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ETHNOBOTANICAL SURVEY OF MEDICINAL PLANTS USED BY THE AMHARA PEOPLE IN THE AFROMONTANE LAY GAYINT DISTRICT, NORTHERN ETHIOPIA

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ABSTRACT: The study was conducted from October 2012 to June 2013. A total of 184 voluntary households were randomly selected for questionnaire-based field survey from stratified sampled ten kebeles (lowest administration unit). Informants between the ages of 20 to 84 were used to collect information on medicinal plant use. Twenty-four key informants (19 males and 5 females) were purposively selected for Focus Group Discussion (FGD) and preference ranking. A total of 104 medicinal plant species from 91 genera and 56 families were identified. From these, 73 (70.2%) of the medicinal plants were used for human treatment, 25 for livestock and 6 for both. Asteraceae, Lamiaceae and Euphorbiaceae were the plant families most represented with 9, 7, and 4 species, respectively. The most frequently used plant part was roots (43.86%). Remedies were mainly prepared as a concoction (27%) and homogenization (24%). Most of the species were native to Ethiopia with a limited number of introduced species. There was high informant consensus for popular medicinal plants. It is possible to conclude that the Lay Gayint inhabitants have a uniquely roots-based herbal medicine that remains closed to be accessed only through cultural and social pathways. Therefore, documentation is very important in order to transfer the knowledge to the coming generation as well as for development and incorporation into modern drugs.

Key words/phrases: Afroalpine, Gonder, Medicinal plants, Phototherapy.

INTRODUCTION

The use of traditional medicines dates back to over 2000 years and is a source of remedies for rural communities throughout the world (Ernst, 2005). More than 80% of the world population use traditional medicine (mainly medicinal plants) to cure their illnesses and ailments (IUCN, 1993; WHO, 2002). In Ethiopia there are more than 81 ethnic groups and many indigenous communities (Pankhurst, 2001) living with nature in different agro-ecological zones of the country, known as 'Degegna' or highland farmers, and 'Kolegna' or lowland pastoralists. The country is also a home to many languages, cultures and beliefs. Among other cultural assets, the

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use of medicinal plants to prevent and cure human and livestock (domestic animal) diseases are being appreciated and documented (Vandebroek and Balick, 2012).

The different agro-ecological zones of Ethiopia were able to accommodate various types of vegetation and medicinal plants. Dawit Abebe and Ahadu Ayehu (1993) reported that 80% of the Ethiopian population depends on traditional medicine for their healthcare. Plants have been used both in the prevention and cure of various diseases of humans and their domestic animals from time immemorial (Mirutse Giday and Gobena Ameni, 2003). Like many other developing countries, the available modern healthcare services in Ethiopia are not only insufficient but also inaccessible and unaffordable to the suburban and rural people (Haile Yineger *et al*., 2008).

Ethiopian traditional medicine is not only used for curing diseases, but also for the prevention and enhancing the human physical, spiritual, psycho-social wellbeing (Kebede Deribe *et al*., 2006). Though the country has had a written language for over 2000 years, written records are found in the last century in three forms. The first, the 'Debterras[3]', those persons who compile books of medicinal recipes mainly herbals called "*Etse Debdabe*" which consists of information on plants with medicinal value and name of diseases (Teferi Gedif and Jurgen, 2003). Often these writings on herbal medicine are composed of medicines, magic and/or superstitions. A famous writing that come across generations with the names of '*Etse Debdabe*,' herbal letters (Teferi Gedif and Jurgen, 2003). The second category of writings involved in compiling information and to some extent also carrying out some studies in traditional medical practices includes primarily French, British and Italian travellers, naturalists, pharmacologists and plant collectors who visited Ethiopia between 1830 and 1930. In the third category we find ecologists, taxonomists, ethnobotanists, chemists and pharmacologists, who work within government ministries, research institutions and educational establishments both within and outside of Ethiopia (Abera Geyid *et al*., 2005).

According to Mirutse Giday and Gobena Ameni (2003), loss of indigenous knowledge in general has been aggravated by modernization, including the expansion of modern education, which has made the younger generation underestimate its values. However, the use of traditional medicine is still widespread in Ethiopia, and its acceptability, availability and popularity is

[3] 'Debtarra' is a person who has church education, can read and write in Amharic and Ge'ez (Old somatic language) and perform church services

doubtless since about 90% of the population use it for healthcare needs (WHO, 2002). Similarly, people in Lay Gayint Woreda had such traditional practices which has been passed down orally through generations to treat both human and livestock ailments. Therefore, the major goal of this study was to identify and document diversity of medicinal plants of the Lay Gayint Woreda, evaluate the management and conservation status of medicinal plants diversity and associated indigenous knowledge of people and traditional healers.

MATERIALS AND METHODS

Lay Gayint Woreda (district) is found in the Amhara National Regional State, the South Gonder Zone located at 11°32′ to 11°39′ N latitude and 38° 06′ to 38°39′ E longitude (Fig. 1). The altitude ranges of Lay Gayint Woreda varies between 1300 m. a.s.l. at Tekeze river gorge to 4231 m. a.s.l. at Mount Guna. The woreda is divided into four traditional agro-ecological zones, namely: 'Kola, Woina-dega, Dega and Wurch' covering 10034 ha, 59942 ha, 52021 ha and 10034 ha, respectively (LGWRAO, 2013).

Of the four agro-climatic zones, over 84% of the areas were found in the highlands and middle altitude zones, which are suitable for settlement and farming. Lowland areas, which lie below 1500 m above sea level, are classified under the 'Kola' zone; the climate is hot and dry with annual mean rainfall less than 450 mm. Like the 'Wurch' zone, the area covered by the 'Kola' zone is very small compared to the other zones.

The annual rainfall of the study area ranges between 740 mm to 1290 mm and the rainfall is bi-modal with some showers during the 'Belg' season (February to May) which accounts for only 5% of the crop production, running from February to April and the main rainy season is 'Meher' which occurs from late June to early September with a peak in July and August and the nature of the rainfall is erratic and uncertain (Fig. 2).

