and mixing with cold water to serve as a drink and chewing to swallow the juice, which accounted for 17% each (Hunde et al., 2006).

In a study conducted in central Tigray, most of the traditional healers were found to have poor knowledge on the dosage while prescribing remedies to their patients. More than one medicinal plant species was used more frequently than the use of a single species for remedy preparations (Yirga, 2010). Several studies have reported the rich medicinal flora and the knowledge around it (Zemedede, 1999; Mirutse et al., 2003; Balemie et al., 2004; Feyyesa et al., 2015; Alebie (2017), reported that 80% of the Ethiopian population, and 90% of the herbals administered to animals, is composed of traditional herbal medicine in Ethiopia. The wide spread use of traditional medicine could be attributed to cultural acceptability, perceived efficacy against certain types of diseases,

physical accessibility and affordability as compared to modern medicine (Bekele, 2007). Incredibly, most of the urban population also continued to use medicinal plants including in Addis Ababa, where 75% of the population continue to use medicinal plants regardless of access to a modern clinic. It has been documented that some diseases such as tumor "*Almaz balechira*" are well cured by traditional medicine (Bekele, 2007).

Abiyot et al. (2006) in their ethnobotanical studies reported 8 insecticides and 11 species of plants used as anti-malarial agents in one of the districts in West Gojam, Ethiopia. These species of plants are among the widely used plants for medicinal purposes. Since malaria is a serious disease in Ethiopia and many developing countries, the list of traditionally used plants to control it must be backed by phytochemical studies to develop an appropriate phytomedicine. Other studies reported include ethnoveterinary medicine of the Welenchi area presented by Hunde, *et al* (2004). Useful and widely used drugs like Digoxin and Digitoxin, from *Digitalis* leaves; quinine from the cinchona bark; reserpine from *Rauwolfia serpentina*; morphine from *Papaver somniferum*; cocaine from *Erythroxylon coca* and the anti-cancer *Vincristine* and *Viblastine* from *Cartharothus troseus* of Madagascar, and again an anti-cancer compound, bruceatin, from the Ethiopian plant, *Brucea antidysenterica*, just to name a few, are examples of the contributions of traditional pharmacopoeia (Desta., 1988).

According to Zerabruk and Yirga (2011), a total of 26 species of medicinal plants were collected and identified for treating 36 human ailments at gindberet district, Western Ethiopia. The study of Zewdu (2013) at Gonder Zuria District, indicated that forty-two medicinal plant species, representing forty-one genera and thirty-one families, were identified to treat diseases (the highest number of uses mentioned for any disease were general health (sixty-nine), respiratory (fifty-one), and gastrointestinal (twenty-eight).

Alemayehu et al. (2015) conducted research on plant parts used in the Minjar-Shenkora District, North Shewa Zone of Amhara Region, Ethiopia and reported that informants of the study area harvest different plant parts (e.g., leaves, roots, seeds, barks and fruit) for preparation of traditional drugs. The informants reported that more species (54; 45.7%), of medicinal plants were harvested to use their leaves in medicine preparation, and these were followed by roots (17; 18.5%) and fruit parts that accounted for 13.5%. Regarding the plant parts for veterinary uses, leaves are a widely used part for a range of preparations compared to the other parts.

Leaves account for greatest preparations (9.40 %), followed by root (2.56 %), flower (1.70 %), fruit and others preparations (0.85%). They also reported that area included 50.60% liquid forms (liquid obtained after crushing the plant part), exudates (sap and drop form (9.03%), powdered forms (22.28%), smashed, juiced, boiled or filtered forms 12.04 and 6.03% as unprocessed

Table 3. Various categories of ailments treated with medicinal plants as gathered from Southern and Western Ethiopia.

| Very commonly mentioned | Fairley commonly mentioned | Occasionally mentioned | Very rarely mentioned (mostly healer Domain) | |
|-------------------------|----------------------------|------------------------|--|--------------------------------|
| Stomach ache | Ascaris | Repelling mosquito | Abortion | Prevention of sterility |
| Tapeworm | Snake bite | Toothache | Anal tumor | Hemorrhoids |
| Malaria | Dysentery` | Rheumatism | Animal sickness | Expel placenta in cow |
| Eye disease | Headache | Gastritis | Asthma | Tongue disease |
| Wound | Sore | Anemia | Broken bone | Snake bite of domestic animals |
| Cold | Worms | Constipation | Insect bite | Liver disease |
| Cough | Hypertension | | Insect repellent | Sexual transmitted disease |
| | Diarrhea | Impotence | Insect born disease | Dandruff |
| Abdominal pain | Gonorrhea | | Insecticide | Lung disease |
| | | | Leech | |

plus other forms. Most of the medicinal plant preparations involved the use of single plant species or a single plant part (60.24%), while those mixing two plants or plant parts (28.3%) and three plants or plant parts (8.43%) were rarely encountered in the study area.

