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Ethnobotanical Investigation of Traditional Medicinal Plants in Dugda District, Oromia Regio

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Abstract

Background: Ethiopia has rich flora with different plant species having medical importance in health care system based on local indigenous knowledge.

Methods: Ethnobotanical data were gathered using semi-structured interviews, field observations and group discussions with local traditional medicine practitioners. Data were analyzed using descriptive statistics. Moreover, informant consensus factor, fidelity level, preference ranking were computed following standard procedures.

Results: Ethnomedicinal use of 88 plant species distributed in 81 genera and 47 families was documented. Highest number of species (6) was under family Fabaceae, Asteraceae, Euphorbiaceae and Solanaceae. Habit wise, 38.2% were herbs followed by shrubs (32.5%) tree species (22.8%) and climbers (3.3%). Plants were used mostly in fresh for remedy preparation. The most widely used method of preparation were pounding (44.1%),crushing (26.4%) and cooking/boiling (19.5%), were the major remedy preparation methods reported. Route of administration mainly oral followed by dermal. Malaria and headache, intestinal parasite, diarrhea, amoebiasis, and stomach ache and common cold and cough had the highest ICF value > 90.

Conclusions: Indigenous people of the study area have their own ways of managing health problems of human and livestock as they are endowed with specific culture, tradition and ethical norms. Biochemical profiles of plant species used for diseases categories of high ICF should be investigated for screening of the active principles.

Introduction

Ethnobotany is the study of how people of a particular culture and religion make use of indigenous plants. It accounts for the study of the relationship between people and plants for their use as medicines, food, shelter, clothing, fuel, fodder and other household purposes [1]. In Africa, up to 80% of the population uses traditional medicine to help meet their health care needs [2]. Traditional medicines of plant origin are less costly than modern medication [3,4]. The current account of medicinal plants use of Ethiopia shows that about 887 plant species are reported to be utilized in the traditional medicine [5]. Among these, about 26 species are endemic and they are becoming increasingly rare and rare at the verge of extinction.

From the beginning of humanity, indigenous people have developed their own local specific knowledge on plant use, management and conservation [6]. In most cases, this traditional knowledge on medicinal plants passes down from generation to generation verbally and prone to loss if not documented [7]. Moreover, due to ecological shifts and environmental perturbations, plant resources are dwindling at an alarming rate, suggesting the rapid loss of medicinal plants and their associated indigenous knowledge. Indigenous knowledge develops as a result of human interaction with their environment. Traditional medical system is, therefore, shaped by the ecological diversity of the country, socio-cultural back ground of the different ethnic groups as well as historical developments, which are related to migration. In Ethiopia, for example, previous studies showed the existence of traditional medical pluralism [8]. Documentation of ethnobotanical knowledge on medicinal plants is basic for conservation and community developments. Ethnobotanical studies are often significant in revealing locally important plant species especially for the discovery of new drugs [9]. Despite the agro-ecological and cultural diversity of the country, the documentation of medicinal plants and associated indigenous knowledge appears incomplete [10]. There is no much study in western part of Ethiopia, and particularly no documented study is found from Dugda District of Oromia Region, Ethiopia. This suggesting that there is still a gap in our knowledge about ethnobotanical data on medicinal plants from various parts of Ethiopia, although we have rich and diverse ethnolingustic groups throughout the country [11]. According to Pankhurst [12], detailed information on the medicinal plant could only be obtained when studies are taking place in the various areas of the country to include places where little or no botanical and ethnobotanical explorations have been made. Among rural Oromo communities of Dugda district as would be the

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case elsewhere, traditional medication is believed to be an important health care system, which mainly involves the use of locally available medicinal plants. However, such knowledge and practices, and plant resources may be threatened due to anthropogenic and other natural factors. Thus, concerted ethnobotanical research plays a vital role to draw information on plants and related indigenous knowledge for conservation and sustainable utilization. This study was, therefore, designed to conduct ethnobotanical study of medicinal plants of Dugda district.

Materials and Methods

Description of the Study Area

Geographically Dugda district is located in between 8°01' N to 8°10' N latitude and 38°31' E to 38°57'E longitude. Dugda district is located in the East Shoa zone of Oromia Regional State that has a total area of 959.45 km2. Overall, the district has 36 rural Peasant Administrations and four urban villages. The main capital of the district is Meki town which is situated 134 km to the southeast of the capital Addis Ababa. Meki has 3 urban villages and has a population of 58,490. The boundaries of Dugda district are Arsi zone in the east, Gurage zone in the west, Bora district from north and northwest and Adami Tulu Jido Kombolcha district in the south.

Study Site Selection

Reconnaissance survey was conducted from July 27 to 30 to select three potential kebeles which included; Cirri, Wayo Gabriel and Xepho for ethnobotanical data collections.

Informant's selection

Ethnobotanical information was collected from 60 informants. Among the 60 informants, 16 key informants (traditional healers) were selected with the assistance of community leaders, elderly people and members of the local community. As pointed out by Purposive sampling technique was used for selecting key informants, while random sampling was employed to select the other 44 informants. The key informant's interviews were very important as they were considered to be experts on local medicinal plants. Generally, the informants were grouped into three age groups, young, adult and elderly (above 50) to see how the knowledge varies with age groups as described in.

Ethnobotanical Data Collection

Prior to Ethnobotanical data collection, respondents were selected from the selected kebeles. Totally, 60 respondents, 16 key informants (traditional healers) were participated in this study. Ethnobotanical data were collected between August, 2017 and October, 2017 on two field trips made to the sites. Data collection methods were through semi-structured questionnaires and interviews, group discussions and guided field walks with key informants (traditional healers) for field observations. Key informants were first interviewed individually to mention about the local names of the plants they use to treat diseases, diseases treated, part(s) of plants used, methods of gathering, methods of preparation of remedies, route of administration of remedies, application of the remedies, dosage, side effects of the treatment, use of the plants other than medicine, types of threat and conservation problems. Thereafter, group discussions were made with them based on the checklist of questions and asked for field walk for onsite observation of the plants. Similar procedure was also applied with randomly selected non-practitioners of traditional medicine. Voucher specimens were collected, pressed, and dried for identification. For some species, preliminary identification was done in the field using keys and illustrations. In addition, further identification of all specimens was done by comparison with authentic specimens, illustrations and taxonomic keys from Flora of Ethiopia and Eritrea, and with assistance of experts of Haramaya University. The identified specimens were deposited in Haramaya University Herbarium.