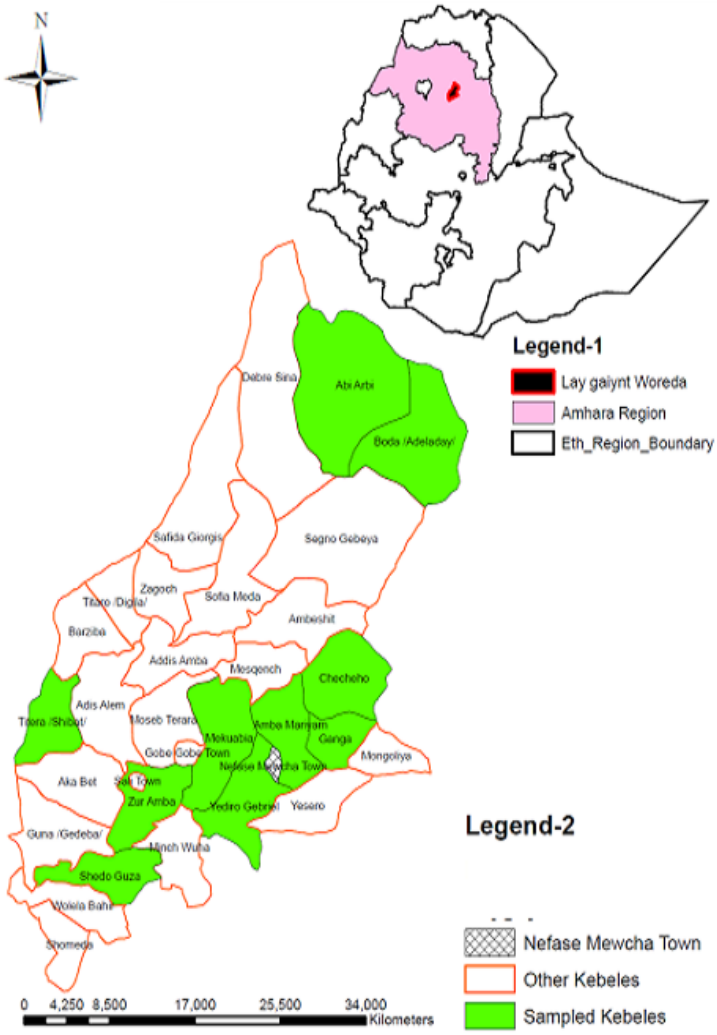

Fig. 1. Map of the study area and sites.

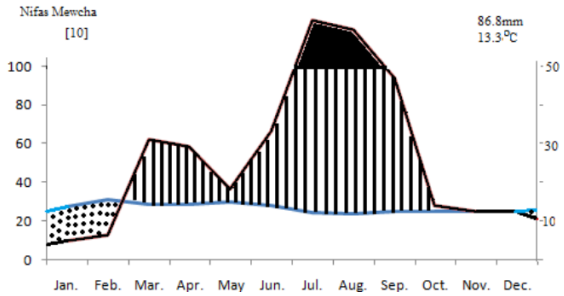

Fig. 2. Climadiagram of the study area using Nefas Mewucha Meteorological station (Data from National Meteorology Agency, Bahir Dar Directorate, 2013).

According to the Lay Gayint Woreda Rural and Agricultural Office (LGWRAO, 2013), population of the district was 248,916, with 51.2% males and only 1.98% living as urban dwellers, which is less than the zone average of 8.3%. The estimated population density was 183 people per square kilometre. The largest ethnic group was the Amhara (98%), Tigre (0.1%) and others (1%). This shows that the district has lowest ethnic dilution compared to other areas in the country. Amharic is spoken as a first language (99.96%), 96.9% of the population followed the Ethiopian Orthodox Christianity and only 2.6% were Muslims, while 0.5% of the population followed other religion.

The agricultural households were primarily engaged in crop-livestock mixed farming systems. Barley (*Hordeum vulgare*), wheat (*Triticum aestivum*), teff (*Eragrostis tef*), sorghum (*Sorghum bicolor*), maize (*Zea mays*), faba bean (*Vicia faba*), pea (*Pisum sativum*), and potato (*Solanum tuberosum*) are dominant crops while chickpea (*Cicer arietinum*) and some oil crops such as linseed (*Linum usitatissimum*) are also grown.

The top ten (major) health problems of the study area were: pneumonia, diarrhea (non-bloody), bloody diarrhea, helminthiasis, acute febrile, acute upper respiratory infection, skin infection, severe malnutrition, otitis media (ear disease) and malaria (clinical without laboratory confirmation) (LGWHO, 2013). The woreda has seven health centres, 38 health stations and three private clinics (Nifas Mewecha town). These common diseases affect people living in the rural areas where the health services are unavailable and they cannot afford to pay for drugs due to high costs relative to their income and/or living far from health services. These conditions and others have forced people to rely more on traditional health practitioners and treatments.

Data collection

In order to obtain first impression about medicinal plants, the physiognomy of the vegetation and identify sampling sites, a reconnaissance survey was conducted from October 03 to 30, 2012. The study employed purposive, cluster and random sampling methods to select specific sampling sites. Selection of the study district was purposive based on the researcher's prior knowledge of the area. The specific rural kebeles (RKs), the lowest in the administrative structure, were selected in a cluster sampling approach where all the RKs in the district were first clustered into the three major zones ('Dega', 'Woina-Dega' and 'Kola') and then four kebeles were selected from the first two zones and two from the last by stratified random sampling

procedure.

Respondents were from three age groups: young (20-35), middle (36-50) and elders (51-84). The highest number of informants were from elders group (47.8%) and middle age group (43.4%). These individuals constituted traditional healers, patients as well as other traders (herbalists) and local people. Out of these, 24 key informants (19 males and 5 females) were systematically selected based on recommendation from elders and local authorities (development agents and kebele administration leaders) in line with the description by Martin (1995). Among informants, only 21.7% had formal education at different levels, 19.5% had informal education (church and mosque education) and others (32.6%) were illiterate.