According to Alebie et al. (2017), the geographic distribution of anti-malarial plants is likely to be predicated on a local trend with regard to disease risk, floral diversity and cultural diversity, including traditional medicinal practices. The western lowlands of Oromia, Amhara, Tigray, Southern Nation and Nationality People (SNNP), and almost the entire areas of Benishangul Gumuz and Gambella regions represent the major malarial hotspots in Ethiopia. According to Assefa et al. (2014), a total of 23 wild medicinal trees and shrubs were identified and documented, of which 56.6% were used to treat human disease, 30.4% to treat livestock disease and 13% for treatment of humans and livestock. Most widely used aromatic and medicinal plants and their parts used were also identified in Wondogenet Agricultural Research Center Botanical Garden. Leaves are the most widely used plant part for aromatic as well as medicinal purposes. Besides, roots, fruits, flower and bark are some important parts of plants used in fresh and dry forms (Banjaw et al., 2016).

Berhane et al. (2014) conducted their study to assess use and management of traditional medicinal plants by Maale and Ari ethnic communities in southern Ethiopia, and reported that predominantly harvested plant parts were leaves, which are known to have relatively low impact on medicinal plant resources. Species with high familiarity indices included *Solanum dasyphyllum*, *Indigofera spicata*, *Ruta chalepensis*, *Plumbago zeylanica* and *Meyna tetraphylla*. Low Jaccards similarity indices (≤ 0.33) indicated little correspondence in medicinal plant use among sites and between ethnic communities (Berhane et al., 2014) (Table 3).

Alemayehu et al. (2015) conducted research on preference ranking of 5 medicinal plants that were reported to be effective for treating skin rash based on

reports provided by 6 key informants. The results showed that *Vernonia amygdalina* scored highest of all and ranked first; indicating that it is the most effective plant in treating skin rash and this is followed by *Rhamnus perinoides*. They also reported that the majority (85%) of these medicinal plants are used for the treatment of human diseases, while about 36 % were used to treat livestock. According to Mekonnen (1990) a majority of indigenous healers and modern health practitioners agree that the integration of indigenous medicines with that of other health care settings would be beneficial. Hunde (2001), Giday (2001), Giday et al.(2006), Amenu (2007), Birhane et al. (2011), Assegid and Tesfaye (2014), Alemayehu et al. (2015), Asmamaw and Achamyeh, (2018), as well as Birhanu and Ayalew (2018) all noted that people in their study areas widely utilize medicinal plants to treat human ailments. Nigusie et al. (2018) conducted a research in gozamen district and reported that ninety-three medicinal plant species were distributed across 51 families and 87 genera. Of the total collected medicinal Plants, 80 plant species were used for the treatment of human ailments and 24 species were used against livestock diseases. Eleven (11) common plants species were listed in both which were used to treat both livestock and human ailments. Asmamaw and Achamyeh (2018) conducted survey in gozamin district to assess medicinal plants utilization practice and reported that medicinal plants were widely utilized to treat human and livestock diseases.

Birhanu and Ayalew (2018) assessed indigenous knowledge on medicinal plants used in and around Robe Town, Bale Zone, Oromia Region, Southeast Ethiopia and the result indicated that 55 medicinally important plants were recorded and most of the medicinal plants documented are used for the treatment of human ailments. They also reported that there is poor indigenous knowledge transfer by elders to younger generations and the knowledge of the traditional medicine is in a verge of disappearing in the near future. Most of the young respondents interviewed in the study know very few, or

even none, of the remedies used by their elders.

Megersa et al. (2013) reported that utilization of leaves for drug preparation is important for conservation of medicinal plants, because harvesting leaves may not cause detrimental effect on the plants compared to the root or whole plant collections. Leaves are the most commonly collected plant parts for medicinal purposes (Zenebe et al., 2012). According to Birhanu and Ayalew (2018) leaf is the most harvested plant part in the Robe Town, Bale Zone, and Oromia Region, Southeast Ethiopia. Wondimu et al. (2007), Yirga (2010); Mesfin et al. (2013), Regassa (2013) also reported that leaves are widely harvested plant parts. Whereas another study by Assefa (2014) in Benna Tsemay district of southern region and a study by Limenih et al. (2015) at Dega Damot district of Amhara region of the Ethiopia reported that root is the dominant plant part collected for medicinal purposes.

Alemayehu et al. (2015) conducted the research on ethnobotanical study of medicinal plants used by local communities of Minjar-Shenkora district and reported that people of the study area prepare remedies for human and livestock ailments, either from a single plant or plant part or by mixing them. The author also indicated that most of the medicinal plant preparations involved the use of a single plant species or a single plant part corresponding to each health problem.

Gender role in utilization of medicinal plants

Men and women differ in terms of their traditional knowledge about medicinal plants for primary health care. Divisions of labour across the traditional societies assign the role of collectors and gatherers in forest, home gardeners, herbalists and custodians of seeds to women. Majority of plant species and varieties used for food and medicine are conserved and managed at the household level by women. Due to social roles assigned to women, the daily work of collecting fuel, fodder, small timber and non-timber forest products like fruits, leaves, seeds, roots, gums and barks require more frequent interaction with forest and nature, resulting in more knowledge. These gender-differentiated local knowledge systems play a decisive role in the conservation and management of medicinal plants and their use for primary healthcare (Singhal, 2005).