Data Analysis

Descriptive statistical methods (percentage and/or frequency) are employed to summarize ethnobotanical data.

Informant Consensus Factor (ICF): Informant consensus factor was calculated for categories of ailments to identify the agreements of the informants on the reported cures using the formula used by [13]. ICF was calculated as follows: number of use citations for each ailment (nur) minus the number of species used (nt) for that ailment, divided by the number of use citations for each ailment minus one.

ICF=(n_ur ⟦-n⟧_t)/(n_ur-1_)

Fidelity Level

The fidelity level (FL), the percentage of informants claiming the use of a certain plant for the same major purpose, was also calculated for the most frequently reported diseases or ailments using the following equation [14].

FL(%)=NP/N x100

Where Np is the number of informants that claim the use of a plant species to treat a particular disease and N is the number of informants that use the plants as a medicine to treat any given disease.

Preference ranking

Preference ranking is used to compare the most effective medicinal plants used by the community to treat the particular disease. Preference ranking was conducted following [15] and [16] for six most important medicinal plants used in treating bloating, as traditional healers treat it usually. For this, ten informants were selected to identify the best preferred medicinal plant species for treatment of the illness. Each informant was provided with six medicinal plants reported to cure Bloating with leaves of medicinal plant used being paper tagged then asked to assign the highest value (6) for the most preferred species against the illness and the lowest value (1) for the least preferred plant and in accordance of their order for the remaining one. The value of each species was summed up and the rank for each species was determined based on the total score. This helps to indicate the rank order of the most effective medicinal plants used by the community to treat the disease

Results and Discussions

Some Socio-Demographic Information of the Respondents

A total of 60 traditional healers were sampled. The respondents were with an average age of 48 years. Males were dominant representing (63.3 %) of the respondents. Generally, (60 %) of the

respondents were above 50 years. The majority (67%) of them was illiterate and those who attended grades one to four constituted (16%) while (17%) attended grades nine to twelve. There was a significant positive correlation (Pearson correlation coefficient, r =0.38, at $\alpha = 0.05$, $p = 0.04$) between the age of informants and the number of species reported by the informants (older respondents reported large number of species).This might be due to exposure to modern education younger people showed minimal interest in learning and practicing ethno medicinal practices. According to less medicinal knowledge in relation to young age might be attributed to the fact that traditional knowledge is built with years of experience. Advancement in science and technology is quickly pushing the younger generation into a new tradition. However, there was highly Significant negative correlation ($r = -0.24$, at $\alpha = 0.05$, $p < 0.001$) between the number of species reported and informants' educational level (illiterates reported large number of species) (Table 1 and Figure 1).

Ethnomedicinal plant species used by people of the study area

A total of 88 species of medicinal plants used to treat 68 different health problems were gathered and documented from the study area. These plants belong to 81 genera and 47 Families. Out of these plants, 51 species (57.3%) and 13 species (14.6%) were noted to treat only human and livestock ailments only, respectively while 25 species (24.5%) were used to treat both human and livestock ailments.

This suggests that local people of Dugda District practice traditional medicine of plant origin besides modern medicine. In terms of species composition, family Asteraceae, Fabaceae, Euphorbiaceae and Solanaceae each consisted of 6 species. The remaining families contained one to three species each. Some plants were reported more frequently as medicinal plants than others to treat various ailments. For example, Aloe macrocarpa L. was cited by 75% of the respondents as a source of remedy for treating different internal parasites for both livestock and humans followed by Carissa spinarum L. cited by 63% respondents for evil spirit, stabbing pain, gonorrhea and malaria; Allium sativum L. by 58% respondents to treat colds, evil eye, malaria and wounds; Croton macrostachyus L. by 51% respondents to treat Ascaris, gonorrhea, bloating, jaundice and stomachache; Vernonia amygdalina Del. by 48% respondents to treat internal parasites, jaundice and diarrhea; Dodonean angustifolia L. by 41% respondents to treat different internal parasites, ear wounds, lice and wounds and Hypoestes forskaolii L. by 37% respondents to treat diabetes, tonsillitis and bleeding (stopping of bleeding completely) (Table 2).

Of the 88 medicinal plants collected, majority are herbaceous followed by shrub, tree and climbers (Figure 2).This shows that herbs and shrubs are most widely used medicinal plants of the study area. This may be due to the abundance of these habits in the study area compared to trees and climbers. Relatively high number of herbs and shrubs for medicinal purpose has also been reported previously by Alemayehu [17] who studied medicinal plants of Ada'a District east Shoa zone.

Plant part(s) used for medicine, preparations methods and conditions

Although different plants part were reported, the most cited plant part for remedy preparations was leaf followed by root, the whole part, seed and bark. Other plant parts including fruit, bulb, stem, sap, latex were also reported. This result agrees with some previous studies conducted in different parts of the country [18-20,22]. According to [4], herbal preparation that involves roots, rhizomes, bulbs, barks, stems or whole parts have negative effects on the survival of the mother plants. In this study area use of root and entire plant part that require uprooting of plants will negatively affect their regeneration. The same is true with collection of bark and seeds. Therefore, emphasis should be given not to excessively collect these plant parts in order to ensure their survival for future use. Concerning the preparation of traditional medicine, the local people employ various methods of preparation of traditional medicines for different types of ailments. The preparations vary based on the type of disease treated and the actual site of the ailment (figure 3). Pounding (44.1%), crushing (26.4%), cooking/boiling (19.5%), squeezing (6.8%) and smoking (2.9%) were the major remedy preparation methods reported.

Preparations may involve using a single plant part or mixtures of different organs of the same plant. For example, fresh fruit of Citrus limon and bulb of Allium sativum are pounded together and mixed with honey and eaten with bread to treat a stomachache. In this study, the local people also use some other products as additives in their preparations. For example, water, oil, sugar, salt, milk, honeys are some of the additives that the local people reported to be used to improve the flavor and reduce adverse effects such as vomiting and diarrhea so that the efficacy of the traditional medicine would be maintained or increased. Such additives were also reported by some previous researchers [22-24]. Most (63.43%) remedy preparations were reported to be from fresh plant materials while 23.13% and 13.43% of preparations were from dried and fresh/dried plant materials, respectively. Similarly, a study conducted by [25] in Borana, Oromia Regional State, south Western Ethiopia, showed that using fresh materials for different health problems is more than dry materials.

