

Ethnobotanical Study of Medicinal
Plants used to treat Human Diseases
in Enarj Enawga District, East Gojjam
Zone, Amhara Region, EthiopiaYihenew Simegniew Birhan^{1*}, Sintayehu Leshe Kitaw¹, Yihalem Abebe
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CC-BY 4.0**Keywords** Ethnobotany; Medicinal
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DMU: Debre Markos University; ICF:
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Abstract

Background: Traditional plant remedies are still the most important sources of therapeutics for nearly 80% of the Ethiopian population. Like other communities in Ethiopia, traditional plant remedies play a vital role in the primary healthcare system of Enarj Enawga District, Amhara Region, Ethiopia. Thus, the aim of the present study was to document and analyze the use and conservation statuses of medicinal plants in Enarj Enawga District.**Methods:** Ethnobotanical data were collected using semi-structured interviews, focus group discussions and field observations. Informant Consensus Factor (ICF), preference/priority ranking exercise and Direct Matrix Ranking (DMR) exercise were used to analyze the data.**Results:** 111 medicinal plant species belonging to 97 genera and 50 botanical families were reported in the District. Asteraceae (9.01%) was found to be the most dominant plant family in the study area. Most of the medicinal plants belong to the herb (47.75%) and shrub (31.53%) categories. Roots (39.53%) and leaves (35.81%) were the most frequently used plant parts for the preparation of remedies. The study also revealed *Securidaca longepedunculata* as the most threatened medicinal plant in the District.**Conclusion:** Although their future use is hampered by poor conservation practices, the diversity of medicinal plants and the associated indigenous knowledge is so immense in the District, promoting appropriate conservation strategy in the study area, Enarj Enawga District.

Introduction

Traditional plant remedies are still the most important sources of therapeutics for most of the developing world populations [1]. In Ethiopia, traditional medicine has played a significant role in treating different public health problems [2-6]. Recent reports revealed that about 80% of the Ethiopian populations still depend on traditional medicinal plants to fulfill their primary healthcare needs [7,8], largely due to its cultural acceptability, economic affordability and efficacy against certain types of disease as compared to modern medicine [9]. However, the plants and the associated indigenous knowledge in the country are gradually being depleted because of environmental degradation, deforestation, lack of documentation and potential acculturation, which in turn brought about the loss of some important medicinal plants [5,10,11].

Similar to other cultural groups in Ethiopia, traditional medicinal plants play a vital role in the primary healthcare system of the Amhara Region, Ethiopia. However, only few attempts made to scientifically document and analyze the ethnomedicinal knowledge and the associated plants in the Region [12-20]. So far, no such study been conducted in Enarj Enawga District, Amhara Region, Ethiopia. Thus, the aim of the present study was to gather and document data on the use of medicinal plant remedies, the indigenous knowledge and practices of the traditional healers and the threats currently affecting medicinal plants in Enarj Enawga District.

Methods

Description of study area

Enarj Enawga District (*Woreda*) is found in East Gojjam Administrative Zone of the Amhara Regional State, Ethiopia. Its capital, Debre Work town, is located at about 195 km south east of Bahir Dar, the capital city of Amhara Regional State and 291 km north of Addis Ababa, the capital city of Ethiopia (Figure 1). The District is bordered on the south by Enemay District, on the southwest by Debay Telatgen District, on the west by Hulet-Eju Enese District, on the north by Goncha Siso-Enese District, on the northeast by Enese Sar-Midir District, on the east by the Nile River that separate it from the South Wollo Zone, and on the southeast by Shebel Berenta District. According to the 2007

national census conducted by the Central Statistical Agency (CSA) of Ethiopia, the District has a total population of 167, 402 in 39, 564 households, of whom 82, 958 are men and 84, 444 women; 13, 623 (8.14%) are urban inhabitants. The indigenous people inhabiting the area belong to the Amhara ethnic group and speak Amharic language, the official language of Ethiopia. Most of the inhabitants (97.36%) in the District practiced Ethiopian Orthodox Christianity and the remaining 2.34% of the population were Muslims [21].

Selection of study kebeles and informants

The ethnobotanical data was collected from 22 Kebeles (the smallest administrative unit in Ethiopia) of the study District that were purposively selected in consultation with elders and local authorities. These Kebeles were known to have better vegetation cover, reputable traditional healers and knowledgeable informants. For the interview, 110 traditional healers and knowledgeable informants (five from each Kebele) were recruited using purposive sampling technique [22], of which 103 were men and 7 were women. The ages of the informants ranged between 20 and 82 years. Key informants for the ranking exercises were selected from the aforementioned study group (already sampled for the interviews).

Ethnobotanical data collection

Ethnobotanical data were collected from November 15, 2015 to October 15, 2016 through semi-structured interviews, focus group discussions and field observations by following the standard methods

[22,23]. Interviews were carried out to gather data on plant parts used, method of remedy preparation, dosage of remedy, route of remedy administration, diseases treated, threats and conservation practices of medicinal plants. Communications with all informants were held in Amharic, the mother tongue language of the study participants and of course, the official language of the District and Ethiopia. Field observations were also conducted to record the habit and habitat of each medicinal plant with the assistance of informants who participated during the interview. For each reported medicinal plant species, specimen was collected, pressed, dried and identified by botanists at DMU and vouchers were deposited at DMU, College of Natural and Computational Sciences store.

Data analysis

Microsoft Excel 2007 software was used for organizing and summarizing the data. Descriptive statistical analysis was employed to determine the number of medicinal plants used and ailments treated in the study District, the most frequently used plant parts, main route of remedy administration and major habitats of the medicinal plants.

Preference ranking technique [22] was used to identify the most preferred medicinal plants to treat evil eye (against which the highest number of medicinal plant species were prescribed by informants) in the District based on informants' personal preference or perception. The medicinal plants (nine in number) used in this exercise were seeded by the key informants following group discussion on their importance to manage evil eye. For this purpose, ten individuals were