Six field trips were made between April and June, 2013 to the study kebeles (localities) following the methods described by Martin (1995) and Cotton (1996). Semi-structured questionnaire designed as recommended by Alexiades (1996) was administered to get detailed information about all the plant species sold in the market and used at home. Information gathered included: (a) vernacular names in 'Amharic" or other local languages; (b) remedies and medical purposes for both medicinal indications and/or spiritual applications; (c) plant parts used, mode of preparation, and administration for each case; and (d) specific complementary information for the preparations of remedies. In some cases, when some plants were not found in their locality, we asked their medicinal use from their vernacular names. In addition to the household survey, a total of ten kebeles were surveyed and three FGDs were conducted in each kebele.

Before starting data collection, signed consent forms were obtained from each informant. From 204 randomly selected households, 184 (152 males and 32 females) were willing to sign consent form and give information. Information was gathered and obtained from local people using semi-structured questionnaire. Questionnaires were administered at places where informants felt comfortable (villages, homes, church yards or farms) and during the convenient time that they have chosen. In order to evaluate the reliability of information, informants were visited at least two times. If ideas deviated from the information given before, it was rejected and only the consistent ones were statistically analyzed.

Medicinally useful plant specimens were collected from various habitats (around the churches, road sides, hills, mountains, river side, natural forest, live fences, farm lands, and back yards) at the spot during guided field walk and then named (locally), numbered, pressed, and dried for identification.

All voucher specimens were obtained and stored at the Teaching Herbarium at Bahir Dar University. Many of the traditional healers/herbalists provided local names of plants being used and were identified on field following Azene Bekele-Tesemma (2007). Scientific names were validated upon return to the laboratory. Nomenclature of medicinal plants was based on Flora of Ethiopia and Eritrea (Edwards *et al*., 1995; 1997; 2000; Hedberg and Edwards, 1989; Hedberg *et al*., 2003; Mesfin Tadesse, 2004).

Data analysis

The most useful information gathered on medicinal plants reported by local people include medicinal value, application, methods of preparation, route of application, disease treated, dosage, part and habit used, which were analyzed through descriptive statistical analysis as suggested by Martin (1995) and Cotton (1996).

Five key informants were chosen from each of the three strata for preference and direct matrix ranking, the latter conducted in order to compare multipurpose medicinal plants commonly reported by informants as described by Martin (1995) and Cotton (1996). The Informant Consensus Factor (ICF) was calculated as shown in Heinrich *et al*. (1998): $ICF = \frac{Nur-nt}{Nur}$ Where: ICF = Informant Consensus Factor, Nur = number of use citations and nt = number of species used. Jaccard's Coefficient of Similarity (JCS) was calculated by: $JCS = \frac{c}{a+b+c}$ Where: a = Number of species found only in habitat A (Lay Gayint Woreda), b = Number of species found only in habitat B (other Woreda) and c = Number of species found in both habitat A and habitat B.

RESULTS AND DISCUSSION

Diversity of medicinal plants in wild and home garden

In this study, a total of 104 medicinal plant species belonging to 91 genera and 56 families were collected, identified and documented. Of these medicinal plants, 78 species (75%) were collected from their natural habitats (wild vegetation), 16 species (15.3%) from home gardens and 10 species (9.7%) from both natural habitats and home gardens (Fig. 3).

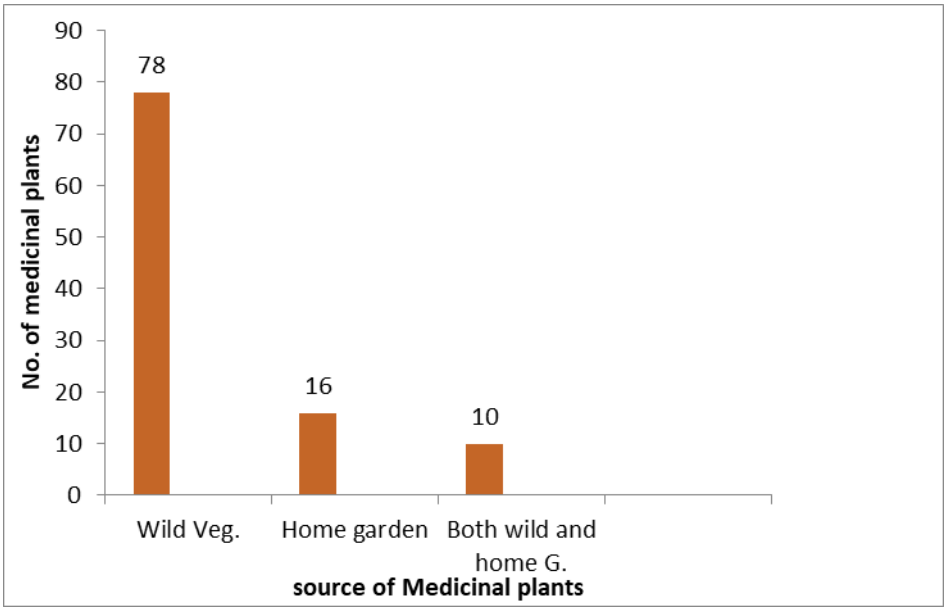

Fig. 3. Sources of medicinal plants used to treat human and livestock ailments.

According to previous studies, most of the medicinal plants utilized by the Ethiopian people are harvested from natural habitats (Mirutse Giday *et al*., 2003; Ermias Lulekal *et al*., 2008; Mohammed Adefa and Berhanu Abraha, 2011). Similarly, in the study area, most (75%) medicinal plants were harvested from natural habitats from different natural ecosystems. In contrast, home gardens contributed lesser number of medicinal plants (15.3%). This indicates that the practitioners are heavily dependent on the wild source or natural environment rather than home gardens to obtain medicinal plants, and medicinal plant cultivation is very poor in the study area. It is also indicative that the natural forest coverage of Lay Gayint Woreda is relatively very small (75 hectares) and still being over exploited by the practitioners and others for various purposes.