Dosage, route and ways of remedy administration

The dosage of medicine to be administered is given by rough estimation of the age and physical condition of the patient. Hence there is no precision on the dosage of the remedy [26]. Reported that lack of precision in the dosage is one of the major drawbacks of practicing traditional remedy. As regards to route of administration, include through oral, dermal, nasal, and others. Overall, oral administration was reported as a dominant route of administration (60.13%) followed by dermal route (34.64 %) (Figure 3) both oral and dermal routes permit rapid physiological reaction of the prepared medicines with the pathogens and increase its curative power. This finding agrees with some previous reports (Kebu et al., 2004; Mulugeta, 2014).

Ways of applications of plant remedies

The prepared traditional medicines are applied in a number of methods, among which drinking (41.66%), eating (20.37%), painting (7.40%), put on and tide (6.48%), smoking (5.55%), rubbing (4.62%),washing (4.62), holding on (3.70%), put on (2.77%), inserting (1.85%), and sniffing (1.85%), were mentioned. In this study, drinking and eating account for the largest percentage (Table 3).

Table 1: List of medicinal plants used for human and livestock diseases in Dugda district.

No	Botanical Name and plant habit	Family	Local Name (Afan Oromo)	Health problem / disease treated	Part(s) used, conditions, mode of preparations & application	Route of Administration
1	Acacia abyssinica Hochst.exBenth Tree	Fabaceae	Laaftoo	Back pain*	Leaf: Fresh crushed leaves are mixed with water and drunk.	Oral
				Eye disease**	Leaf: Fresh leaves are pounded, squeezed and the juice is added to the eye.	Eye
				Horse scabies**	Root and bark: Fresh root and bark grounded together and wash the animal with the solution.	Dermal
2	Acacia etabaica Schweinf subsp. Etabaica Tree	Fabaceae	Doddota	Internal parasite*	Fruit: Adding the dried fruit with sugar and drunken 3 to 4 cup.	Oral
3	Agavesisalana Perrine ex.Engl. Herb	Agavaceae	Algee	Black leg**	Root: Fresh root is crushed, mixed with water and given to cattle.	Oral
4	Allium cepa L. Herb	Alliaceae	Shunkurtii diimaa	Poisoning*	Root: Tie up the dried root powder with the leaf concoction of Vernonia amygdalina and Premna schimperi.	Dermal
5	Albizia schimperiana Oliv. Tree	Fabaceae	Ambaltaa	Wound*	Bark: Dried bark of the plant powdered and applied on affected part.	Dermal
6	Allium sativum L. Herb	Alliaceae	Qullubbii Adii	Colds*	Bulb: The dried bulb is Pounded, mixed with honey and 2-3 teaspoon is eaten Every day for five days.	Oral
				Evil eye*	Bulb: The dried bulb is crushed together with one rhizome of Zingiber officinale with honey and 3 tea spoons are taken.	Oral
				Malaria*	Bulb: The fresh bulb is pounded, mixed with the crushed fresh leaves of Ruta chalepensis, and applied externally to prevent the disease.	Dermal
				Wound*	Bulb: The dried bulb is pounded and tied on the wound every two days for one week days.	Dermal
7	Acacia albida Del. Tree	Agavaceae	Garbii	Eye bruise**	Bark: Fresh bark masticated and spitted out on the eye.	Dermal

8	Aloe macrocarpa Tod. Herb	Aloaceae	Argiisa	Intestinal parasite***	Leaf: Fresh leaves chewed and swallow the juice.	Oral
				Leprosy*	Leaf: Fresh Leaves of this plant are pounded and mixed with butter and applied on the skin.	Dermal
				Bloat**	Leaf: Fresh Leaves Chewed and mixed with water and given orally	Oral
				Nose bleeding*	Leaf: Fresh Leaves are crushed and tie on The wound and squeeze in to the nose. This helps to stop nose bleeding.	Nasal
9	Azadirachta indica L. Tree	Meliaceae	Nimii/niimii dhugaa	Lice**	Leaf: First fresh leaves are prepared and applied on cattle skin.	Dermal
				Tick**	Stem: Fresh stem grounded and polishing the bitten area.	Dermal
10	Beta vulgaris L. Herb	Chenopodiaceae	Hundee diimaa	Abdominal pain*	Root: Fresh root of the plant is collected and eaten.	Oral
11	Brassica carinata A. Br. Herb	Brassicaceae	Goommana	Common cold*	Leaf: The dried leaf Powdered and mixed with water then dunk.	Oral
12	Bidens macroptera (Sch. Bip. ex Chiov.)Mesfin Herb	Asteraceae	Keelloo	Athletes foot*	Leaf: Fresh Leaves put on fire and rubbed on affected part.	Dermal
13	Calpurnia aurea (Ait.) Benth. Shrub	Fabaceae	Ceekataa	Lice**	Leaf: Fresh leaves are pounded, mixed with water and wash the boy of the animal every morning until the parasites are eradicated.	Dermal
				Diarrhea***	Leaf: Fresh leaves is chewed and swallow for humans or the seeds are roasted, pounded, mixed with water and drunk by cup and leaf is pounded, mixed with water and given to animal until the diarrhea stops.	Oral
				Syphilis*	Seed: The dried seeds are crushed, mixed with honey and one teaspoon is eaten for five consecutive days.	Oral
				Leech**	Leaf/seed: Fresh leaf or seed are pounded together with leaf of Nicotiana tabacum and are applied through the nostrils.	Nasal