On the other hand, Bekele (2007) reported that medicinal plant collectors in Ethiopia (86%) are mostly men than women (14%); while the customers of medicinal plants are equally male and female.

Educational level of users for medicinal plants has little effect. Both rich and poor are equally likely to use medicinal plants. The traditional health care appears to be dominated by men (89%) in some of the study areas. Traditional healers are relatively more educated than the collectors and the traders except in smaller towns and

rural areas.

Building the healthcare treatment knowledge of women would increase access to essential cost-effective rural healthcare services. Because Women have a significant share of the workload in agriculture, household & child care responsibility, women are primary healthcare providers of the family and women have also more access to home gardens where most of the drug plants are conserved or grow. Gender can significantly influence the number of human medicinal plants (Berhane et al., 2014). Zerabruk and Yirga (2011) reported that the gender distribution of traditional healers was 84 (70%) and 36 (30%) for males and females respectively at Gindeberet district, Western Ethiopia.

PREPARATION METHODS, DOSAGE AND ROUTE OF ADMINISTRATION

Medicinal preparations of plants contain many things such as powdered plant materials, extracts and purified active substances isolated from plant materials. The medicinal plant preparation and application are accomplished in various forms. However, according to most literature sources, it has been shown that simple crushing and pounding a particular plant part(s) and homogenizing it in water are the commonly used form of herbal preparation for both human and livestock health problems. An ethnobotanical study of medicinal plants in Fentale area, in Ethiopia by Balemie et al. (2004), revealed that various routes of application are available. Among them oral application accounts for 51.7%, dermal 31%, while nasal and other account for 0.1%, each.

In the same study, Balemie et al. (2004) found that there are variations in amount, and unit of measurement of medicinal plants used by healers for the same kind of health problems. Sofowora (1982) and Dawit (1986) also showed that the lack of precision and standardization is a drawback for the recognition of the traditional healthcare system.

Samuel et al. (2015) reported that the participants in their study area have used many plant products for different disorders and they prepare the plants in different dosage forms (liquid, solid, and gaseous forms) and administer them by mixing with water, tea, egg, and honey or without any mixing. Different studies also reported similar practices (Belayneh, 2012). The plant preparations are mainly used once daily for few days (ranging from 1 day to 6 months). Most commonly used routes of administration are oral, topical, and inhalational routes of administration. Reta (2013) reported that oral, dermal, and nasal routes are the three most commonly used routes of administration.

According to Yirga et al. (2011), leaves were the mainly harvested part for traditional medicine preparation in the area. The practice does not affect the sustainable utilization of the medicinal plants in the area. The findings

Table 4. Major human disease types and number of species used by people of Boosat sub district, Central east Ethiopia.

| Disease treated | Total number of species | % of total medicinal plants used by humans |
|----------------------|-------------------------|--|
| Snake poison | 10 | 19.2 |
| Gonorrhoea | 4 | 7.2 |
| Infected wiund | 3 | 5.8 |
| Malariya | 11 | 21.2 |
| cancer | 3 | 5.8 |
| Febril Illness(mich) | 4 | 7.2 |
| Cough | 3 | 5.8 |
| Evil eye | 6 | 11.5 |
| toothace | 4 | 7.7 |
| Kideny problem | 3 | 5.8 |
| Diarrhoes | 3 | 5.8 |
| Tetanus | 4 | 7.7 |

Source: (Hunde et al., 2006).

of Mesfin et al. (2009) indicated that roots were the most frequently utilized plant parts. According to Abebe and Ayehu (1993), about 58.3% of traditional medicine is prepared from roots in Ethiopia. Regassa, (2013) reported that 70% of the preparations of traditional medicine by indigenous people of Hawassa city were drawn from mixtures of different plants or plant parts.

The medicinal plant preparations were applied through different routes of administration like oral, topical or dermal and nasal routes. Of these, oral application (54%) was the highest and most commonly used route of application followed by dermal application (29%). Both the dominant routes of administration (oral and dermal) routes permit rapid physiological reaction of the prepared medicines with the pathogens and increase the curative power (Balemie et al., 2004; Alemayehu et al. 2015).

According to Zerabruk and Yirga (2011), in Gindeberet district, Western Ethiopia the medicinal plant preparations were administered through oral, dermal and nasal routes. However, oral application (33 preparations, 67.3%) was the highest and most commonly used route of application followed by dermal application (15 preparations, 30.6%). In addition to these, the most commonly used plant parts for herbal preparations in the area were leaves (28%) and roots (28%) followed by barks (14%) and fruits (14%). In this region, 72.5% of the healers were rural dwellers.