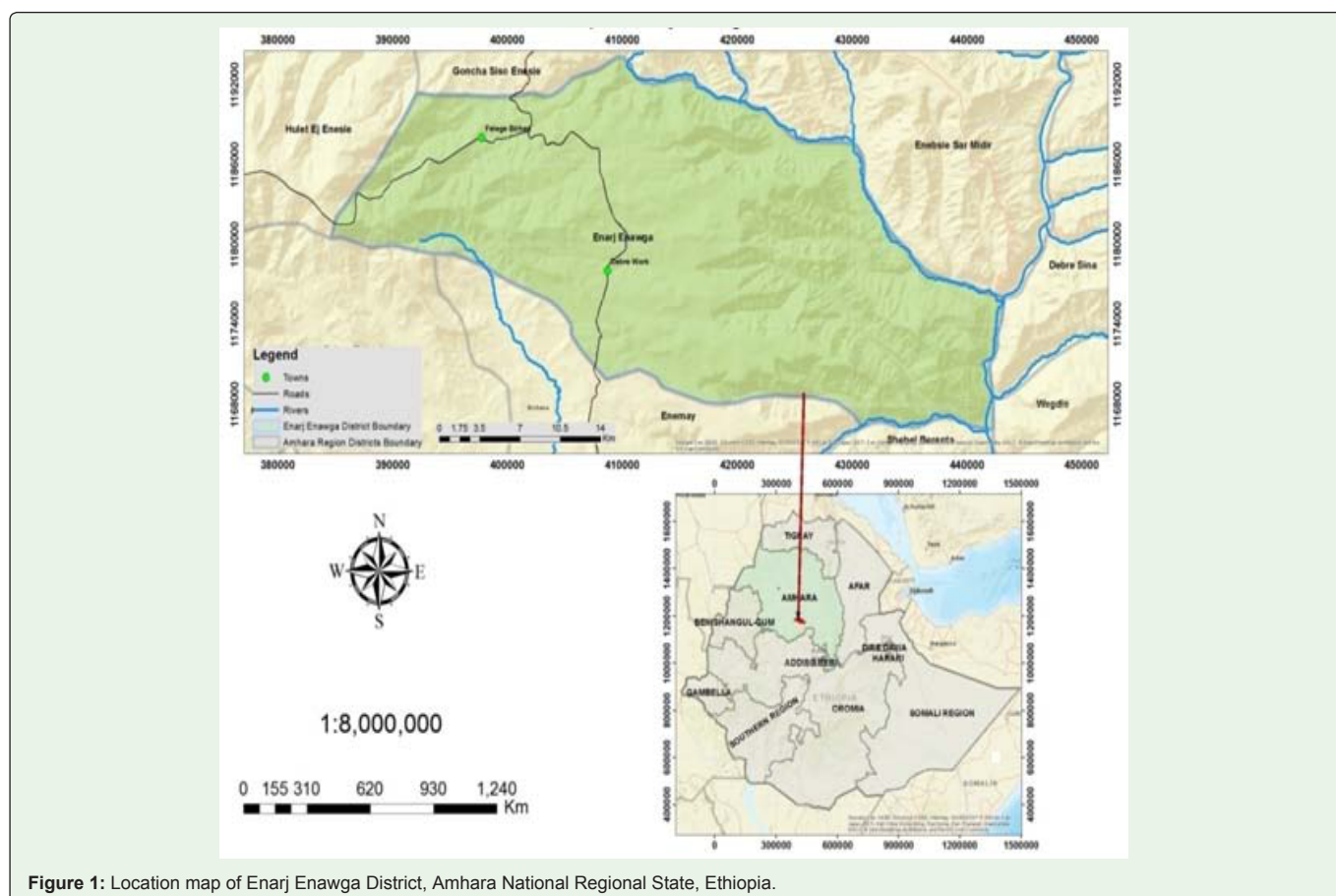


Figure 1: Location map of Enarj Enawga District, Amhara National Regional State, Ethiopia.

selected from the key informants and each individual was then asked to rank the plants according to their degree of preference. The highest value (9) was assigned to the most preferred medicinal plant to treat evil eye, while the least preferred plant was given the lowest value (1). Scores of each medicinal plant was then added and ranked.

Similar approach was followed to identify the most threatened medicinal plants in the study District using ten key informants on six medicinal plants reported by most informants as threatened species. The informants were then asked to arrange them based on their perceived level of threat or extinction. A medicinal plant that was believed to be the most threatened was given the highest value (6), and the least threatened plant was given the lowest value (1) and rank was determined based on the total score of each plant species.

Priority ranking exercise was also performed to determine the principal factors perceived as threats to medicinal plants in the study District based on the level of destructive impacts. Ten key informants were selected to rank the six threatening factors (that were suggested by informants during the ethnobotanical data collection) in the District. The highest value (6) was given for the most threatening factor and the lowest value (1) was assigned for the least threatening one, and scores of each plant species were finally summed and ranked.

DMR exercise [22,23] was done for seven medicinal plants that were most frequently reported as multipurpose medicinal plants in the study District. Ten key informants were selected and asked to assign, to each attribute, a value between 0 and 5 (0 for no use and 5 for the highest value). The average scores of key informants were then added and plants ranked.

ICF, which is a measure of informants' agreements on cures for group ailments, was computed after the reported traditional remedies and corresponding diseases were grouped in to 11 categories [24]. The ICF value of each disease category was calculated as follows:

$$ICF = \frac{nur-nt}{nur-1}$$

Where,

ICF = Informants Consensus Factor

nur = Number of use citations in each category

nt = Number of plant species used

Ethical approval and consent to participate

The study was reviewed and approved by Research Evaluation Committee of Natural and Computational Sciences College, Debre Markos University. Verbal consents, deemed appropriate by the committee for the study, were obtained from informants after brief introduction about the objective of the study prior to the interviews, field observations, ranking exercises. All verbal consents made with research participants were tape-recorded.

Results

Comparison of medicinal plant knowledge among informants

Most of the informants (93.64%) in the study area were men traditional healers, the remaining (6.36%) were women. It was found that men informants were more knowledgeable than women in

terms of number medicinal plants reported number of use citations, diversity of disease treated and habitats of medicinal plants. In addition, elder informants (45 years old and above) regardless of their sex, cited more number of medicinal plants, had fruitful conversations on how to collect medicinal plants, prepare and administer remedies than the relatively younger age group (20-44 years old). Informants from all age groups asserted the relatively better curative effects of the remedies prepared by the elders in the study District.

Acquisition and transfer of indigenous medicinal plant knowledge

The main way of indigenous knowledge transfer on types of medicinal plants, traditional concepts of illness and method of diagnosis in the District was through oral tales to a family members (especially to an elder son). Besides, some informants acquired their knowledge secretly through systematic follow up and observation of practitioners at the time of medicinal plant collection and preparation. Furthermore, few informants reported that they develop their knowledge by copying healers after seeking treatment and upon careful observations of domestic animals, especially for plant remedies with antidote effects.

Medicinal plants reported and diseases treated

111 medicinal plant species used to treat 48 human diseases were reported by the informants in the study area, Enarj Enawga District (Appendix A). The medicinal plants belonged to 50 families and 97 genera. The family Asteraceae was represented by 10 species (9.01%), Lamiaceae by 9 species (8.11%), Solanaceae by 8 species (7.21%), Euphorbiaceae by 7 species (6.31%) and Fabaceae by 6 species (5.41%) (Table 1).

Relatively higher numbers of medicinal plant species were used to treat evil eye (23 species), snakebite (16 species), anthrax (10 species), stomachache (12 species), retained placenta (11 species), LIFIE (10 species), eczema (9 species), swelling (9 species), donkey's wart and febrile illness 8 species each, hepatitis, cut/bleeding and dysentery 6 species each, cough 5 species (Table 2).

Habit, habitat and sources of medicinal plants

Most of the recorded medicinal plants were herbs and shrubs accounting for 47.75% and 31.53% of plant species respectively, followed by trees (11.71%) and climbers (9.01%) (Figure 2). Out of 111 medicinal plant species, 63 (56.76%) were obtained from the wild, 25 (22.52%) from roadside, 12 (10.81%) from home gardens, 5 (4.50%) from croplands, 6 (5.41%) from both wild and roadside (Figure 3). According to informants, the search for medicinal plants in the study area, especially trees and shrubs, required lots of time, energy and travelling longer distances. Among the total medicinal plant species, 66 (59.46%) were rarely encountered, eight (7.21%) were commonly found elsewhere and the remaining 37 (33.33%) were moderately or occasionally encountered (Figure 4).