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14	Capparis tomentosa Lam. Shrub	Capparidaceae	Harangamaa	Swelling**	Root: Fresh/dried root is pounded, mixed with butter and is applied to the affected breast.	Dermal
				Toothache*	Leaf: The fresh leaf of the plant is chewed and placed on the teeth for 2-3 hours.	Oral
				Evil eye*	Leaf/root: Dried Leaf or root is crushed, add to fire and smoked to the victim.	Dermal
15	Capsicum annuum L. Herb	Solanaceae	Barberee	Bloat**	Fruit: Dried fruit Pounded, mixed with water and given orally	Oral
16	Citrus limon (L.) Burm.f. Shrub	Rutaceae	Loomii	Stomach ache*	Fruit: Fresh Fruit of Citrus limon and bulb of Allium sativum are pounded together and mixed with honey and eaten with wheat bread.	Oral
17	Coriandrum sativum L. Herb	Apiaceae	Dimbilaala	Diffuse cutaneous leshmaniasis*	Leaf: The fresh leaf of this plant pound with leaf of Croton macrostachyus and creamed on pain area for 2-3 days.	Dermal
18	Carica papaya L Tree	Carricaceae	Paappayyaa	Jaundice*	Seed: Dried seeds are roasted, pounded and is drunk three coffee cups every morning for seven days.	Oral
19	Catha edulis (Vahl) Forssk .ex Endl. Shrub	Celastraceae	Catii	Urine retention***	Leaf: Fresh leaf of Catha edulis is pounded, mixed with water add local areke or katkala and is given orally.	Oral
20	Carissa spinarum L. Shrub	Apocynaceae	Agamsa	Evil spirit*	Root: Fresh root of Carissa spinarum is pounded and added to fire and smoke to the patient.	Dermal
				Stabbing Pain*	Root: Fresh Root is pounded, boiled in water and is drunk by cup.	Oral
				Gonorrhea*	Root: Fresh/dried root is crushed, boiled, add cow milk and is drunk after cooling.	Oral
				Malaria*	Root: Fresh root is pounded, insert into cold water, wait for day and is drunk.	Oral
21	Coffea Arabica L. Shrub	Rubiaceae	Buna	Wound *	Seed: Roasted fresh/dried seeds grounded, and tied on the wound.	Dermal
22	Cordia africana Lam. Tree	Boraginaceae	Waddeessa	Bleeding/c Ontinous	Bark: Fresh or dried bark drunk with one coffee cup for four consecutive days.	Oral

23	Clutia abyssinica Joub. & Spach. Shrub	Euphorbiaceae	Ulee	Toothache*	Leaf: Fresh leaves hold in teeth for 30-40 minutes.	Oral
			foonii	Wound***	Leaf: Fresh leaf is pounded and the fine powder is mixed with butter and applied on the affected part.	Dermal
				Rheumatic Pain*	Bark: Fresh bark is crushed, boiled together with honey and drunk.	Oral
24	Croton macrostachyus Del. Tree	Euphorbiaceae	Bakkanniisa	Ascaris*	Leaf and bark: The tip of fresh young leaf and the bark is pounded, boiled, add butter, cool it and after it solidifies, five to ten tablets are made and three tablets for children, five to ten tablets for elders is given.	Oral
				Bloat**	Bark: The fresh bark of root is grounded, mixed with water and given to the animal by drinking material (merti/xaasaa).	Oral
				Jaundice*	Leaf: Fresh leaf Cooked, pasted with honey and eaten.	Oral
				Gonorrhea*	Leaf: Fresh five to ten shoot tips is cut, cooked and two spoonful of the solution is drunk per a day for five consecutive days.	Oral
				Stomach ache*	Bark: Fresh bark together with bulb of Allium sativum, is pounded, mixed with butter and eaten.	Oral
25	Clematis simensis Fresen. Shrub	Ranunculaceae	Hidda	Intestinal parasite*	Root: Fresh root crushed and given for cattle by mixing in water to get relief from Internal parasite.	Oral
			fiitii	Cough *	Leave: Place young fresh leaves in the nostrils.	Nose
26	Cucurbita pepo L. Shrub	Cucurbitaceae	Dabaaquula	Hookworm*	Seed: Fresh or dried Seeds are soaked in water overnight, chew and swallowed as they are.	Oral
				Bloat*	Root: Fresh root together with Vernonia amygdalina is pounded; local areke or katukala is added and given orally.	Oral

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27	Cyphostemma cyphopetalum L Climber	Vitaceae	Gaalee	Hemmoroids *	Flower: Fresh flower is squeezed and the flower is rubbed over the wound.	Dermal
28	Cynoglossum lanceolatum Forssk. Herb	Boraginaceae	Chigoogitii	Mich*	Leaf: Fresh leaf together with Ocimum lamiifolium is pounded and drunk with coffee.	Oral
29	Datura stramonium L. Herb	Solanaceae	Manjii	Cough*	Leaf: Dried or fresh leaf is pounded; one spoon is added to a cup of coffee and drunk every morning up to four days.	Oral
				Toothache*	Seed: Fresh or dried Seeds are boiled in water and inhaled the vapour.	Oral
				Eye disease*	Leaf: Fresh or dried Leaf is squeezed and the juice is applied to the eye.	Eye
30	Dodoneaan gustifolia L.f. Shrub	Sapindaceae	Ittacha	Ear wound***	Leaf: Dried leaf Crushed mixed with butter and placed on the damaged part.	Dermal
				Tapeworm*	Flower: Fresh or dried flowers are crushed, soaked in water for a day and drunk with local katukala or farsoo.	Oral
				Internal Parasite**	Seed: Dried seed grounded, pasted with oat flour, bake and give to the animal.	Oral
				Wound***	Leaf: Fresh or dried leaf is grounded and apply to the wound after washing with squeezed leaf of Calpurnia aurea.	Dermal
				Lice**	Leaf: The fresh leaf of the plant is collected and adds water and applies on animal skin.	Dermal
31	Dovyalis abyssinica (A.Rich.) Warb. Shrub	Flacourtiaceae	Koshommii	Rheumatic Pain*	Root: Fresh or dried root powder is together with the pounded young shoot of Cordia africana is smoked.	Dermal
				Ascaris*	Bark: Fresh or dried Fine powder of pounded bark of Dovyalis abyssinica is mixed and taken at meal time.	Oral
32	Echinops macrochaetus Fresen Shrub	Asteraceae	Kosorruu	Foot and mouth Disease**	Stem: Fresh stem of this plant is chopped and fumigated to sheep.	Dermal