Diversity of habits (growth forms) of medicinal plants

The results of growth forms (habits) analysis of medicinal plants showed that shrubs made up the highest proportion being represented by 42 species (40.3%), followed by 38 species (36.6%) of herbs, 16 species (15.4%) of trees, 7 species (6.8%) of climbers and 1 species (0.9%) of succulent plants (Fig. 4). The results revealed that this finding agrees with the finding of ethnobotanical inventories conducted by Alemayehu Kefalew *et al*. (2015), Debela Hunde *et al*. (2000), Mirutse Giday and Gobena Ameni (2003) and Ermias Lulekal *et al*. (2008).

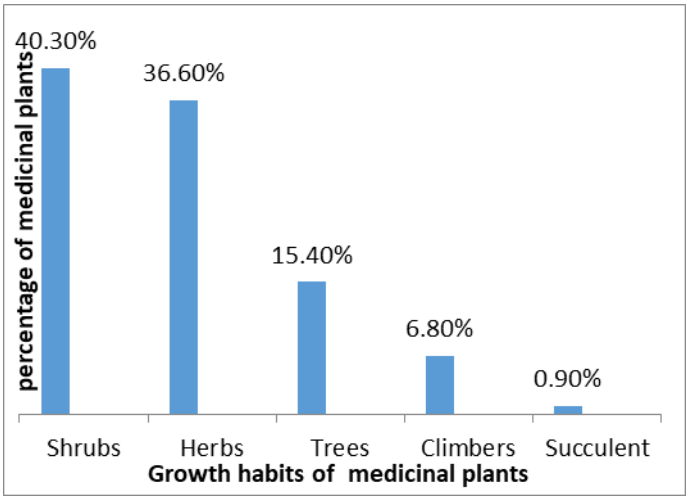

Fig. 4. Habits of medicinal plants used for treating human and livestock ailments.

On the other hand, the findings differ from the results of Tilahun Teklehaymanot (2009), wherein herbaceous medicinal plants were found to be dominant. This could be associated with the abundance and year round availability of shrub species in the study area.

Medicinal plants used to treat humans and livestock

From the total collected and recorded plant species (104 species), about 73 species (70.1%) were documented to treat human ailments, 25 species (24.4%) to treat livestock and a very few plant species (6, 5.5%) were recorded to treat both human and livestock in the study area. These plant species were distributed across 91 genera and 56 families. The family Asteraceae was represented by 9 species, followed by Lamiaceae which was represented by 7 species, and Euphorbiaceae by 4 species, whereas the Poaceae, Solanaceae, Polygonaceae, Rubiaceae, Ranunculaceae. Cucurbitaceae accounted for 3 species each while Acathaceae, Simaroubacceae, Anacardiaceae, Aliaceae, Fabaceae, Hypericaceae, Malvaceae, Moraceae, Myrsinaceae, Rutaceae and Rosaceae accounted for 2 species each. The other (remaining) families were represented by 1 species each.

In this study, most of the medicinal plants (70.1%) were used for human diseases. Similar results were reported by Mohammed Adefa and Berhanu Abraha (2011) from Tehuledere Woreda, South Wollo, Ethiopia.

A number of medicinal plants documented in this study were also found to be used as remedies in other parts of the country, as for instance, 38 (36.5%) species in Tilahun Teklehaymanot and Mirutse Giday (2007), 23 (22.1%) species in Haile Yineger *et al.* (2008) and 45 species (43.2%) in Tesfaye Awas and Sebsebe Demissew (2009). Such widespread reports on the use of these plants in different areas of the country could be attributed to validate the medicinal properties of the species. So, people in Ethiopia have a tendency to use some common medicinal plants indicating the wider distribution of the plants and cultural knowledge sharing.

Very few of the claimed medicinal plants of the study area were used for the treatment of two and more than two ailments. For example, *Verbascum sinaiticum* and *Phytolacca dodecandra* each were used to treat three human and one livestock diseases and *Hagenia abyssinica* was found to be used for four human ailments. The data also showed that most of the ailments were treated by more than two medicinal plants, while some ailments were treated by only one plant. This is in agreement with the findings of Mirutse Giday and Gobena Ameni (2003).

Conditions (forms) and parts of medicinal plants used

In this study, the conditions (forms) of plant part used revealed that most remedies (84.6%) were prepared from fresh plants and plant parts; whereas 11.2% and very small (4.2%) proportion were prepared from dried and dried or fresh plant materials, respectively. Similar results were reported in the findings of Alemayehu Kefalew *et al*. (2015), Mirutse Giday and Tilahun Teklehaymanot (2013). In contrast to this, Etana Tolosa (2007) stated that 60% of the preparations were fresh or dried followed by fresh (36.47%) and dried (14%).

The results regarding plant parts used showed that roots were the most widely used parts which accounted for 34.06% than other parts including leaves (27.47) and others (Table 1).

This finding agrees with Fisseha Mesfin *et al*. (2009) and Ermias Lulekal *et al*. (2008). However, it differs from the general pattern seen in other ethnobotanical investigations conducted in Ethiopia. For example, Mirutse Giday and Gobena Ameni (2003), Haile Yineger and Delenasaw Yewhalaw (2007) and Mohammed Adefa and Berhanu Abraha (2011) have found that leaves were the most widely used plant part in their investigations.

Table 1. Plant parts used for the preparation of remedies.