Plant parts used and condition of remedy preparation

In this study, the most commonly used plant parts in remedy preparations were roots (39.53%), followed by leaves (35.81%), seed (6.05%), stem (2.79%), latex (2.79%) and whole plant (1.40%) (Figure 5). Most of the remedies were prepared from fresh plant materials

Table 1: Medicinal plant families with three or more plant species in the study area.

Family name	No of plant species	% of plant species	No of plant genera	% of plant genera
<i>Asteraceae</i>	10	9.01	8	8.25
<i>Lamiaceae</i>	9	8.11	8	8.25
<i>Solanaceae</i>	8	7.21	6	6.19
<i>Euphorbiaceae</i>	7	6.31	4	4.12
<i>Fabaceae</i>	6	5.41	6	6.19
<i>Malvaceae</i>	4	3.6	4	4.12
<i>Ranunculaceae</i>	4	3.6	3	3.09
<i>Apiaceae</i>	3	2.7	3	3.09
<i>Polygonaceae</i>	3	2.7	1	1.03
<i>Oleaceae</i>	3	2.7	2	2.06
<i>Rosaceae</i>	3	2.7	3	3.09

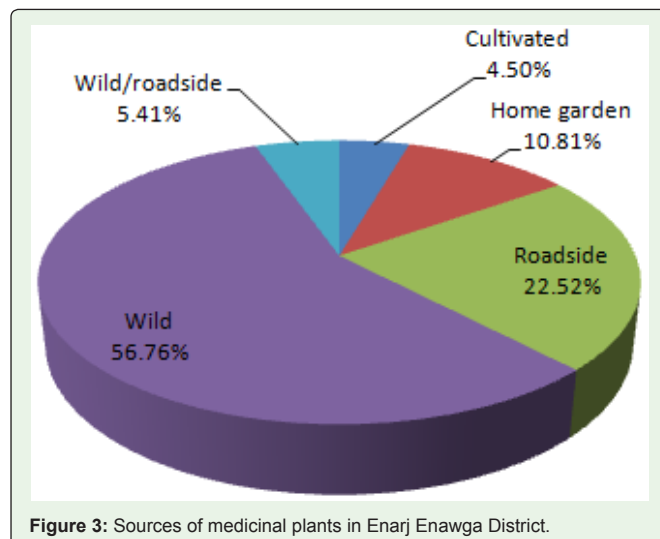
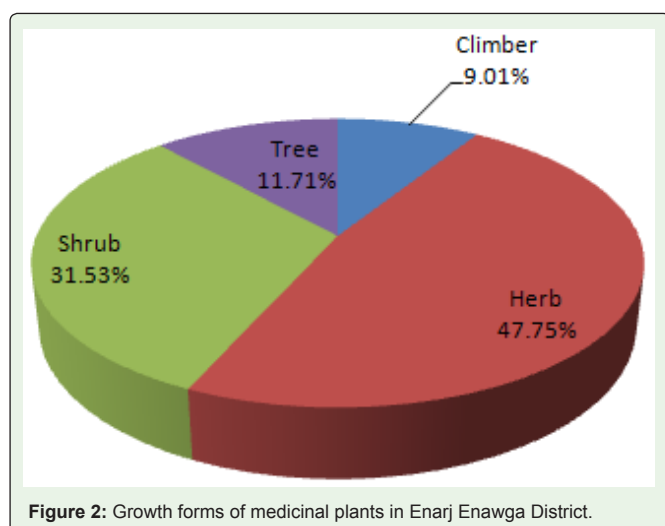
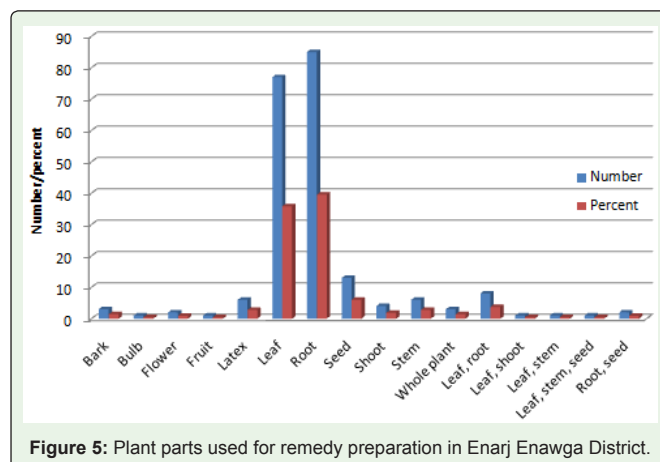
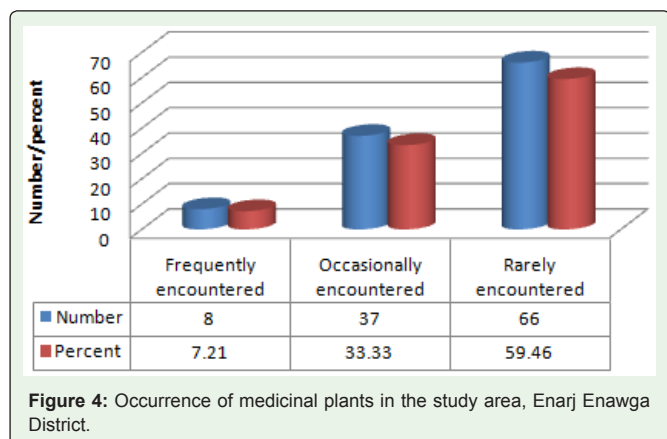


Table 2: List of human diseases against which five or more medicinal plants were prescribed.

Disease name	Number of plant species used	Percent of plant species used	Number of plant genera used	Percent of plant genera used
Evil eye	23	20.72	23	23.71
Snake bite	16	14.41	16	16.49
Stomach ache	12	10.81	12	12.37
Retained placenta	11	9.91	10	10.31
Anthrax	10	9.01	10	10.31
LIFIE	10	9.01	10	10.31
Eczema	9	8.11	9	9.28
Swelling	9	8.11	9	9.28
Febrile illness	8	7.21	7	7.22
Donkey's wart	8	7.21	8	8.23
Hepatitis	6	5.41	6	6.19
Cut/bleeding	6	5.41	6	6.19
Dysentery	6	5.41	6	6.19
Cough	5	4.5	5	5.15

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(73.95%). Some (9.77%) were prepared from both dry or fresh plant materials and others (16.28%) preferentially from dry parts. Water, honey, milk, butter, salt, tea and local beer/TELA were among the notable additives often used in the preparation of remedies for multiple reasons such as making suitable formulations, localizing remedy administration, improving patient compliance and reducing toxic side-effects of remedies (Figure 6).

Routes of remedy administration and dosage

Most of the medicinal plant preparations reported in the study District were taken orally (43.72%). Around 26.98% of the plant remedies were administered topically through the skin. In addition, 9.3% of the plant remedies were administered nasally (Figure 7). According to informants' response, the dose of plant remedies differed among traditional healers even in treating the same health problems. The plant remedies in the study area were prescribed with units of traditional dosage measurement such as MANKIA (teaspoon), TIFIR (tablet size), FINJAL (coffee cup), BIRCHIKO (teacup), TASSA (water cup), and ATIQ (a third of finger length). Most of the remedies were reported to have no adverse effects excluding *Calpurina aurea*, *Euphorbia abyssinica*, *Phytolacca dodecandra*, and *Nicotiana glauca* that were indicated to be poisonous to humans if taken in excess amount.