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33	Ehretia cymosa Thonn. Tree	Boraginaceae	Ulaagaa	Stomach ache***	Leaf or root: Fresh or dried Leaf or root is pounded, add katicala and given to cattle.	Oral
				Mich*	Leaf: Fresh leaf is crushed and is drunk.	Oral
				Taeniasis *	Seed: Fresh or dried seeds are grounded, mixed with water and is drunk.	Oral
34	Ensete ventricosum (Welw.) Herb	Musaceae	Warqee	Stomachache*	Root: Dried root is crushed, mixed with honey and is drunk.	Oral
				Leech **	Bark: Fresh or dried bark is pounded, mixed with small amount of water and is added through the nostrils for two consecutive days.	Nasal
35	Eleusine floccifolia Forssk. Herb	Poaceae	Coqorsa	Snake bite*	Above ground part: Fresh above ground part pounded and paste on the skin.	Dermal
36	Epilobium hirsutum L. Herb	Onagraceae	Ashuffee	Diffuse cutaneous leshmaniasis*	Leaf: The Fresh leaf of this plant put in fire by taking away from fire and by rubbing creamed pain area.	Dermal
37	Euphorbia tirucallii L. Shrub	Euphorbiaceae	Cadaa	Hemorrhage *	Sap: Fresh white milky sap of the plant carefully tapped on hemorrhage.	Dermal
38	Eucalyptus globulus Labill. Tree	Myrtaceae	Baarzaafii adii	Cough*	Leaf: Fresh young leaves are boiled in water and fumigate the vapour under sealed clothes at morning time.	Dermal
39	Euclea racemosa Murr. Shrub	Ebenaceae	Mi'eessaa	Gonorrhea*	Root: Fresh or dried root is pounded, boiled in water and drunk with goat milk.	Oral
				Internal Parasite*	Root: Fresh or dried Crushed root is boiled and drunk with sugar.	Oral
40	Euphorbia abyssinica Gmel. Tree	Euphorbiaceae	Adaamii	Gonorrhea*	Latex: Fresh or dried very small amount of the milky latex is mixed with grain flour, bake and eaten for five consecutive days.	Oral
				Hemorrhage*	Sap: Fresh white milky sap of the plant carefully tapped on hemorrhage.	Dermal

41	Euphoriba depauperata A.Rich. Herb	Euphorbiaceae	Anxarfaa	Eczema*	Latex and seed: Fresh Latex and pounded seed of Calpurnia aurea are mixed and applied at the part in the night for five days.	Dermal
42	Ficus sycomorus L. Tree	Moraceae	Odaa	Abdominal pain***	Fruit: Eating the fresh fruits of the plant.	Oral
43	Ficus vasta Forssk. Tree	Moraceae	Qilxuu	Worm**	Bark: Fresh bark crushed and mixed with water and two litters is given for big cattle and one Litter for calf.	Oral
44	Ficus sur Forssk. Tree	Moraceae	Harbuu	Wound***	Bark: Fresh or dried fine powder of the bark is mixed with butter, applied to the wound and sit for 10-15 minutes under the sun.	Dermal
				Urine Retention***	Leaf: Fresh leaf are pounded, mixed with water and given.	Oral
45	Guizotia scabra (Vis.) Chiov. Herb	Asteraceae	Hadaa	Wound***	Whole part: Fresh or dried The plant parts are crushed; the fine powder is mixed with butter and is applied to the wound.	Dermal
46	Grewia ferruginea Hochst. ex A. Rich. Tree	Tiliaceae	Dhoqonuu	Dandruff*	Leaf: The hair washed by fresh or dried leaves of Grewia ferruginea and used as soap.	Dermal
				Taeniasis *	Root: The dried root is infused in water solution and three full cups of coffee is drunk.	Oral
47	Helianthus annuus L. Herb	Asteraceae	Suufii	Abdominal pain*	Seed: The dried seed collected and powdered and then add water and drink half of litter.	Oral
48	Hordeum vulgare L. Herb	Poaceae	Garbuu	Bloat**	Seed: fresh or dried Seed is crushed and sprinkled on the feed.	Oral
49	Hypoestes forskaolii (Vahl) R.Br. Herb	Acanthaceae	Darguu	Bleeding**	Leaf: Fresh leaf is rubbed on the damaged part until the bleeding stops.	Dermal
				Diabetes*	Leaf: Dried leaves powdered and mixed in water and taken when need arise.	Oral
50	Juniperus procera Hochst .ex Endl. Tree	Cuppressaceae	Gaatiraa	Toothache*	Bark: Dried Powder form mixed with fine powder of Rumex nepalensis in the presence of food oil is kept on the teeth.	Oral

51	Justicia schimperiana (Hochst. ex Nees) T. Anders Shrub	Acanthaceae	Dhumuugaa/Sansalii	Jaundice***	Leaf: Newly growing fresh leaves milled on palms and the squeezed liquid added to a coffee cup 4. Drink the liquid every night time for a week.	Oral
				Eczema*	Leaf: The fine powder of dried leaf together with the powder of leaf of Croton macrosrachyus are pasted with butter and apply once a day for five.	Dermal
				Lice***	Leaf: Dried leaf decoctions of this plant are mixed with Calpurina aurea and wash the body.	Dermal
52	Lagenaria siceraria (Molina)Standl. Shrub	Cucurbitaceae	Buqqee	Evil eye*	Seed: Fresh Seeds are grounded and add to fire and smoke or drink with honey.	Dermal
				Snake bite*	Leaf: Fresh leaves are pounded and drunk in the presence of small amount of water.	Oral
53	Laggera tomentosa (Sch.Bip.ex A.Rich.) Oliv. & Hiern Tree	Asteraceae	Ajoo	Any swelling expecting tuberculosis***	Leaf: Fresh Pounded leaf is tied on the smelling.	Dermal
54	Lantana camera L. Shrub	Verbenaceae	Akayi sinbiraa	General malaise (Mich)*	Leaf: Fresh pounded together with leaf of Ocimum lamiifolium and the squeezed out liquid drink with tea.	Oral
55	Lippia adoensis	Verbanaceae	Kusaayee	Intestinal Parasite*	Root: Fresh/ dried root together with the dried bark of Croton macrostachyus is crushed and eaten after breakfast.	Oral
				Cough*	Leaf: Dried leaf is pounded and boiled and a tea spoon of it is added to cup of coffee and drunk for four days every.	Oral
56	Linum usitatissimum L. Herb	Linaceae	Talbaa	Amoebisis*	Seed: The dried pondered seed is drunk in an empty stomach.	Oral
				Retention Of placenta***	Root: Dried root and seed is boiled and drunken days.	Oral
				Constipation***	Seed: The dried seeds are soaked in water over night and the water solution is drunk.	Oral
57	Lycopersicon esculentum (L.) Mill. Herb	Solanaceae	Timaatima	Common cold*	Fruit: Fresh fruit put in fire and eaten when get hot in order to get relief from common cold.	Oral