Plant parts used	Plant parts (#)	Percentage (%)
Root	31	34.06
Leaf	25	27.47
Fruit	8	8.79
Root and leaf	7	7.80
Leaf and stem	4	4.39
Stem	3	3.29
Seed	3	3.29
Milky latex	2	2.19
Fruit and seed	2	2.19
Bulb	2	2.19
Rhizome	1	1.09
Resin	1	1.09
Whole plant parts	1	1.09
Flower	1	1.09

The popularity of root parts as medicine has grave consequences both from ecological point of view and the survival of the medicinal species (Dawit Abebe and Ahadu Ayehu, 1993). Such wide harvesting of roots, which are important for survival of plants has a negative influence on the survival and continuity of useful medicinal plants and hence affects sustainable utilization of the plants. On the other hand, collecting leaves alone could not pose a lasting danger to the continuity of an individual plant compared with the collection of roots, bark, stem or whole plant. As the top source of medicine was root, this was a commonly mentioned problem by the informants.

Methods of preparation, dosage and routes of administration

The most popular method (mode) of preparation was concoction which accounted for 27.5% (Table 2) followed by pounding and homogenized preparations with water (17.8%).

Table 2. Types of preparation methods of herbal medicine.

Methods of preparation	Preparations(#)	Percentage
Concoction	37	27.5
Pounding and homogenization with water	24	17.8
Squeezing	19	14.3
Pounding alone	17	12.6
Decoction	8	5.9
Chewing	8	5.9
Powdering	6	4.4
Crushing and roasting	5	3.7
Creaming	4	2.9
Infusion/Soaking	3	2.2
Rubbing	2	1.4

In many of the treatment preparations, healers used mixture of few plants and/or non-plant additives for different reasons. For instance, informants/healers indicated that the curing (healing) potential of *Saccharum officinarum* for the treatment of chronic cough is increased by mixing it with seeds of *Nigella sativa* and leaves of *Coffea arabica* preparation. When *Kalanchoe petitiana* is used for the treatment of wounds, its efficacy is assumed to increase by mixing it with leaves of *Plumbago zeylanicum* and roots of *Verbasicum sinaiticum* and *Cucumis ficifolius*. According to Dawit Abebe and Ahadu Ayehu (1993), the effect of one plant on the other in the prescription of multiple treatments is well recognized in Ethiopian traditional medicinal practice.

Treatments and dosage determination

The informants' responses indicated that there were variations in the unit of measurement, duration and time at which remedies are taken and prescribed by healers for the same kind of health problems. Amare Getahun (1976) and Sofowora (1996) have also reported lack of precision and standardization as one of the major drawbacks for recognition of the traditional healthcare system.

In the study area, the local people used various units of measurements such as figure length for root, root bark, stem; pinch/can/cup for powdered and pounded remedy preparations in the form of liquid. The informants in the study area reported that some medicinal plants including *Hagenia abyssinica*, *Phytolacca dodecandra*, *Verbasicum sinaiticum*, and *Croton macrostachyus* are poisonous to human beings if not used with proper care. Even though these medicinal plants do have their own side effects, they are effective in treating different ailments. In this case, the healers advised to take antidotes such as milk, coffee and honey to reduce the adverse effects of such medicinal plants, if the doses are beyond the patient's capacity.

Routes of administration

The prepared medicinal plants, as described by informants, were applied through different routes of administration. The data revealed that oral application was the most common one, which accounted for 53.8%, followed by dermal (27.2%), fumigation (6.8%) and others (amulet, nasal, ocular, Eustachian, anal and bathing) had lower frequencies as routes of medicine administration.

Similar results were obtained by Haile Yineger and Delenasaw Yewhalaw (2007), Ermias Lulekal *et al.* (2008) and Emiru Birhane *et al.* (2011) who

found in their respective study areas that oral administration was the most widely used route of administration. In contrast to this finding, Gidey Yirga (2010) in Alamata reported differently, that is dermal (48%), oral (20%), nasal (16%) and others constituting 16% of the total routes of administration.

Informant consensus

Some medicinal plants which are popular in the study area for treatment of diseases are well known by the local people including healers. Based on the informants' consensus, the top ten medicinally important plants were identified in the study area. This revealed that among the medicinal plants some are more popular than others. For example, *Verbasicum sinaiticum* which was reported by 80.4% of informants stood first whereas the last one from the top ten medicinal plants was *Artemisia abyssinica* cited by 47.8% of the informants.

In this study, the results showed that the medicinal plants that are effective in treating certain diseases have higher informant consensus factor values. Among the disease categories that had high informant consensus (ICF) values were dermal health problems, ailments grouped as febrile and headache and bleeding problems (particularly that occur during labour, cuts or nasal cases) with 0.71, 0.68 and 0.62 ICF values, respectively. While higher ICF values usually indicate disease categories for which plant medicines are effective for treating the diseases, those disease categories that are only treated by healers are rare in the area and have lower ICF values (Heinrich *et al*., 1998). The dermal health problems including wound, swelling, boil, fire burn, eczema, scabies, ring worms and others not only indicate high incidence of the diseases, but also the poor socio-economic and sanitary conditions of the people.

Direct matrix ranking for multiple use of medicinal plants

The informants explained that the majority of the community in the study area rely on wild plants for various purposes such as medicinal, firewood, construction, furniture and charcoal. To assess the relative importance and to check the major impacts on the plant resources of the area, direct matrix ranking was computed as shown in Table 3. The highly preferred multipurpose tree species (*Eucalyptus globulus* and *Olea europaea* ssp. *cuspidata*) are relatively more preferred by the community than the top two medicinal plants (*Hagenia abyssinica* and *Croton macrostachyus*).

In general, the long term survival of the top ranked indigenous tree species is questionable, as they are currently threatened or highly vulnerable, because the people in the study area are totally dependent on these species for the above mentioned uses without any conservation measures.

Table 3. Direct matrix ranking of multipurpose medicinal plants by five key informants (I_1-I_5).

Plants uses	**Medicinal plants and total scores by five key informants (I_1-I_5)**				
	Hagenia abyssinica	***Croton macrostachyus***	***Eucalyptus globulus***	***Juniperus procera***	***Olea europaea***
Medicinal	25	22	16	19	21
Fire wood	20	18	24	22	25
Construction	15	10	25	19	18
Charcoal	12	20	22	18	24
Fencing	16	16	21	17	20
Furniture	10	8	22	18	13
Total score	98	94	130	113	121
Rank	4th	5th	1st	3rd	2nd

Key: 5=Best, 4=Very good, 3=Good, 2=Less used, 1=Least used, 0=No use

Threats and conservation status of medicinal plants

In this study, most informants perceived agricultural expansion (25.9%) associated with population growth to be the main threat to medicinal plants while construction was considered as the least threat (14.8%) (Table 4).