Market availability of medicinal plants

Surveys were conducted in Debre Work, Felege Birhan, Meaza Genet, Temguma and Gedeb local markets to assess the marketability of medicinal plants in the study District. It revealed that some

medicinal plants were sold in the above local markets for their use as food, spice and insect repellents. These includes: *Allium sativum* (spice), *Brassica carinata* (food and spice), *Citrus aurantifolium* (food), *Coriandrum sativum* (spice), *Echinops kebericho* (insect repellent), *Guizotia abyssinica* (food), *Lenis culinaris* (food), *Linum usitatissimum* (food), *Lycopersicum esculantum* (food), *Olea europaea* (insect repellent), *Trigonella foenum-graecum* (spice), *Zingiber officinale* (spice). *Embelia schimperi* is the only plant species solely sold for its medicinal significance in the surveyed local markets of Enarj Enawga District.

Informant consensus factor

The public health problems (where informants prescribed remedies and claimed to cure) were grouped in to 11 disease categories and the agreement of informants towards their cures were assessed. Comparatively better informant agreements were observed for evil eye (ICF = 0.90), snakebite (ICF = 0.88), emergency disease (ICF = 0.83), uterine and related disease (ICF = 0.75) categories (Table 3).

Informants' preference on medicinal plants used to treat evil eye

Evil eye was the disease against which the highest numbers of medicinal plants (23 species) were prescribed by informants in the study District. Among these medicinal plants, *Achyranthes aspera*, *Capparis tomentosa*, *Carissa spinarum*, *Clerodendrum myricoides*, *Cyphostemma molle*, *Gomphocarpus purpurascens*, *Leonotis ocymifolia*, *Lobelia rhynchopetalum* and *Securidaca longepedunculata* were also short-listed by the key informants as most preferred plant

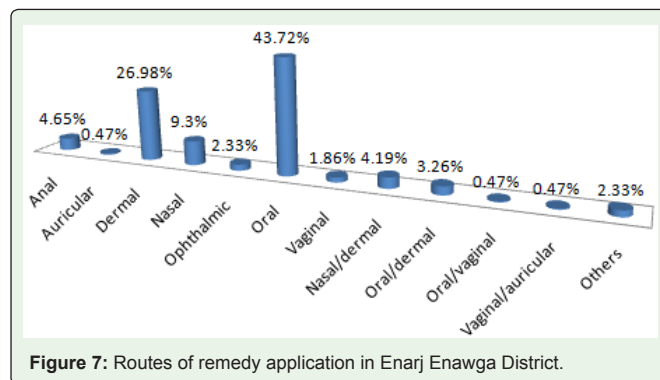
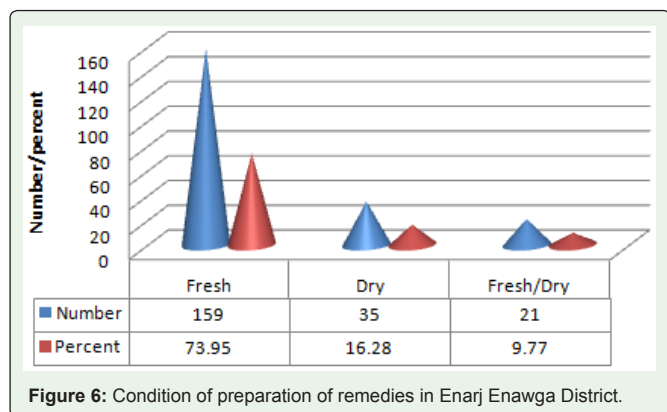


Table 3: ICF values of traditional medicinal plants used to for human diseases in the study area.

Category of diseases	Diseases included	nt	nur	ICF
Evil eye	Evil eye and evil spirit	27	257	0.9
Snakebite	Snakebite and python poison	17	129	0.88
Emergency diseases	Malaise, QURIBA, anthrax, febrile illness, and KELECHA	38	238	0.84
Uterine and related diseases	Rh diseases, retained placenta, enhanced labor, bleeding after delivery and SHIL MAZAWER	18	69	0.75
Gastrointestinal and parasitic infection	Stomachache, dysentery, hemorrhoids, Donkey's wart and tapeworm	30	107	0.73
Dermatological problems	Leishmania, itching, eczema, LIFIE, herpes zoster, wound healing, cut/bleeding, wart and fire burn	37	130	0.72
Cancer and swelling	Cancer and swelling	10	33	0.72
Internal diseases	Rabies, malaria and fever	8	25	0.71
Organ diseases	Toothache, hearing loss, eye infection, eye pain and hepatitis	16	52	0.71
Respiratory diseases	Nasal bleeding, epiglottitis, tonsillitis, cough and asthma	13	39	0.68
Others diseases	Epilepsy, urine retention, impotence, weaken babies and babies' sickness	10	33	0.72

species to treat evil eye. Preference ranking exercise conducted on the aforementioned medicinal plants, using ten key informants, revealed that *Lobelia rhynchopetalum* was the most preferred medicinal for the management of evil eye, followed by *Gomphocarpus purpurascens* and *Capparis tomentosa* respectively (Table 4).

Multipurpose medicinal plants

Acacia sleberiana, *Brucea antidysenterica*, *Carissa spinarum*, *Croton macrostachyus*, *Milletia ferruginea*, *Olea europaea* and *Prunus africana* are among the plant species that were repeatedly reported as multipurpose medicinal plants by most of the informants in the study area. The people in the District often used these medicinal plants as a construction material, firewood, medicine, charcoal, agricultural tool, lumbering, shade, forage, etc. According to the DMR exercise result, conducted using ten key informants, *Olea europaea* was the most useful multipurpose medicinal plant species, followed by *Croton macrostachyus* and *Acacia sleberiana* respectively (Table 5).

Threats and conservation status of medicinal plants

Preference ranking exercise was conducted on *Acokanthera schimperi*, *Dodonaea angustifolia*, *Echinops kebericho*, *Embelia schimperi*, *Prunus africana* and *Securidaca longepedunculata* (reported by most informants in the District as threatened plant species) to identify the most threatened plant species. The result showed that *Securidaca longepedunculata* is the most threatened medicinal plant species followed by *Prunus africana* and *Echinops kebericho* respectively (Table 6). The principal threats of medicinal plants in the study area were reported to include agricultural expansion, firewood collection, overgrazing, drought, construction material and urbanization. Informants ranked agricultural expansion as the most serious threat to medicinal plants followed by construction material, firewood collection, urbanization, overgrazing, drought respectively (Table 7).

Table 4: Preference ranking of medicinal plants reported for treating evil eye in the study area.

Plant species	Respondents (R ₁ -R ₁₀)										Totaal	Rank
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10		
<i>Achyranthes aspera</i>	5	6	7	8	4	7	6	3	6	1	53	4th
<i>Capparis tomentosa</i>	7	7	8	9	7	6	7	8	9	7	75	3rd
<i>Carissa spinarum</i>	6	4	5	2	5	3	4	2	1	6	38	6th
<i>Clerodendrum myricoides</i>	2	1	1	3	3	2	2	5	2	4	25	8th
<i>Cyphostemma molle</i>	1	3	2	1	2	1	3	1	5	2	21	9th
<i>Gomphocarpus purpurascens</i>	8	9	6	5	9	8	8	9	7	8	77	2nd
<i>Leonotis ocymifolia</i>	4	2	4	4	1	5	1	4	3	3	31	7th
<i>Lobelia rhynchopetalum</i>	9	8	9	7	8	9	9	6	8	9	82	1st
<i>Securidaca longepedunculata</i>	3	5	1	6	6	4	5	7	4	5	46	5th

N:B - Scores in the table indicate ranks given to medicinal plants based on their efficacy. Highest number (9) given for the medicinal plant which informants thought most effective in treating evil spirit and the lowest number (1) for the least effective plant.