Around Minjar Shenkora area the predominant method of remedy preparation is by crushing the plant parts (Alemayehu et al., 2015). Another ethnobotanical study of medicinal plants in Wonago Distict, SNNPR, indicated that the predominant method of remedy preparation was powdering (Mesfin, 2009). Hunde (2001), Giday (2001), Giday *et al.*(2006), Amenu (2007), Birhane et al. (2011), Assegid and Tesfaye (2014), Alemayehu et al. (2015), Asmamaw and Achamyeleh, (2018), and Birhanu and Ayalew (2018) reported that drinking (oral application)

was the dominant method of administration in different parts of the country. Nigussie et al. (2018) conducted research in Gozamen district and reported that most common route of administration is internal, particularly oral that accounted for 51.61% followed by dermal, 24.73%. Many diseases such as headache, cough, peptic ulcer disease, asthma, cold, skin disease, hypertension, and others are reported to be treated with the different plant preparations. Leaves, stems, and seeds were mainly used for treatment. The plants were obtained from home garden, market, or traditional medicine practitioners. The use of traditional medicine was significantly associated with the age of the population; particularly the age groups of 18–28 and 29–38 were highly associated with the level of traditional medicine use with a statistical significance value of $p < 0.02$ and 0.004 , respectively. Religion, family size, annual income, and marital status were found to have no association with use of traditional medicine (Samuel et al., 2015) (Table 4).

MEDICINAL PLANTS DOCUMENTATION AND INDIGENOUS KNOWLEDGE TRANSFER

The local indigenous knowledge on medicinal plants is being lost at a faster rate with the increase of modern education, which has led the younger generation to underestimate its traditional values (Pankhurst, 2001). This is partially attributed to the fact that most Ethiopian traditional medicinal knowledge is kept in strict secrecy; however, it also is dynamic in that the practitioners make every effort to widen their scope by reciprocal exchange of limited information with each other or through reading the traditional pharmacopeias (Dawit, 1986).

The acquisition and transfer of indigenous knowledge on traditional medicine, in most developing countries

Table 5. The number of human diseases and medicinal plants registered for various Ethiopian kingdoms.

| Kingdom | No. of human diseases treated | No. of medicinal plants used |
|---------------------------|-------------------------------|------------------------------|
| Axumite | 1500 | 800 |
| Zagwe | 280 | 2800 |
| Gondar | 305 | 900 |
| Kaffa | 200 | 596 |
| Libinedengel (Gondar) | 800 | 500 |
| King Hailemeleket of Shoa | 500 | 700 |

Source: (Bekele, 2007).

including Ethiopia, is passed from one generation to the next by words of mouth. Results of studies by B and M Development Consultants PLC (2001) in the Bale Area, Ethiopia also indicate that 70% of the practitioners have acquired the traditional knowledge either from their parents or close relatives. 65% have reported that they have either already trained a member of their family or that they have plans to do so. Although the majority (70%) believes that oral transfer of indigenous knowledge is effective, they have also expressed their serious concern about future validity of the method. The main reason for this concern is the unwillingness of the young generation to acquire indigenous knowledge. The young generation has other ambitions and priorities than seeking knowledge on traditional practices. As a result, collecting and compiling indigenous knowledge as written accounts seems to be a necessity. The government and, particularly NGOs involved in ethnobotanical studies can play important roles in sponsoring ethnobotanical and ethno-pharmaceutical studies to collect compile and preserve such crucial indigenous knowledge for future generations before it is too late.

According to Berhane et al. (2014), the dominant ways of medicinal plant knowledge acquisition and transfer is vertical: from parents to children through oral means. Zemed (2001) reported that indigenous knowledge of medicinal plants in Ethiopia is unevenly distributed among community members. The knowledge on medicinal plants is largely oral. However, Ethiopia's ancient church practices have documented some of the knowledge as inscribed in Parchments, which partly characterize the traditional medical system usually described as medico religious writings in Geez manuscripts of the 15th Century (Abebe and Ayehu, 1993). Other ancient written sources include the book of remedy (*Metsehafe Fewes*) of the 17th century, which contains a wide range of medicinal plant prescriptions (Fullas, 2001) (Table 5).

In a study conducted in central Tigray (Yirga, 2010), the indigenous knowledge transfer was found to be different. Some traditional healers transfer their indigenous knowledge, while others kept the knowledge with them for the sake of secrecy. The distribution of knowledge

and services are hierarchically placed. Services are obtained from the family, the neighborhood, the village or beyond. A common saying attributed to traditional wisdom goes as follows: 'Leave alone human beings, even a goat knows which twig to nibble when bitten by a snake.' (Fassil, 2005). As a consequence of the pure knowledge transition gap, most of traditional medical practitioners have shifted to the use of conventional medicines that are adulterated with herbal medicines, which may cause high damage to the patient due to antagonistic herbal-drug interactions (WHO, 2002). A study conducted by Debella et al. (2008) to check the presence of active pharmaceutical ingredients (APIs) of conventional drugs in herbal remedies prescribed or supplied by traditional healers, indicates that 51 of 76% samples prescribed for treatment of malaria, gonorrhoea, tuberculosis, tropical ulcer and diabetes and/or hypertension were found to be adulterated with one or more modern drugs. The existence of legal framework is not only intended to the promotion and integration of traditional medicines but also governs the activities of the healers who are doing dangerous practices.