Like any other parts of Ethiopia, plant resources are vital for the livelihoods of people of Lay Gayint Woreda. However, the resources are being eroded from time to time because of the above mentioned threatening factors. Associated with this, the demand of agriculture is high and clearing of vegetation is very high. As it was observed during field observation and interviewing of informants, there are some remnant vegetation patches here and there, mainly between farm lands, in church compounds and in a very few 'protected' areas of the sampled kebeles (localities). This revealed that agricultural expansion associated with population growth was the main cause for the destruction of plants in the study area.

Table 4. Ranking of threats on medicinal plants based on their destructive effect (values 1 to 5, from the least destructive to most destructive).

Threats	**Informants (I_1-I_6)**								
	I_1	**I_2**	**I_3**	**I_4**	**I_5**	**I_6**	**Total**	**%**	**Rank**
Construction	3	4	1	3	2	3	16	14.8	5th
Fire wood and charcoal	4	3	4	5	3	4	23	21.2	2nd
Agricultural expansion	5	4	5	5	4	5	28	25.9	1st
Grazing and browsing	4	3	2	4	3	4	20	18.5	4th
Drought	5	4	3	4	3	2	21	19.4	3rd

In the study area, patchy remnant of old age tree species (*Juniperus procera*, *Olea europaea* sub sp. *cuspidata*, *Erica arborea*, *Carissa spinarum*, *Dodonaea angustifolia*, *Euphorbia candelabrum*, *Hagenia abyssinica* and other vegetation and community types) that contain many medicinal plants can be found in and around the church compounds. For instance, a patch of indigenous old-aged tree species around a church can be observed even from a distant area, usually built on an elevated area of the surrounding villages. But, because of the above mentioned threats and circumstances associated with loss of vegetation, the use of plants for medicinal purposes has declined and consequently the effective traditional healthcare system will probably be lost in the near future. This will also affect the health service provided by the traditional knowledge of the people of the study area.

Because of the strong belief and reasons associated with the culture of the local community in an area, it is strictly forbidden to cut and use trees in the church compounds and the surrounding areas. If anyone cuts the trees in and around church yards, he/she is considered in violation of the traditional bylaws or norms of the society; and stigmatized by the local people as a punishment. As a result, no one cuts and uses any tree species in and around church yards, due to fear of stigmatization and respect to religious beliefs. Under this circumstance, church compounds are the safe refuges for plants in general and medicinal plants in particular.

Furthermore, very few healers have experience to bring and cultivate the most threatened medicinal plants in their home gardens. Some households were seen cultivating or tolerating some medicinal plants including *Withania somnifera*, *Verbasicum sinaiticum* and *Artemisia abyssinica*. In this regard, Zemede Asfaw (2001) reported that the home garden is a strategic and ideal farming system for conservation, production and enhancement of traditional medicinal plants and valuable indigenous knowledge.

CONCLUSION

The third medicinal plant richness (104 species) in the region was documented in this study area. These traditional medicinal plants were harvested mostly from natural vegetation and/or home gardens. Shrubs were found to be the dominant (40.3%) growth forms or habits and roots were also found to be the most (34.06%) frequently used parts.

It is also reported that some elders, who know more about medicinal plants, may pass away without sharing and transferring their vast indigenous

knowledge to the young generation. Moreover, there is a problem in the transfer of knowledge from the elders to the young generation due to secrecy, introduction of modern education, acculturation and culture-related problems. Therefore, documentation is very important in order to transfer the knowledge to the coming generation as well as for the development and incorporation into modern drugs. To overcome these problems, the local community, healers and other knowledgeable persons should engage in cultivating medicinal plants in their home gardens as well as sustainable use and conservation of wild vegetation through training and education by local authorities/administrative personnel and government offices of different sectors.

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Annex 1. List of medicinal plants collected from the study area used for treating human and/or livestock with their habits, sources and additional uses (Habit: T=Tree, Sh=Shrub, Herb, Cl=Climber, Suc=Succulent; Source: W=Wild, HG=Home garden, W/HG=Wild or Home garden and for additional uses: Fw=Fire wood, Ch=Charcoal, Co=Construction, Fe=Fence, Fo=Forage, Sp=Spice, St=Stimulant and Ed=Edible.

No.	Scientific name	Family	Local name	Habit	Source	Other use
1	*Acanthus sennii* Chiov.	Acanthaceae	Koshelie	Sh	W	Fw, Fe
2	*Achyranthes aspera* Lam.	Amaranthaceae	Telenj/Metol	H	W	Fo
3	*Acmella caulirhiza* Del.	Asteraceae	Guticha abeba	H	W	Fo
4	*Albizia* sp.	Fabaceae	Etse libona	T	W	Fw, Ch
5	*Allium cepa* L.	Aliaceae	Key shinkurt	H	HG	Ed, Sp
6	*Allium sativum* L.	Aliaceae	Nech shinkurt	H	HG	Ed, Sp
7	*Apodytes dimidiate*	Icacinaceae	Donga	T	W	Fw, Fe, Ch
8	*Argemone mexicana* L.	Papaveraceae	Yemidir koshele	H	W	Fo
9	*Artemisia absinthium* L.	Asteraceae	Chikugn	H	H/HG	---
10	*Arundo donax* L.	Poaceae	Shembeko	Sh	HG	Co
11	*Asparagus aethiopicus* L.	Asparagaceae	Yeset kest	Sh	W	Fe, Fo
12	*Asparagus africanus* Lam.	Asparagaceae	Yeset kest	Sh	W	Fe, Fo
13	*Bersama abyssinica* Fresen	Melianthaceae	Azamir	Sh	W	Fo
14	*Brucea antidysenterica* J.F. Mill.	Simarobaceae	Waginos	Sh	W	Fo
15	*Buddleja polystachya* Fresen	Loganiaceae	Anfar	T	W	Fe, Fw
16	*Calotropis procera* (Ait.) Ait.f	Asclepiadaceae	Tobiaw	Sh	W	Fw, Fe
17	*Calpurnia aurea* (Ait.) Benth.	Fabaceae	Digita	Sh	W	Fw, Fe
18	*Canabis sativa* L.	Canabaceae	Ets fars	H	W	Fo
19	*Capparis tomentosa* L.	Capparidaceae	Gumero	Sh	W	Fe, Fw, Fo
20	*Carduus schimperi* Sch.Bip.	Asteraceae	Dandaro	Sh	W	Fo
21	*Carissa spinarum* L.	Apocyanaceae	Agam	Sh	W	Fe, Fo, Fw
22	*Centaurodendron dracaenoides* Johow	Asteraceae	Engochye	H	W	Fw
23	*Citrus limon* Risso	Rutaceae	Lomi	Sh	W	Ed, Fo
24	*Clemantis simensis* Fresen	Ranunculaceae	Azo hareg	Cl	W	Fo
25	*Clerodendrum myricoides* (Hochst.) Vatke	Lamiaceae	Misirch	Sh	W	Fo, Fw