Table 5: Results of DMR for seven multi-purpose medicinal plants in the study area, Enarj Enawga District.

Plant species	Medicine	Agricultural tool	Firewood	Construction	Lumbering	Charcoal	Shade	Forage	Total	Rank
<i>Acacia sleberiana</i>	3	3	5	4	3	4	4	2	28	3rd
<i>Brucea antidysenterica</i>	4	1	3	3	2	1	1	4	19	7th
<i>Carissa spinarum</i>	5	0	3	2	2	3	2	3	20	6th
<i>Croton macrostachyus</i>	4	2	5	5	4	3	5	1	29	2nd
<i>Millettia ferruginea</i>	3	2	5	5	3	3	3	3	27	4th
<i>Olea europaea</i>	2	3	4	5	5	2	5	3	30	1st
<i>Prunus africana</i>	3	3	3	5	5	2	3	2	26	5th

N:B - Scores in the table shows average scores of ten key informants given to each medicinal plant based on multipurpose use criteria (5 = best; 4 = very good; 3 = good; 2 = less used; 1 = least used and 0 = no value).

Table 6: Priority ranking results of the most threatened medicinal plants in Enarj Enawga District.

Plant Species	Respondents (R ₁ -R ₁₀)										Total	Rank
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10		
<i>Acokanthera schimperi</i>	2	3	1	3	1	2	2	2	1	2	19	5th
<i>Dodonaea angustifolia</i>	3	2	3	2	2	3	4	3	3	3	28	4th
<i>Echinops kebericho</i>	4	4	2	5	4	5	3	6	4	5	43	3rd
<i>Embelia schimperi</i>	1	1	4	1	3	1	1	1	2	1	14	6th
<i>Prunus africana</i>	5	6	5	4	5	6	5	4	6	4	50	2nd
<i>Securidaca longepedunculata</i>	6	5	6	6	6	4	6	5	5	6	55	1st

N:B - Scores in the table indicate ranks given to the most threatened medicinal plants. Highest number (6) given for the most threatened plant and the lowest number (1) for the least threatened plant.

Table 7: Priority ranking results of the factors perceived as threats to medicinal plants in Enarj Enawga District.

Threatening factor	Respondents (R ₁ -R ₁₀)										Total	Rank
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10		
<i>Acokanthera schimperi</i>	2	3	1	3	1	2	2	2	1	2	19	5th
<i>Dodonaea angustifolia</i>	3	2	3	2	2	3	4	3	3	3	28	4th
<i>Echinops kebericho</i>	4	4	2	5	4	5	3	6	4	5	43	3rd
<i>Embelia schimperi</i>	1	1	4	1	3	1	1	1	2	1	14	6th
<i>Prunus africana</i>	5	6	5	4	5	6	5	4	6	4	50	2nd
<i>Securidaca longepedunculata</i>	6	5	6	6	6	4	6	5	5	6	55	1st

N:B - Scores in the table indicate ranks given to threats to medicinal plants. Highest number (6) given for the most threatening factor and the lowest number (1) for the least threatening factor.

Discussion

Medicinal plant knowledge among informants and its acquisition/transfer

As a rule of thumb, traditional remedy preparation is considered as a routine task for men in different parts of Ethiopia. This scenario is supported by our findings, where most of the traditional healers or knowledgeable informants belong to the male gender group (93.64%). Besides, women traditional healers cited very few numbers of medicinal plants as compared to men in the study District. Other ethnobotanical studies conducted elsewhere in Ethiopia [14] or around the globe [25,26] came up with a similar conclusion. This may be attributed to their de facto role to cook food, care family members and thereby limited interaction with their environment and knowledgeable individuals [27]. In addition, the common line of

traditional medicinal knowledge acquisition or transfer, which favors males (especially elder sons) [5], was also responsible the observed variation between gender groups. In contrast, Lulekal et al. [16] documented insignificant variation in medicinal plant knowledge between gender groups in the same Region, Ankober District, and North Shewa Zone, Ethiopia. In addition, our findings clearly indicated that, elders are more knowledgeable as far as the number of medicinal plant remedies, the method of collection, preparation of remedies and their mode of administrations were concerned. This report is in line with different results documented in different parts of Ethiopia [11,16,28-30] and elsewhere in the world [25,31,32].

The foremost way of indigenous knowledge transfer in the study District was by word of mouth to a family member (especially to an elder son). Similar findings were reported for other communities in Ethiopia [16,17,20,29]. Besides, some brave informants acquired their knowledge secretly through systematic follow up and observation of

knowledgeable individuals at the time of medicinal plant collection and preparation. This is due to the existence of high level of secrecy regarding the traditional knowledge among traditional healers, even to family members [16,17]. Moreover, few informants reported that they develop their knowledge by following up healers after seeking treatment. In very few cases, informants develop their knowledge upon careful observations of different animals, which use plant materials to detoxify poisonous substances of snakes and pythons. *Clutia abyssinica* (for python poison and snakebite) and *Abutilon mauritianum* (for snakebite) were among the medicinal plant species discovered in this way by some informants of the study District. Chekole et al. [20] also reported the discovery of *Vernonia adoensis* for the treatment of snakebite by a similar mechanism. These natures driven in vivo bioactivity testing results clearly indicated the efficacy of such type medicinal plant species as antidotes.

Medicinal plants distribution and occurrence in the study area

Interestingly, this study documented high numbers of medicinal plants (111 species) used to cover the primary healthcare demand of the local community in Enarj Enawga District. Ethnobotanical studies conducted in Mecha [18], Chilga [19] and Libo Kemkem District [20] of the same Region came up with comparable numbers of medicinal plants, 107, 101 and 163 species respectively. Several medicinal plants documented from Enarj Enawga District were also mentioned in reports of studies previously conducted in the same Region; 31 in Zegie Peninsula [13], 35 in Dek Island [14], 53 in Ankober District [16], 50 in Mecha District [18] and 56 in Libo Kemkem District [20]. Moreover, some of these medicinal plants were found to be used for the same remedial purpose in different parts of the Amhara Region or Ethiopia. For instance, the use of *Brucea antidysenterica* (for eczema), *Calpurina aurea* (for QURIBA), *Datura stramonium* (for toothache), *Dracaena steudeneri* (for evil eye), *Glinus lotoides* (for tapeworm), *Justicia schimperiana* (for evil eye), *Kalanchoe petitiiana* (for swelling), *Ocimum lamiifolium* (for malaise), *Phytolacca dodecandra* (for rabies, hepatitis, wound and QURIBA), *Rumex nepalensis* (for retained placenta), *Verbena officinalis* (for stomachache) and *Zehneria scabra* (for malaise) were documented in a similar study conducted in Zegie Peninsula, Northwestern Ethiopia [13], which agrees with our findings in Enarj Enawga District. These findings asserted the pharmacological effectiveness of the aforementioned medicinal plant remedies and the existence of shared indigenous knowledge among different communities in the Region and Ethiopia.