Zemed (1999) studied the ethnobotany of nations, nationalities and peoples in Gambella, Benshangul/Gumuz and Southern regions of Ethiopia. The study targeted Kefficho, Wolaita, Dawro, Gamo, Dizi and Hammar people in Southern Ethiopia, the Anywa, Nuer, Komo Majanger and Opuo people in Gambella and the Mao, Berta, Gumuz, Shinasha, and Komo people in Benshangul and Gumuz region. That study reported that plants used by these people under different categories of food, medicine, craft implements, construction were documented. The study indicated that medicinal plants were important for the health care of the Maale and Ari communities, as they used at least 128 species and traditional medicine was considered as the first line of treatment by 89% of our respondents. Knowledge differed between and within ethnic groups and also among sites. The fact that knowledge transfer was predominantly to family members and in particular to first-born sons may negatively affect its continuity and may result in knowledge loss if medicinal plant resources become scarce in the future (Table 6). There is very little

Table 6. The number of medicinal plants documented for each group.

| Group | Number of Medicinal Plants Documented |
|-----------------|--|
| <i>Anywa</i> | 28 |
| <i>Berta</i> | 25 |
| <i>Dawro</i> | 18 |
| <i>Meinit</i> | 65 |
| <i>Bench</i> | 35 |
| <i>Sheko</i> | 71 |
| <i>Wolaita</i> | 13 |
| <i>Shinasha</i> | 18 |
| <i>Nuer</i> | 21 |
| <i>Majanger</i> | 5 |
| <i>Komo</i> | 9 |
| <i>Kefficho</i> | 20 |
| <i>Gamo</i> | 13 |
| <i>Gozamin</i> | 93 |

Source: (Endashaw, 2007).

ethnobotanical documentation on most medicinal species in Ethiopia. The status of phytomedicine, preparation of crude extracts and isolation of active principles is very minimal. There are, however, differences in terms of prevalence of use of species over time; for instance, the use of *T. abyssinica* has now declined mainly because of over-harvesting and degradation of wild bush lands in Shewa and Tigray (Mesfin, 1991). To save indigenous knowledge from disappearing, the young generation has a very crucial role to play. The documentation and preparation of manuals, as a means to preserve local knowledge and experience must be encouraged before they disappear along with dissemination of information on appropriate cultivation methods for scarce medicinal plants in demand. The government also ensures the rights of people to use their traditional practices which are known for their proven safety and effectiveness (Tadesse et al., 2005; Flatie et al., 2009).

Accordingly, it is highly recommended to include in the school curriculum aspects of traditional medicine and medicinal plants. School children should be introduced to the vital role traditional medicine. They have to be instilled that traditional medicine is still valid and important and that medicinal plants have been sources of several important drugs and are still potential sources of more wonder drugs. In addition, students and pupils alike should be encouraged to ask and learn from their parents and community elders about the indigenous knowledge and the practice of traditional medicine (Endashaw, 2007).

MEDICINAL PLANTS MARKETING IN ETHIOPIA

Marketing of medicinal plants harvested from wild and semi-wild stands is not common. Expansion of agricultural land and lack of cultivation efforts by local

communities are mentioned by locals to affect the availability of medicinal plant resources (Berhane et al., 2014). The survey conducted by Alemayehu et al. (2015) in two markets of Minjar-Shenkora area showed that most of the medicinal plants are not widely traded for medicinal purposes, but mostly for other uses. Since the local people prefer either collecting these plants by themselves from the available areas (vegetation's) in the district, to prepare the medicines, or they prefer to go directly to the local healers to get treatments instead of buying the medicinal plants from the market. However, some of the medicinal plants (*Allium sativum*, *Artemisia absinthium* and *Foeniculum vulgare*,) are widely traded and used as spices and others (*Eucalyptus globulus* and *Olea europaea*) are used for firewood, construction, household tools and farming tools other than their medicinal uses.

According to Megersa et al. (2013), medicinal plants are not widely sold in the market. Similar results were reported by Etna (2007) and Berhane et al. (2014). Research studies conducted on marketing of medicinal plants in Ethiopia had provided different conclusions depending on the location of the studies. A market survey of medicinal plants in rural markets around Bahir Dar (North western Ethiopia) came up with no products entirely targeted for medicine but only a collection of food spices and plant products for cosmetics use including many products used as incense or fumigants or steam bath (Hareya, 2005), possibly due to inappropriate seasons for sampling since seasonal variation exists in the products sampled. Most of the local trade of open market is dominated by a few species including *Embelia Schimperi*, *Hagenia abyssinica*, and *Glinus lotides*. The export trade includes *Caltha edulis* and gums from various species of *Boswellia* and *Commiphora*; but these plants are known to be primarily traded for their non-

Table 7. Once purchase and sale price of the most common medicinal plants.

| S/No | Species | Purchase price birr/kg | Sale price birr/kg |
|------|-----------------------------|------------------------|--------------------|
| 1 | <i>Aloe spp</i> | 2.13 | 27.5 |
| 2 | <i>Carisa spinarum</i> | 0.67 | 15.67 |
| 3 | <i>Croton macrostachyus</i> | 4.02 | 262.64 |
| 4 | <i>Hagenia abyssinina</i> | 7.85 | 47.78 |
| 5 | <i>Myrsine africana</i> | 12.71 | 35.62 |
| 6 | <i>Osmium lamifolium</i> | 1.11 | 90.29 |
| 7 | <i>Rumex absyninica</i> | 3.4 | 93.86 |

Source: (Berhane et al., 2014).

medicinal uses the former as stimulants or narcotics and the latter species for cosmetics and other industries. Survey on socioeconomic study of medicinal plants by Abdulhamid et al. (2004) compiled various uses of medicinal plants using local names in Bale. The plants include *Allium sativum*, *Ruta chalepensis*, *Zinger officinale*, *Nigella sativa*, and *Artemisia* spp. All these are cultivated plants and households have reported that many of them are maintained regularly at home.