No.	Scientific name	Family	Local name	Habit	Source	Other use
26	*Coffeea arabica* L.	Rubiaceae	Buna	Sh	HG	St, Fo
27	*Croton macrostachyus* Dei.	Euphorbiaceae	Bisana	T	W	Fw, Fe, Ch
28	*Cucumis ficifolius* A. Rich	Cucurbitaceae	Yemidir embuay	Sh	W	Fe
29	*Cyathula cyllinderica* Moq.	Boraginaceae	Chegogot	H	W	Fo
30	*Cyphostemma adenocauale* (Steud ex A. Rich.) Desc. Ex	Vitaceae	Aserkushtebeteb kush	Cl	W	Fo
31	*Datura stramonium* L.	Solanaceae	Astenagir	H	H/HG	---
32	*Dodonaea angustifolia* L.F	Spindaceae	Kitkita	Sh	W	Fo, Fe, Fw
33	*Dombeya torrida* (J.F. Gmel.) P. Bamps	Malvaceae	Welkefa	T	W/Hg	
34	*Dovyalis abyssinica* (A. Rich.) Warb	Flacourtiaceae	Koshim	T	W	Ed, Fw
35	*Echinops kebericho* Mesfin.	Asteraceae	Kebericho	Sh	W	Fo
36	*Erica arborea* L.	Ericaceae	Asta	Sh	W	Fo, Fw, Ch
37	*Eucalyptus globulus* Labil.	Myrtaceae	Nech bahirzaf	T	HG	Co, Fw, Fe, Fu
38	*Euphorbia candelabrum* Kotschy	Euphorbiaceae	Kulkual	T	W	Fw, Fe
39	*Ferula communis* L.	Moraceae	Dogg	H	W	Fo
40	*Ficus carica* L.	Moraceae	Beles	Sh	W	Fw, Fo
41	*Gnidia glauca* Fresen.	Thymelaceae	Awura	Sh	W	Fo, Fw
42	*Hagenia abyssinica* (Bruce) J.F. Gmel	Rosaceae	Kosso	T	W	Fw, Fe, Ch
43	*Hibiscus micranthus* L.F	Malvaceae	Yetija chenger	H	W	Fo
44	*Hypericum quartinianum* A. Rich.	Hypericeae	Amija	Sh	W	Fo, Fw
45	*Inula confertiflora* A.Rich	Rubiaceae	Woinagift	Sh	W	Fo, Fw
46	*Juniperus procera* Hochst. ex Endl	Cuppressaceae	Yehabesh tid	T	W	Fw, Co, Fu
47	*Jusminum grandiflorum* L.	Oleaceae	Tenbelel	Sh	W	Fo, Fe
48	*Justicia schimperiana* (Hochst. ex Nees)T Anders.	Acanthaceae	Simiza/sensel/	Sh	W/HG	Fe, Fw
49	*Kalanchoe petitiana* A.Rich	Crassulaceae	Endawula	H	W	Fo
50	*Laggera tomentosa* Oliv. & Hiern	Asteraceae	Alashume	H	W/HG	Fo, Fw
51	*Leonotis ocimifolia* (Burm.f)	Lamiaceae	Yefers zeng	H	W	Fo
52	*Lepidium sativum* L.	Brassicaceae	Feto	H	W/HG	Fo
53	*Lippia adoensis* Rochst.ex Walp.	Lamiaceae	Kessie	Sh	W	Fo, Fw