58	Maytenus senegalensis (Lam.) Exell Shrub	Celastraceae	Kombolcha	Hemmoroids*	Leaf: Dried Leaf together with young stem of Olea europea and pounded mixed with butter and the paste is applied on it.	Dermal
				Diarrhea**	Bark: Fresh bark is pounded, mixed with water and local beer and given orally.	Oral
				Lice**	Leaf: The fresh leaf of the plant is collected and adds water and applies on animal skin.	Dermal
59	Mangifera indica L. Tree	Anacardaceae	Maangoo	Stomach ache**	Leaf: Dried leaf of powdered and mixed in water then given for the cattle.	Oral
60	Musa x paradisiaca L. Herb	Musaceae	Muuzii	Headache*	Fruit: Eating fresh fruits 1 to 2 when headache happen.	Oral
61	Melia azedarach L. Tree	Meliaceae	Nimii	Toothache*	Stem: Fresh young stem is chewed and kept on the teeth.	Oral
				Anthrax**	Bark: The fine powder of dried bark is added to a glass of water and applied through the mouth twice.	Oral
62	Nicotiana tabacum L. Herb	Solanaceae	Tomboo	Leech**	Stem or leaf: The fresh young stems and or leaf is ground, add salt then one glass of the mixture is given every morning for four days orally or through the nose.	Oral
				Epilepsy*	Leaf: Bath the patient with fresh leaf decoction of Nicotiana tabacum and Ocimum lamii folium, for five days.	Dermal
63	Ocimum basilicum L. Herb	Lamiaceae	Bassobiaa	Flu*	Leaf: Fresh leaves together with root of Aloe macrocarpa concocted together and drink the solution.	Oral
64	Ocimum lamiifolium Hochst. ex Benth. Shrub	Lamiaceae	Damakese	Mich*	Leaf: Fresh leaf together with leaf of Eucalyptus globules is pounded, mixed with water and drunk.	Oral

65	Olea europaea L. subsp.cuspidata (Wall. exG.Don) Cif. Tree	Oleaceae	Ejersa	Itchy skin*	Leaf: Fresh leaf of Olea europaea is boiled in water and steam the vapour to the part.	Dermal
				Wound***	Stem: Partly dried stem is inserted into fire and the oily liquid produced from the stem is applied on the wound.	Dermal
				Gastritis*	Stem: A very small amount of the oily liquid produced from the dried stem is drunk after meal for four consecutive days.	Oral
66	Panicum hochstetteri Steud. Herb	Poaceae	Marga gogorrii	Kidney problem*	Leaf: Fresh Leaves chewed and swallowed	Oral
67	Podocarpus falcatus (Thunb.) R.B. ex. Mirb. Tree	Podocarpaceae	Birbirsa	Intestinal parasites*	Bark: Decoction of the dried fine powder of the bark, grounded garlic and honey are pasted and about two tea spoon is eaten at bed time for 2-4 days.	Oral
68	Phytolacca dodecandra L. Herit. Shrub	Phytolaccaceae	Handoode	Rabies***	Root: Fresh root of Phytolacca dodecandra is pounded, mixed with water, one arake glass of the solution is given for 7-10 day (for humans) for animals 15-20 for ten days.	Oral
				Malaria*	Root: Fresh root is grounded mixed with water and drunk in the morning for five consecutive days.	Oral
69	Plantago lanceolata L. Herb	Plantagiaceae	Qorxoobii	Mitch*	Leaf: Rub the body with the squeezed fresh leaves.	Dermal
70	Phoenix reclinata Jacq. Tree	Arecaceae	Meexxi	Eye disease**	Leaf and stem: Fresh or dried leaf and stem of Phoenix reclinata chewed together and spitted on cattle eye.	Dermal
71	Rhamnus prinoides L. Herit. Shrub	Rhamnaceae	Geeshoo	Leech**	Leaf: Fresh leaf together with Nicotiana tabacum, pepper is pounded mixed with water and goat butter, and then applied through the nose.	Nose
				Tonsillitis*	Leaf: Chew the fresh leaf and swallow twice a day for four days.	Oral

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72	Ricinus communis L. Shrub	Euphorbiaceae	Qobboo	Tuberculosis sis(swelling)***	Leaf: The fresh leaf is warmed on fine and rubbed on the swelling.	Dermal
				Impotency*	Seed: The dried seeds are pounded, mixed with small quantity of latex from Aloe spp. And drunk two coffee cups before bed time for two days.	Oral
73	Rosmarinus officinalis L. Herb	Lamiaceae	Urgooftuu	Headache*	Root: Fresh root powder and drunk the solution when headache occur.	Oral
74	Ruta chalepensis L. Herb	Rutaceae	Qinidaabii	Abdominal pain*	Root: Fresh root chewed and ingest the juice.	Oral
75	Rosa abyssinica Lindley Shrub	Rosaceae	Goraa	Ascaris*	Leaf: Fresh leaf is pounded, mixed with water a cup of the mixture is drunk once.	Oral
76	Rumex nervosus Vahl. Shrub	Polygonaceae	Dhangaggoo	Wound ***	Root: Crushed fresh or dried root together with butter is placed on the wound.	Dermal
				Retained placenta**	Leaf: Grounding the fresh leaf and drinking one cup of the solution.	Oral
77	Senna italica Mill. Climber	Fabaceae	Fitii	Cough*	Leaf: Fresh leaf infusion is inhaled or places the leaf in the nostrils again and again.	Nose
78	Solanum incanum L. Shrub	Solanaceae	Hiddii	Snake bite*	Root: Fresh root powder is drunk with coffee.	Oral
				Toothache*	Root: Fresh root is chewed and keep between the teeth.	Oral
79	Schinus molle L. Tree	Anacardiaceae	Kundoberbere	Wound on rectal area*	Root: Fresh root powder and fruit applied on the wound twice a day.	Dermal
80	Solanum tuberosum L. Herb	Solanaceae	Dinnicha	Loss of Appetite*	Root: Fresh root boiled and eaten.	Oral
81	Sacchharum officinarum L. Herb	Poaceae	Shankora	Common cold*	Stem: Fresh Steam put in fire and eaten when gets hot in order to get relief from common cold.	Oral
82	Snowdenia polystachya (Fresen.) Pig. Herb	Poaceae	Muja	Scabies**	Root: Fresh root boiled with root of Carissa spinarium and wash the animal.	Dermal