Kloos et al. (1978) reported results from an interview-based survey in 19 markets of towns and villages distributed in the central plateau (including Addis Ababa) and rift valley covering 416 vendors and found that three taenicides: *Embelia Schimperi*, *Glinus lotiodes* and *Hagenia abyssinica* were the most frequently found species on sale WITH 241, 234 and 202 vendors respectively. The plants sold as medicine added to 41 species and these are common in markets to date. A market survey undertaken in Jimma, Bonga, Gambella and Addis Ababa in 1998 reported on some of the common medicinal plants and their trade routes within the country and to external markets indicating that there are no exports particularly for medicinal purposes (Dessaegn, 2001). Marshall (1998) also reported that Ethiopia had no legal export and import of products for medicinal use but plants of medicinal importance are exported to Djibouti and other countries as agricultural products (Table 7). Letchamo and Storck, (2006) conducted a research on medicinal plants marketed in Eastern, Central and Western Ethiopia and reported medicinal plant products that were offered in Dire Dawa, Jimma, Aggaro and Hossaina. For individuals in rural settlements, herbalist's clinics, village markets, town etc. are major retail outlets where people buy their plant medicines.

HEALTH AND ECONOMIC ROLE OF MEDICINAL PLANTS IN ETHIOPIA

Over the past 100 years, the development and mass production of chemically synthesized drugs have revolutionized health care in most parts of the world.

However, large sections of the population in developing countries still rely on traditional practitioners and herbal medicines for their primary care (Negero et al., 2015). Medicinal plants play a crucial role in health care needs of people around the world especially in developing countries (Bekalo et al., 2009). This is because modern health care has never been, and probably never will provide, adequate and equitable health service anywhere in Africa, and Ethiopia in particular, due to financial limitations related to rapid population growth and poor economic performance. Thus, medicinal plants continue to be in high demand in the health care system as compared to the modern medicine (Hunde et al., 2006). About 80% of the populations of most developing countries still depend on the utilization of traditional medicine obtained from plants (Cunningham, 1993). Medicinal plants also play a key role in the development and advancement of modern studies by serving as a starting point for the development of novelties in drugs (Pramono, 2002). Approximately 25% of drugs used in modern Pharmacopoeia are derived from plants (Schippman et al., 2002). It is widely accepted that more than 80% of drug substances are either directly derived from natural products or developed from a natural compound. And, in fact, around 50% of pharmaceuticals are derived from compounds first identified or isolated from herbs/plants (Negero et al., 2015). Thus, in Ethiopia, medicinal plants and knowledge of their use are culturally deep-rooted and contribute greatly to the health care of humans and livestock throughout the country.

An estimated 80 to 90 percent of Ethiopians use herbal medicine as a primary form of health care. Despite significant recent improvements in modern health care, many rural communities continue to have limited access to modern health care due to availability and affordability. It is widely acknowledged that the wisdom of both professional and lay healers in applying traditional medicine to support health and manage illness may be lost to future generations unless urgent efforts. Many medicines widely in use today incorporate ingredients from plants. Medicinal plants have greatly contributed to the development of modern medicines. In many developing countries such as Ethiopia, traditional medicinal plants are still commonly used in daily life and

play important roles as complements to underdeveloped modern health care services.

According to Berhane et al. (2014) herbalists' incomes obtained through giving treatments to local communities of Maale and Ari were not high; the most important aspect observed from traditional healers is local recognition and respect by the community and they also reported that on average they were consulted by patients five times per month. The charges for a treatment depended on the type of health problem treated and on patient/healers' relationships. Payment per treatment ranged from 1-10 Ethiopian Birr (equivalent to 0.05 - 0.5 \$) and sometimes were free of charge, especially in Maale area. However, in the Ari sites, traditional healers believed that whatever relation existed, the patient had to pay money for a consult; otherwise they underlined that the medicine would not be effective. Limited income obtained from marketing of medicinal plants or from treatments given to patients may have negative implications future cultivation, maintenance and conservation of medicinal plants in the landscape.

In Ethiopia the market for essential oils extracted from medicinal plants is very high and increasing in alarming rate from time to time. The country imported 1,596.5 tons of essential oils extracted from medicinal plants spending more than 30 million USD in the year 2011 from countries such as Ireland, Switzerland, South Africa, Spain, United Kingdom, Italy and Germany. The import trend of essential oils during the past 12 years has been consistently rising. The imported quantity which was 375.8 tons in the year 2000 has reached to 1,596.5 tons by the year 2011. The total increment in the past twelve years is more than fourfold, which is equal to an annual average growth rate of 14%, which is really a historic demand growth rate. It was estimated that the demand for essential oil extracted from medicinal plants is projected to reach 3,660 tons and 7,363 tons by the year 2017 and 2022, respectively, requiring a respective amount of 92 and 184 million USD annually. This suggests the existence of huge demand for essential oils locally and knocks the doors of investors to participate in the cultivation, processing and marketing of aromatic plants to get benefited from the sector (EIAR, 2006).