Among the plant families, Asteraceae, Lamiaceae, Solanaceae, Euphorbiaceae and Fabaceae were found as the dominant medicinal plant species in Enarj Enawga District, which could reflect their abundance (species richness) in the flora of Ethiopia and Eritrea [33,34]. The study also revealed the family Asteraceae as a major contributor of plant species (10, 9.01%) used for medicinal purpose than other families, which is in agreement with similar studies conducted in different corners of Ethiopia [35-37]. About 47.75% of the plant remedies in the study area were prepared from herbs. This may be due to their relative better abundance, accessibility in nearby areas as compared to trees and shrubs mostly harvested from forests distantly located from resident areas. Our finding agrees with studies conducted in different parts of the country [38-40]. In contrast, other

ethnobotanical studies conducted elsewhere in Ethiopia indicated shrubs as the most frequently used growth forms of medicinal plants [5,30,36,41-43].

Plant parts used for remedy preparation, forms of preparation and collection

Except for evil eye, where multiple plant species were recommended for remedy preparation, most of the reported remedies in the study area were prepared from a single plant or plant parts. The result deviated from other findings where traditional healers mostly used more than one plant species to prepare remedy for an ailment [38,44]. In the present study, roots were the most used plant parts in the preparation of remedies as compared to other parts. Similar studies conducted in South Omo (Southern Ethiopia) [2], Zegie Peninsula (Northwestern Ethiopia) [13], Fentalle area (Eastern Shewa, Ethiopia) [30], Mana Angetu District (Southeastern Ethiopia) [5] and *Wonago Woreda* (SNNP, Ethiopia) [36], witnessed the common usage of root, which is highly threatening for the survival of the plants. This is because harvesting root of a plant poses more threat to the survival of plant than collecting other parts such as fruits, seeds and leaves [45]. In contrast, many studies conducted elsewhere in Ethiopia revealed the dominance of leaves in the preparation of remedies [35,42,46]. Complimentary to other studies conducted in different parts of the country [28,29,41], the majority (56.76%) of the medicinal plants in the study District were collected from the wild. Thus, such dependence on the wild habitats will have a long-term negative effect on the conservation statuses of medicinal plants in the area.

Crushing was the most widely used method of preparation of remedy in the study District. Ethnobotanical studies conducted in Debre Libanos [35], Wayu Tuka [38] and Sekoru [42] Districts of Oromia Region, Ethiopia documented crushing as the most common method for the preparation of plant remedies. However, traditional healers in *Wonago Woreda* (SNNP, Ethiopia) [36] commonly used powdering as a means to prepare herbal remedies. The informants in the study area prefer fresh plant materials (73.95%) to prepare effective and efficient remedies due to the fact that, most of the bioactive phytochemicals are retained in fresh plant materials as compared to dry ones [47]. Although frequent collection of fresh plant materials in dry seasons has a devastating influence on the conservation statuses of medicinal plants, it is common to use fresh plant materials for the preparation of remedies elsewhere in Ethiopia [13,35,36,42,46].

Route of remedy administration and dosage

The majority (43.72%) of the remedies in the District were reported to be taken orally followed by dermal applications (26.98%). Different studies from other parts of Ethiopia also reported oral as a preferred route of remedy application followed by dermal [30,38]. Similarities among these results showed that patients visit traditional healers to relieve internal diseases. Contrary to our findings, the studies conducted in Bench District (Southeastern Ethiopia) [11] and Kilde Awulaelo District (Tigray Region, Ethiopia) [6] witnessed external application as the most common route of remedy administration.

Traditional plant remedies are less costly and more accessible as compared to modern medicine in the study area. Besides this, informants in the study District indicated their preference to

traditional medicines over modern drugs to relieve certain diseases such as rabies, hepatitis (caused by bat urine), herpes zoster, eczema, snakebite, evil eye and evil spirit. Similar trends were seen in Wayu Tuka District, Oromia Region, Ethiopia, where the local people showed preference to traditional medicine over modern medications for the management of rabies, liver disease, spider poisoning and diseases caused by bat urine [38].

Lack of standard dosage and precise measurement are the common drawbacks of traditional herbal medicine [48]. According to the responses of the informants in the study District, there was no agreement in measurement or unit used among traditional healers even in treating a similar disease. In general, the dose and frequency of remedy administration varied depending on the age, sex, health status of patients and in pregnancy conditions. The variation in quantity, unit of measurement and duration of treatment of prescribed plant preparations was also noted in studies conducted elsewhere in the country [6,16,20,29].

Informants' consensus on herbal medicines

Relatively highest ICF value was recorded for evil eye disease category (ICF = 0.90) in the study area, indicating the popularity of curative medicinal plants against diseases in the category. In addition, higher share of similar plant use information [49] was observed for snakebite (ICF = 0.88) and emergency disease (ICF = 0.84) categories. Moreover, the observed high plant use citation (23.11%) for treating ailments in the evil eye disease category may also indicate the relatively high incidence of such diseases and ease of identifying ailments and corresponding curative plants occurring in the District [17]. Since plants with high ICF values are thought to be pharmacologically effective [24], it is trustworthy to investigate the efficacy of the medicinal plants species cited in evil eye, snakebite, emergency disease categories using appropriate models.

Most important medicinal plants for the treatment of evil eye

Preference ranking exercise results are important parameters to identify the most favored plant species to treat evil eye in the study area, usually the most efficacious at least in the context of the local people. The people in the study District mainly relied on *Achyranthes aspera*, *Capparis tomentosa*, *Carissa spinarum*, *Clerodendrum myricoides*, *Cyphostemma molle*, *Gomphocarpus purpurascens*, *Leonotis ocyimifolia*, *Lobelia rhynchopetalum* and *Securidaca longepedunculata* plant species to manage evil eye. The preference ranking exercise result indicated that *Lobelia rhynchopetalum*, *Gomphocarpus purpurascens* and *Capparis tomentosa* scored highest values (first, second and third respectively) and were found to be the most preferred plants to treat evil eye in Enarj Enawga District. Ethnobotanical investigations done in different parts of the country also reported the use of *Carrisa spinarum*, *Capparis tomentosa*, and *Clerodendrum myricoides* for treating evil eye [6,13,20,29], which supports our findings. Taking this into account, we inferred the presence of bioactive chemicals, in these medicinal plants, responsible to relieve evil eye and shall be considered for further pharmacological investigations.

Medicinal plants used for other purposes

Most of the people in the study area rely on wild plants for various purposes such as agricultural tool, firewood, charcoal, construction material, food, etc. To assess the relative importance and to check the major impact on plant species, DMR exercise was performed on *Acacia sleberiana*, *Brucea antidysenterica*, *Carissa spinarum*, *Croton macrostachyus*, *Millettia ferruginea*, *Olea europaea* and *Prunus africana*. The result indicated that *olea europaea* was the most preferred multipurpose medicinal plant followed by *Croton macrostachyus* and *Acacia sleberiana*. Other studies conducted in different parts of Ethiopia, revealed *Croton macrostachyus*, *Prunus africana* and *Olea europaea* as multipurpose medicinal plants [6,29,38]. These similar reports suggested their relative importance for the livelihood of the local residents and the burden posed on these plant species. Thus, appropriate protection mechanisms with immediate effects are demanded to conserve these plant species before they wiped out.