83	Stephania abyssinica (Dillon& A.Rich.) Climber	Menispermaceae	Hidda hantuutaa	Rabies**	Root: Dry root of Stephania abyssinica will be powdered and backed with grain flour and given to cattle.	Oral
				Pasteurellosis**	Root and leaf: Dry root and leaf of Stephania abyssinica will be powdered together, mixed with water and given to the animal.	Oral
84	Toddalia asiatica (L.) Lam. Shrub	Rutaceae	Harangamaa	Evil eye*	Bark: The fresh or dried root is chewed and swallowed. Leaf is crushed and then the decoction is mixed with coffee and drunk. Fresh root is crushed and the infusion is taken, a cup of the solution once a day.	Dermal
85	Verbena officinalis L. Herb	Verbenaceae	Darguu	Tonsillitis*	Root: Fresh root is fumigated to the patient or fresh leaf is pounded, mixed with water and drunk.	Oral
				Mich*	Root: Dried root together with the root of Verbena officinalis and Carissa spinarum is fumigated to the patient.	Oral
				Diarrhea*	Root: Fresh root of this plant and bark of Croton macrostachyus is pounded mixed with water and then after a day is given.	Oral
86	Vernonia amygdalina Del. Shrub	Asteraceae	Ibichaa	Jaundice*	Leaf: Fresh leaf is pounded, mixed with water, filter and drunk.	Dermal
				Internal parasite**	Leaf: Fresh leaves chopped and added to local katukala and salt and will be given to the animal.	Oral
				Diarrhea*	Leaf: Fresh leaf is pounded together with coffee. Seeds, mixed with butter and eaten.	Oral
				Bloat**	Leaf: Fresh leaf Pounded, mixed with water and given orally	Oral
87	Vicia faba L. Herb	Fabaceae	Baaqelaa	Stomach ache*	Seed: Dried or fresh Leaves decoction of this plant is drunk.	Oral
				Tapeworm*	Seed: Fresh seeds are soaked in water over night and eaten for five days.	Oral

88	Verbascum sinaiticum Benth. Herb	Scrophulariaceae	Gurra Harree	Hemmoroids*	Root/bark: Fresh root are pounded, boiled in water, allow cooling and washing the affected part with it.	Dermal
				Nightmare**	Root: Dried root crashed, placed in a fire and fumigating.	Dermal

Table 2: Some of the medicinal plants cited most by informants.

Botanical Name of Medicinal Plants	Disease treated	No. of Informants	Percentage
Aloe macrocarpa Tod (Argiisa)	Internal parasites	75	75
Carissa spinarum L. (Agamsa)	Malaria	63	63
Allium sativum L.	Wounds	58	58
Croton macrostachyus L.	Ascaris	51	51
Vernonia amygdalina Dell.	Jaundice	48	48
Dodonean gustifolia L.	Ear wounds	41	41
Hypoestes forskaolii L.	Tonsillitis	37	37
Calpurnia aurea (Ait.)Benth	Lice	35	35
Ocimum lamiifolium	Flu	29	29
Melia azedarach L.	Toothache	21	21

Table 3: Informant Consensus Factor.

Disease categories	Nt	Nur	ICF
Malaria and Headache	7	100	0.93
Abdominal problems, Intestinal parasite, Diarrhea, Amoeba, urine problems and stomach ache	11	95	0.9
Common cold and Cough	10	87	0.9
Sensorial diseases (ear, eye and epilepsy)	7	60	0.89
Tonsillitis	8	64	0.88
Skin problems, Dandruff, Hair loss, Hemorrhoid, Swelling wound	9	57	0.85
Rabies, Snake bite, Spider poison	12	73	0.84
Heart problems, Diabetes, Blood pressure	6	34	0.84
Tooth ache	4	15	0.78
Jaundice	6	23	0.77
	6	23	0.77

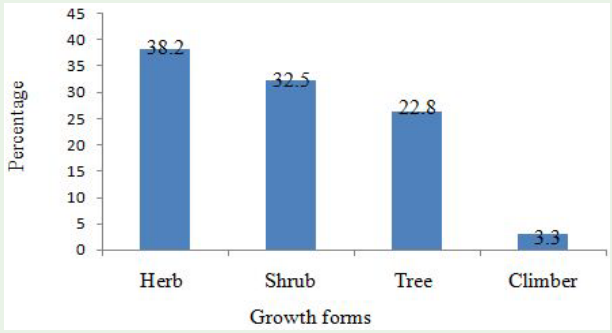

Figure 1: Growth forms of medicinal plants used for human and livestock ailments in the study.

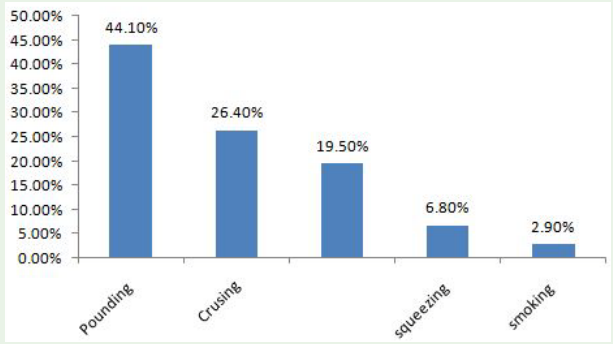

Figure 2: Percentage preparation methods of Traditional medicinal plants.