Cultivation of medicinal plants in Ethiopia has remained predominantly traditional over the centuries, being produced mainly by smallholder farmers operating on small plot of land around homestead and in natural forests. Most of the medicinal plants are perennials; their cultivation contributes positively for soil conservation. The processing of medicinal plants doesn't pollute the environment and production and processing of medicinal plants in agreement with green development policy of the government and are contributory to climate change adaptation and mitigation. Hence, the development of medicinal plants subsector has diverse benefits for the environment, additional income generation for the poor and small holder farmers, plays a significant role in import

substitution, contributes for agricultural diversification, for export promotion and creates valuable job opportunities for large number of people (EIAR, 2016). For persons involved in collecting and selling traditional medicinal plants, as well as in providing traditional medical services, these plants are often the most profitable commodity available. Hence, great potential exists for medicinal plants to contribute to economic development and poverty alleviation in Ethiopia. Moreover, appropriate management of these plant resources could contribute to efforts to conserve biodiversity and protect the environment.

The value of both imported and domestically produced pharmaceutical products were about ETB 1.05 billion. During the same year, the value of medicinal plants including traded and non-traded ones was ETB 423 million; making average health coverage by 42% of Ethiopian expenditure on pharmaceutical products. This is a significant saving in terms of foreign currency as well. The economic importance of the trade on medicinal plants was limited: the price of *Embelia shimperii* seeds was only 2 Ethiopian Birr (0.10 \$) per glass (about 250 ml). The product was not always available and marketed in small quantities.

Medicinal plants are widely documented to have a range of health benefits and cultivation can be beneficial to households and the wider community. Health and wealth from medicinal aromatic plants. For example, rosemary is used to treat headaches, poor circulation and as a natural breath freshener. Bay leaves can be made into an infusion to relieve flatulence and bloating and to help with arthritis. African basil (*Ocimum canum*) can be drunk as a refreshing tea and is used to treat diabetes, as an expectorant to clear throat and lungs, and as a mosquito repellent. Antioxidants are found in many spices and herbs which can contribute to the body's defense against cardiovascular disease and intestinal cancers. Roselle (*Hibiscus sabdariffa* L.) red calyces (based on 100 g dry weight) contain 6.4 % protein, 79.3 % carbohydrates, 5.1 % fat, 2.7 % crude fiber, and 6.5 % ash. Its leaves are emollient and are used in Guinea mostly as a diuretic, refrigerant and sedative and used to sour the curry or "dal" preparation in Bangladesh as well as the young leaves is used as a vegetable (JAICAF, 2008).

MAJOR THREATS TO MEDICINAL PLANTS AND ASSOCIATED INDIGENOUS KNOWLEDGE

Home based medicinal plants use relies on plants of the home garden, weeds and that grow wild around human habitation. The cultivated medicinal plants are mostly produced in home gardens, either for medicinal or rather primary purposes. Medicinal plants obtained from wild habitats are found in different natural ecosystems of the forests, grasslands, woodlands, wetlands etc. (Zemede,

1999). The demands of the majority of the people in developing countries for medicinal plants led to over exploitation of wild sources, environmental degradation, agricultural expansion, loss of forests and woodlands, over-harvesting. Consequently, many species are being extinct, threatened or endangered (Omobuwajo et al., 2008).

According to WHO (1986), 90% of plant materials used as medicinal plants are collected from the wild with parallel regeneration programs and as a result many medicinal plant species are driven to extinction or severe genetic loss. However, as observed by WHO (1986), detailed information is not available. When a population may suffer both from heterozygosity and allelic diversity loss and if such threats continue genetic drift can be avoided.

In general, studies in different parts of the country indicated that, medicinal plants were highly threatened by Environmental degradation, deforestation, agricultural expansion over exploitation and population growth is the principal threats to medicinal plants in Ethiopia (Ensermu et al., 1992; Zemedede, 2001; Balemie et al., 2004; Mesfin et al., 2009; Geday, 2001; Alemayehu et al., 2015; Birhanu and Ayalew 2018). Medicinal plants can have uses other than sources of medicines and threats from over harvesting, may be due to or partly due to their collection for purposes other than medicinal uses. Thus, as elsewhere in Africa, in most region of Ethiopia, Ethiopia's plant based traditional medicine is faced with problems of continuity and sustainability (Ensermu et al., 1992; Zemedede, 2001; Abebe, 2001; Balemie et al., 2004). In Ethiopia the traditional medicinal plants and its knowledge which is available in rural communities and perpetuated by word of mouth within families and the communities are fragile traditional skills that are likely to be lost when communities emigrate to towns or to other region with a different flora; and can also be lost by life style changes, by industrialization, rapid loss of natural habitats. Additionally, the expansion of modern health institutions, schools some environmental and cultural modifications were among the reasons for the loss of the knowledge on medicinal plants (Alemayehu et al., 2015).