Ranking of the most threatened medicinal plants

As indicated, most remedy preparations in the study District relied on plant roots, as a result, frequent collection posed a threat to most of the medicinal plants. The preference ranking exercise conducted on *Acokanthera schimperi*, *Dodonaea angustifolia*, *Echinops kebericho*, *Embelia schimpri*, *Prunus africana* and *Securidaca longepedunculata* showed that *Securidaca longepedunculata* is the most threatened plant followed by *Prunus africana* and *Echinops kebericho*. Other ethnobotanical studies conducted in different regions of Ethiopia documented *Securidaca longepedunculata* [38], *Embelia schimpri*, *Dodonaea angustifolia* [50] and *Acokanthera schimperi* [6,29] as the most threatened medicinal plants, which is in harmony with our findings in Enarj Enawga District. These results showed the depletion of the above plant species in the habitats of the country due to different factors. Thus, we strongly acknowledge the need for a complementary conservation action to save the fast eroding medicinal plant species of the country.

Threats to medicinal plants and conservation practices

Medicinal plants are at increased risk from destruction of their natural habitats due to agricultural expansion, firewood collection, overgrazing, urbanization, drought and collecting plants for construction materials. The preference ranking exercise result revealed agricultural expansion as the most powerful threat for medicinal plants followed by construction material and firewood collection respectively. Similar findings documented agricultural expansion and deforestations (for the purpose of firewood and construction materials) as the main threats of medicinal plants [20,36]. As expected agriculture is the main cause for the loss of medicinal plant habitats, because the communities in the study area depend on mixed agriculture as the main economic activity with limited landholding and high human population.

Sustainable medicinal plant management and conservation are crucial for the rural community healthcare and wellbeing in the study area. The effort to conserve the useful medicinal plants was found to be poor in the study District which agrees with other findings reported in different parts of Ethiopia [5,6,20]. Some traditional healers of the District have tried to conserve medicinal plants by cultivating at their home gardens, yet their efforts were significantly compromised by agro-ecological variations and shortage of land for cultivating trees

and shrubs. Cultivating the useful medicinal plants in home garden is praiseworthy, but conservation in the natural setting (in situ) must also be considered [5] since plants that grow without stress are expected to conserve their bioactive phytochemicals and hence potent as remedies.

In addition to the threat posed on the medicinal plant species, the indigenous knowledge is also on the verge of extinction as lack of interest to use and acquire the traditional medicinal knowledge was observed among the youths in Enarj Enawga District. Let alone the maximum secrecy that exist in the traditional knowledge acquisition or transfer, members of the young generations are lenient to acquire and conserve the practice. Elders mentioned less economic value of the practice, 'modernization', and associating traditional knowledge and practices with bad habits (such as witchcrafts) as mitigating factors during the discussions. Other studies also reported lack of interest to acquire the indigenous knowledge among the younger generations in different cultural groups in Ethiopia [5,11,16,30]. Moreover, most of the traditional healers in the study area revealed the decline in their medicinal plant knowledge through time partly because they lacked a habit of properly documenting the ethnomedicinal knowledge. Hence, a great threat is posed on the future use of indigenous ethnomedicinal knowledge to fulfill the primary healthcare demand of the local people under consideration.

Conclusion

Although the future use of medicinal plants and the associated indigenous knowledge are endangered due to poor conservation practices, 119 medicinal plants were reported by informants to treat different human diseases, suggesting their pivotal roles in the primary healthcare system of the study area. The traditional knowledge and practices are still being transferred from generation to generation as oral tales, in the study area, and appeared to weaken in recent years due to 'modernization', absence of strong traditional healers' associations and culture related factors. Thus, participatory conservation strategies are compulsory for sustainable use of the plants and the indigenous medicinal knowledge to fulfill the primary healthcare demand of the local community, to scientifically investigate the efficacy and safety of the medicinal plants and to isolate lead compounds that can serve as template for the synthesis of drugs with different pharmacological activities.

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Appendix A: List of medicinal plants used for treating human ailments in the study area, Enarj Enawga District.

No.	Scientific name	Family	Local name	Habit	Parts used	Disease treated (English/AMHARIC)	Mode of preparation and application	Application route	Voucher number
1	<i>Abutilon mauritianum</i> (Jack.) Medic.	Malvaceae	Yebab medihanit	Climber	Root	Snakebite	Roots are chewed and fluid swallowed	Oral	YS096
2	<i>Acacia sieberiana</i>	Fabaceae	Nech girar	Tree	Leaf	Epiglottitis/QOH	Leaves are crushed and pasted on the swelling	Dermal	YS049
3	<i>Achyranthes aspera</i> L.	Amaranthaceae	Telenj	Herb	Leaf	Snakebite	Leaves are crushed, mixed with water, filtered and taken orally	Oral	YS124
					Stem	Cut/bleeding	Stems are crushed and tied on the arm	Dermal	
					Leaf	QURIBA	Leaves are crushed, mixed with butter and pasted on the affected part	Dermal	
					Root, seed	LIFIE	Roots and seeds are roasted, powdered, mixed with butter and applied the affected part	Dermal	
					Root	Evil eye	Roots are crushed with seeds of <i>Allium sativum</i> , leaves of <i>Ruta chalepensis</i> and leaves of <i>Artemisia abyssinica</i> , burned on fire and fumigated	Dermal	
					Leaf	Fire burn	Leaves are crushed, dried, powdered mixed with butter and smeared on the affected part	Dermal	
4	<i>Acokanthera schimperi</i> (A. DC) Schweinf.	Apocynaceae	Meriz	Shrub	Leaf	Febrile illness/MEGAGNA	Leaves are collected from seven different areas, chopped, grounded and sniffed or taken nasally	Nasal	YS010
					Bark	Stomach ache	Dry bark is grounded, powder mixed with water and taken orally	Oral	
					Root	Hepatitis	Roots are burned on fire and fumigated	Dermal	