No.	Scientific name	Family	Local name	Habit	Source	Other use
54	*Lobelia rhynchopetalum* Rems	Lobeliaceae	Jibira	H	W	Fo
55	*Lupinus albus* L.	Fabaceae	Gibto	H	HG	Ed
56	*Malva verticillata* L.	Malvaceae	Tult	H	W/HG	Fo
57	*Myrica salicifolia* A.Rich	Myricaceae	Shennet	T	W	Fw, Ch, Fe
58	*Myrsine africana* L.	Myrisnaceae	Kechem	Sh	W	Fe, Fo
59	*Myrtus communis* L.	Myrtacae	Ades	S	W	Fw
60	*Nigella sativa* L.	Raunnculaceae	Tiqur azmud	H	HG	Sp, Ed
61	*Ocimum lamifolia* Hochst. ex Benth.	Lamiaceae	Damakesse	H	HG	Fo
62	*Olea europaea* sub sp. *cuspidata* (Wall. ex G.Don) Cif	Oleaceae	Woira	T	W	Ch, Fw, Fu
63	*Orobanche minor* Smith	Orobanchaceae	Yejib	H	W	Fw
64	*Osyris quadripartite* Decn.	Santalaceae	Keret	Sh	W	Fw, Fo
65	*Otostegia integrifoilia* Benth	Lamiaceae	Tunjit	Sh	W	Fw, Fo
66	*Passiflora tripartita* var. *mollissima* (Kunth) Holm-Niels. & P.Jørg.	Passifloraceae	--	C	HG	---
67	*Phagnalon schweinfurthii* Sch. Bip. ex Schwein	Asteraceae	Nib weda	Sh	W	Fo
68	*Phytolacca dodecandra* L.Herit	Phytolaccaceae	Endod	Sh	W/HG	Fo
69	*Plactranthus punctatus* (Lj) L 'Her	Lamiaceae	Dinba	H	W	Fo
70	*Plumbago zeylanicum* L.	Plumbaceae	Homma	T	W	Fw, Ch, Fe
71	*Ranunculus oligocarpus* Hochst. ex A. Rich.	Ranuculaceae	Tinkusht	H	W	---
72	*Rhamnus prinoides* l 'Herit.	Rhamnaceae	Gesho	Sh	HG	Local beer ingr.
73	*Rhus glutinosa* A.Rich	Anacardiaceae	Embis	T	W	Fw, Ch, Co, Fe
74	*Rhus natalensis* Krauss	Anacardiaceae	Takima	T	W	Fw, Fo,Ch
75	*Ricinus communis* L.	Euphorbiaceae	Gulo	Sh	HG	Oil (seeds)
76	*Rubia cordifolia* I.	Rubiaceae	Mencherer	Cl	W	Fo
77	*Rumex abyssinicus* Jacq	Polygonaceae	Mekmeko	H	W	Fo
78	*Rumex nepalensis* Spreng	Polygonaceae	Yebere milas	H	W	Fo
79	*Rumex nervosus* Vahl.	Polygonaceae	Embuacho	Sh	W	Fo, Fe, Fw
80	*Ruta chalepensis* L.	Rutaceae	Tena adam	H	HG	Sp

No.	Scientific name	Family	Local name	Habit	Source	Other use
81	*Saccharum officinarum* L.	Poaceae	Shenkora	H	HG	Ed, Fo
82	*Salix mucronata* Willd	Salicaceae	Haya	Sh	W/HG	Fo, Fw
83	*Satureja abyssinica* (Benth.) Briq.	Lamiaceae	Mut adin	H	W	Fo
84	*Satureja biflora* (Harn. ex Don) Briq.	Fabaceae	Etse libona	T	W	Fw, Ch
85	*Schefflera abyssinica* (Hochst. ex A. Rich.) Harms	Araliaceae	Getem	T	W	Fo, Fu,Ch
86	*Sida schimperiana* Hochst. ex A. Rich	Malvaceae	Chifrig	H	W	Fo
87	*Snowdenia polystachya* (Fresen.) Pilg,	Poaceae	Muja	H	HG	Fo
88	*Solanecio gigas* Vatke.	Asteraceae	Lib agiba	Sh	W/HG	----
89	*Solanum adoense* Hochst. ex A.Rich.	Solanaceae	Zirch enbuay	Sh	W	
90	*Solanum marginatum* L.	Solanaceae	Geber embuay	Sh	W	Fo
91	*Spirogira* sp.	Zygemataceae	Yewuha sefef	---	W	---
92	*Stephania abyssinica* (Dillon & A. Rich.) Wlp	Menispermaceae	Yayit hareg (Etse Eyesus)	Cl	W	Fw
93	*Thalictrum rhynchocarpum* Dill. & A. Rich.	Ranunculaceae	Sire bizu	Cl	W	Fo
94	*Thymus schimperi* Ronniger	Lamiaceae	Tosign	H	W	Fo, Sp
95	*Thymus* sp.	Lamiaceae	Tosign	H	W	Sp
96	*Tragia abortiva* M. Gilbert	Euphorbiaceae	Ablalit	Cl	W	Fo
97	*Urtica simensis* Hochst. ex A.Rich.	Urticaceae	Samma	H	HG	Ed, Fo
98	*Verbasicum sinaiticum* Benth	Scrophulariaceae	Kutintina	Sh	W/HG	Fo
99	*Verbena officinalis* L.	Verbenaceae	Atuch	H	W	Fo
100	*Vernonia amygdalina* Del.	Asteraceae	Girawa	Sh	W/HG	Fo, Fe
101	*Vernonia myriantha* Hook.F.	Myrsinaceae	Kotkoto	H	W	Fo
102	*Withania somnifera* L.	Solanaceae	Gizewa	Sh	W	Fo
103	*Zehneria scabra* L.	Cucurbitaceae	Hareg resa	Cl	W	Fo
104	*Zingiber officinale* Roscoei	Zingiberaceae	Zinjibil	H	HG	Ed, Sp

Annex 2. Jaccard's Coefficient of Similarity of Lay Gayint Woreda with five other areas with respect to medicinal plant compositions.

Sampled areas and authors	**A**	**B**	**C**	**JCS(%)**
Lay Gayint (present study)	104	-	-	
Bonga Woreda, SouthWestern Ethiopia (Tesfaye Awas and Sebsebe Demissew, 2009)	124	23	45	24.3
Zegie Peninsula, NorthWestern Ethiopia (Tilahun Teklehaymanot and Mirutse Giday, 2007)	67	35	32	23.8
Bale Mountains National Park, Oromya (Haile Yineger *et al*., 2008)	101	18	23	16.1

Annex 3. Informant consensus factor of some disease categories.

Categories of health problems	$\mathbf{N_t}$	$\mathbf{N_{ur}}$	**ICF**
Dermal health problems (wound, swelling, boil, fire burn, eczema, scabies, ring worm, sore, ulcer)	19	64	0.71
Febrile and headache ailments	14	42	0.68
Evil eye and devil sickness	18	46	0.62
Bleeding health problems (bleeding during labour, cuts, nasal bleeding)	4	7	0.5
Respiratory diseases (common cold, asthma…)	7	12	0.45