The study conducted by Etana, (2006) to assess use and conservation of traditional medicinal plants by indigenous people in Gimbi Woreda, Western Wellega reported that several cultural beliefs and traditions were recorded as threatening factors. Sustainable use of medicinal plants has now grown to be a timely issue in Ethiopia because of resource degradation in the lowlands and highlands alike. Ecosystem conservation will ensure in-situ conservation of medicinal plants so as to apply sustainable harvesting methods for collecting medicinal plants from wild habitats.

In an ethnobotanical study conducted on medicinal plant species used to manage human ailments at Bale Mountains National Park, Southeastern Ethiopia, 56 ailments were reported to be managed using 101

different ethno medicinal plant species. Most medicinal plant species reported in this study were found to be under threat and this calls for urgent conservation measures so as to maximize the sustainable use of these vital resources in the study area (Yineger et al., 2008). This is due to those medicinal plants harvesting system and utilization system varied from culture to culture and from place to place. The medicinal plant preparation method and the indication for treating different diseases also varied from place to place based on the legendary knowledge. Many medicinal plants are also harvested for non-medicinal values such as for timber implements, fuel wood and other purposes and hence they are subjected to multiple pressures like *Hagenia abyssinica* (Bekele, 2007).

CONCLUSION

Medicinal plants play important roles in daily life in developing countries of Asia and Africa, including Ethiopia. Medicinal plants were used by human and animals to control and prevent disease for a long period of time; however cultivation practice of medicinal plants for medicinal purposes is not well organized. There is a wide variety of medicinal plants in Ethiopia in different agroecological areas. There is also a huge knowledge about the medicinal plants and their preparation by the different communities of Ethiopia. Medicinal plant harvesting systems and utilization systems varied from culture to culture and from place to place. The medicinal plant preparation method and the indication for treating different diseases also varied from place to place based on the legendary knowledge. Medicinal preparations of plants contain many ingredients such as powdered plant materials, extracts and purified active substances isolated from plant materials. The medicinal plant preparation and application are accomplished in various forms. Most commonly used routes of administration are oral, topical, and inhalational routes of administration.

The acquisition and transfer of indigenous knowledge on traditional medicine, in most developing countries including Ethiopia, is passed from one generation to the next by word of mouth/orally. Also vertically: from parents to children through oral means and is unevenly distributed among community members. To save indigenous knowledge from disappearing, the young generation has a very crucial role to play. The documentation and preparation of manual, as a means to preserve local knowledge and experience must be encouraged before they disappear along with dissemination of information on appropriate cultivation methods for scarce medicinal plants in demand. Traditional medicine has also contributed its own healing remedies, and more preferably can lead to new drug development. Majority of plant species and varieties used for food and medicine are conserved and managed at the

household level by women. Building the healthcare treatment knowledge of women would increase access to essential cost-effective rural healthcare services. Ethiopia has the potential to become an important source country, given the diversity of plants and the rich traditional knowledge regarding their use as medicine. Reports showed that the main sources of medicinal plants for utilizers are the wild forests. There is also cultivation practice of medicinal plants in home garden in different communities of Ethiopia.

About 80% of human and 90% of livestock population in Ethiopia depends on utilization of traditional medicines for primary health care on different types of health problems. The knowledge transfer about medicinal plants in Ethiopia is largely oral. Medicinal plants in Ethiopia were collected for the purpose of treating different kinds of human and animal illnesses. Most of the traditional medicinal plants were collected from the wild stands and leaves and roots were the most commonly used plant parts for traditional medicine preparations. Utilization of leaves for drug preparation is important for conservation of medicinal plants since harvesting leaves may not cause detrimental effect on the plants compared to the root or whole plant collections.

Medicinal plants play a crucial role in health care needs of people around the world especially in developing countries like Ethiopia. Because modern health care has never been and probably never will provide adequate and equitable health service anywhere in Africa, and Ethiopia in particular, due to financial limitations related to rapid population growth and poor economic performance. Despite significant recent improvements in modern health care, many rural communities continue to have limited access to modern health care due to availability and affordability. In Ethiopia the market for essential oils extracted from medicinal plants is very high and is increasing in an alarming rate from time to time. The country imported 1,596.5 tons of essential oils; spending more than 30 million USD in the year 2011 from different countries. Through increasing production potential and modernizing the sector of medicinal plants, they play a great role to substitute importing and exporting them. Great potential exists for medicinal plants to contribute to economic development and poverty alleviation in Ethiopia. Environmental degradation, deforestation, agricultural expansion over exploitation and population growth is the principal threats to medicinal plants in Ethiopia. In general, other areas to look into as regards medicinal plants are:

- (i) Increase cultivation of medicinal plants in home gardens and in farming land for large scale production
- (ii) Preserve local knowledge and experience before they disappear along with dissemination of information on appropriate cultivation methods, for scarce medicinal plants in demand.
- (iii) Establish sustainable harvesting practices in wild areas.

(iv) Establish optional harvesting techniques for cultivated plants.

(v) Provide training for traditional healers for improving their skill on cultivation and harvesting of medicinal plants

(vi) Identify genuinely effective medicinal plants and encourage their production and cultivation.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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