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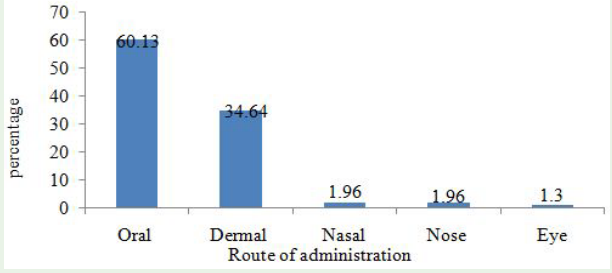

Figure 3: Percentage distribution of route of administration of plant remedies used for human and livestock.

Fidelity Level (FL) is an index, which shows the specificity of a given plant to effectively treat a particular disease. Fidelity level was then calculated for some commonly used medicinal plants to treat ailments. Result showed that Allium sativum had the highest FL followed by Buddleia polystachya, Vernonia amygdalina, Aloe macrocarpa, Calpurnia aurea, Citrus Limon, Brassica carinata and Croton macrostachyus (Table 4). The medicinal plants that are widely used by the local people to treat one or very few ailments have higher FL values than those that are less popular [22]. High FL could also be an indication of efficiency of the reported plant to cure a specific ailment.

Where Np is the number of informants that claim the use of a plant species to treat a particular disease, and N is the number of informants that use the plants as a medicine to treat any given disease.

Table 4: Fidelity index of some medicinal plants.

Botanical Name of Medicinal Plants	Examples of ailment treated	Np	N	FL	FL%
Allium sativum	Malaria	46	48	0.95	95
Buddleia polystachya	Diarrhea	40	45	0.88	88
Vernonia amygdalina	Bloat	35	41	0.85	85
Aloe macrocarpa	Intestinal parasite	31	38	0.81	81
Calpurnia aurea	Syphilis	28	36	0.77	77
Citrus limon	Stomach ache	25	34	0.73	73
Brassica carinata	Common cold	21	29	0.72	72
Croton macrostachyus	Ascaris	18	26	0.69	69
Dovyalis abyssinica	Rheumatic Pain	14	21	0.66	66
Carissa spinarum	Gonorrhea	12	19	0.63	63

Table 5: Preference ranking of medicinal plants used for treating bloating.

List of medicinal Plants	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	Total	Rank
Aloe macrocarpa	5	6	5	6	4	5	4	6	3	5	49	1st
Capsicum annuum	6	5	6	5	6	4	4	3	4	2	45	2nd
Croton macrostachyus	5	4	6	3	3	2	6	3	3	1	36	3rd
Vernonia amygdalina	6	2	2	3	5	4	3	3	2	1	31	4th
Hordeum vulgare	3	3	3	1	2	3	1	1	3	3	23	5th
Cucurbita pepo	2	2	1	2	1	4	1	2	1	3	19	6th

Key: R= informant.

Informant consensus factor and fidelity level

The diseases of the study area have been grouped into different categories based on the site of incidence of the disease, condition of the disease as well as treatment resemblance of the disease to the local people. Analysis of ICF showed that values ranged from 0.77 to 0.93 for the diseases categories (Table 3). Of the disease categories, Malaria and head ache had the highest ICF value suggesting the common occurrence of these problems and agreement of the people on their remedy. It has been showed that medicinal plants that are effective in treating certain diseases and well known by community members have higher ICF values. Gonorrhea, kidney problem and Jaundice, had the lowest (0.77) ICF value, which may be due to the rare occurrence of these diseases.

Preference Ranking

When there are different species prescribed for the same health problem, people show preference of one over the other. Preference ranking of six medicinal plants that were reported for treating Bloating was conducted after selecting ten key informants. The informants were asked to compare the given medicinal plants based on their efficacy and to give the highest number (6) for the medicinal plant which they thought most effective in treating Bloating and the lowest number (1) for the least effective plant in treating Bloating. Aloe macrocarpa scored 49 and ranked first indicating that it is the most effective in treating Bloating followed by Capsicum annuum and the least effective was Cucurbita pepo (Table 5).

Threats to Medicinal Plants and Indigenous Knowledge, and Conservation Efforts of Traditional Medicinal Plants.

Rural people need plants for their livelihood in different aspects. In this study several factors both human and natural were found to contribute to the threats that affect survival of medicinal plants species in the study area. From the interview with informants various factors were recorded as the main threats to medicinal plants in Dugda District. Agricultural encroachment, firewood collection, charcoal production, plant use for house and fence construction, overgrazing and urbanization were reported to the factors for the dwindling of natural vegetation in general and medicinal plants in particular. As a result, according to the respondents, the accessibility of medicinal plants has become less when compared to the previous times.

Traditional healers also keep their knowledge on medicinal plants for the sake of securing means of income and a cultural belief that telling information may make plants ineffective to cure the ailments. Similar findings were reported elsewhere [27-29]. However, it was recognized that ethnobotanical knowledge on uses of some medicinal plants is transmitted orally to one or few family members to use in secrecy. They disclose their knowledge on medicinal plants at old age by the time when they most probably die before teaching the details of medicinal plants or when they are too old to walk to the field to show the plants in their habitats. According to the respondents, access to modern medication has also contributed to the loss of indigenous knowledge as new generations give less attention to traditional medicinal plants. As a result the indigenous knowledge seems to be endangered in the study area. Indigenous people of the study area practice some conservation measures. For instance, some medicinal plants are found in majority of household gardens and farm borders in the study area, as they need these plants in their daily life as medicine or for other values. Medicinal plants are also maintained or protected near vicinity due to their fragrance, as live fences to avoid enemies, as spices and for food. Plants are also left as remnants of forest in agricultural field due to their uses for construction, fuel wood and other values. Here, the intermixing of multi-purpose plant species by farmers on their farmland is evidence to management practices in the area. The healers conserved some medicinal plants by cultivated mixing with crops in agricultural field, planted in special places, such as, live fences of home gardens and fields.

Conclusions

In conclusion, the study area revealed that people in the study area have substantial amount of indigenous knowledge on traditional medicine, which needs to be further strengthened by all age groups and gender. As this study revealed the knowledge of traditional medicine mainly reside in the hand of illiterate and aged groups. Indigenous people of the study area have their own ways of managing health problems of human and livestock as they are endowed with specific culture, tradition and ethical norms. Biochemical profiles of plant species used for diseases categories of high ICF should be investigated for screening of the active principles.

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