5	<i>Albizia gummifera</i> (J. F. Gmel.) C. A.Sm	Fabaceae	Mukarba/ Sessa	Tree	Leaf	Swelling	Leaves are crushed, mixed with water, filtered and taken orally	Oral	YS013
					Leaf	Anthrax/ <i>KIFUYIT</i>	Leaves are crushed, filtered and fluid taken orally; crushed leaves are pasted on the swelling	Oral/Dermal	
6	<i>Aloe caculirhiza</i> Del.	Aloaceae	Eret	Herb	Root	Snakebite	Roots are crushed, mixed with water, filtered and taken orally	Oral	YS054
					Leaf	Eye infection	Juice is prepared from the leaf and used in the form of ointment	Ophthalmic	
					Root	Rh disease/ <i>SHETELAY</i>	Roots are crushed, mixed with water, filter and taken orally at the six month of the pregnancy	Oral	
7	<i>Aloe pulcherrima</i> Gilbert & Sebsebe	Aloaceae	Sete eret	Herb	Root	Evil spirit	Roots are grounded together with seeds of <i>Allium sativum</i> and leaves of <i>Ruta chalepensis</i> , powder burned on fire in the patient's house or fumigated	Nasal / Dermal	YS023
8	<i>Artemisia abyssinica</i> Sch. Bip. ex A. Rich	Asteraceae	Chiqugne	Herb	Leaf	Evil eye	Leaves are crushed with seeds of <i>Allium sativum</i> and leaves of <i>Ruta chalepensis</i> , powder soaked in water and inhaled; burned on fire and fumigated	Nasal/ Dermal	YS137
9	<i>Arundo donax</i> L.	Poaceae	Shenbeko	Herb	Root	Evil eye	Roots are grounded with seeds of <i>Allium sativum</i> , leaves of <i>Ruta chalepensis</i> and leaves of <i>Artemisia abyssinica</i> , powder soaked with water and inhaled; burned on fire and fumigated	Nasal/ Dermal	YS028
10	<i>Asparagus africanus</i> Lam.	Asparagaceae	Yeset kest	Shrub	Root	Bleeding after delivery	Roots are tied in the neck of the patient till bleeding stops	Dermal	YS107
					Root	Epilepsy	Dry roots are burned on fire and fumigated	Dermal	
					Leaf, stem	Stomach ache	Leaves and stems are chewed and fluid swallowed	Oral	
					Root	Febrile illness	Roots are chewed and fluid swallowed	Oral	
					Root	Evil eye	Roots are crushed together with seeds of <i>Allium sativum</i> and leaves of <i>Ruta chalepensis</i> , powder soaked in water and inhaled	Nasal	
11	<i>Brassica carinata</i> A. Braun	Brassicaceae	Gomenzer	Herb	Seed	Eczema	Dry seeds are melted in a dish without water and smear it on the affected part	Dermal	YS116
12	<i>Brucea antidysenterica</i> J. F. Mill.	Simaroubaceae	Abalo	Tree	Seed	Eczema	Dry seeds are grounded, powder mixed with <i>Citrus aurantifolium</i> juice and honey and applied on the affected part	Dermal	YS058
13	<i>Calpurina aurea</i> (Ait.) Benth.	Fabaceae	Digita	Shrub	Root	Snakebite	Roots are chewed and fluid swallowed	Oral	YS110
					Leaf	<i>QURIBA</i>	Leaves are crushed, mixed with water, filtered and taken orally	Oral	
14	<i>Capparis tomentosa</i> Lam.	Capparidaceae	Gumero	Climber	Root	Epilepsy	Roots are burned on fire and fumigated	Dermal	YS122
					Root	Evil eye	Roots are crushed together with seeds of <i>Allium sativum</i> and leaves of <i>Ruta chalepensis</i> , powder soaked in water and inhaled; burned on fire and fumigated	Nasal / Dermal	
15	<i>Carissa spinarum</i> L.	Apocynaceae	Agam	Shrub	Leaf	Snakebite	Leaves are chewed and fluid swallowed	Oral	YS071
					Leaf	Eye infection	Leaves are crushed with water, filtered and three drops are taken as ointment for five days	Ophthalmic	
					Leaf, root	Evil eye	Leaves and roots are chewed and fluid swallowed	Oral	

16	<i>Catha edulis</i> (Vahl) Forssk. Ex Endl.	Celastraceae	Chat	Tree	Leaf	Snakebite	Leaves are chewed and fluid swallowed	Oral	YS142
17	<i>Centella asiatica</i> L.	Apiaceae	Yeait joro	Herb	Root	Rabies	A quarter of a finger-sized root is grounded, mixed with water, filtered and taken orally	Oral	YS102
18	<i>Cirnum orantum</i> (L.f. ex Aiton) Bury	Amaryllidaceae	Yejob shinkurt	Herb	Root	Itching	Roots are crushed and pasted on the affected part	Dermal	YS097
19	<i>Citrus aurantifolia</i> (Christm.) Swingle	Rutaceae	Lomi	Shrub	Fruit	Cough	Juice is made, mixed with egg yolk, honey and taken orally	Oral	YS007
20	<i>Clausena anisata</i> (Wild.) Hook.f. ex Benth.	Rutaceae	Limich	Shrub	Root	Evil eye	Roots are crushed with seeds of <i>Allium sativum</i> and leaves of <i>Ruta chalepensis</i> , powder soaked in water and inhaled; burned on fire and fumigated	Nasal/ Dermal	YS009
21	<i>Clematis hirsuta</i> Perr. & Guill.	Ranunculaceae	Woyin hareg	Climber	Leaf	Anthrax	Leaves are crushed, filtered and taken orally	Oral	YS086
22	<i>Clematis simensis</i> Fresen.	Ranunculaceae	Azo areg	Climber	Whole plant	Donkey's wart	The whole plant is washed, crushed and applied on the affected part	Anal	YS065
					Root	Swelling	Roots are crushed, dried, grounded, powder soaked in water and applied as cream on the swelling	Dermal	
					Leaf	Epiglottitis	Leaves are squeezed and solution applied on the head or wash head	Dermal	
					Leaf	Leishmania	Leaves are crushed, filtered and applied on the affected part using cotton	Dermal	
					Leaf	Eczema	Leaves are crushed and pasted on the affected part	Dermal	
23	<i>Clerodendrum myricoides</i> (Hochst) Vatke	Lamiaceae	Misirich	Shrub	Leaf	Epiglottitis	Leaves are crushed, filtered and taken orally	Oral	YS016
					Leaf	Swelling	Leaves are squeezed and taken orally; crushed and pasted on the swelling	Oral/Dermal	
					Leaf	Anthrax	Leaves are squeezed and drunk; applied on the affected part	Oral/Dermal	
					Root	Evil eye	Roots are grounded with seeds of <i>Allium sativum</i> and leaves of <i>Ruta chalepensis</i> , powder soaked in water and inhaled; burned on fire and fumigated	Nasal/ Dermal	
24	<i>Clutia abyssinica</i> Jaub. & Spach.	Euphorbiaceae	Fiyele-fej	Shrub	Root	Snakebite	Roots are chewed and fluid swallowed	Oral	YS151
					Leaf	Swelling	Leaves are squeezed and fluid taken orally	Oral	
					Leaf	Anthrax	Leaves are crushed, filtered and taken orally; crushed leaves are pasted on the swelling	Oral/Dermal	
					Root	Python poison	Roots are chewed and fluid swallowed to detoxify the poison	Oral	
25	<i>Commicarpus plumbagineus</i> (Cav.) Standl.	Nyctaginaceae	Yejob chama	Herb	Root	Retained placenta	Roots are crushed, filtered and taken orally with local beer (TELA)	Oral	YS106
					Root	Asthma	Roots are chopped, soaked in water for three hours and taken orally	Oral	
26	<i>Convolvulus steudneri</i> Engl.	Convolvaceae	Flatsat	Herb	Root	Snakebite	Roots are chewed and fluid swallowed	Oral	YS159
27	<i>Coriandrum sativum</i> L.	Apiaceae	Dimbilal	Herb	Seed	Cough	Seeds are grounded, mixed with water and solution taken orally	Oral	YS112
28	<i>Croton macrostachyus</i> Del.	Euphorbiaceae	Bisana	Tree	Bark	Snakebite	Bark is crushed, powdered, mixed with water, filtered and solution taken orally	Oral	YS037
					Shoot	Hepatitis	Shoots are crushed with water, filtered and solution taken orally	Oral	
					Bark	Febrile illness	Bark is crushed with water, filtered and taken orally	Oral	
					Root	Evil eye	Roots are crushed, dried, burned on fire and smoke inhaled	Nasal	

29	<i>Cucumis ficifolius</i> A. Rich.	Cucurbitaceae	Yemdir embuay	Climber	Root	Snakebite	A quarter of a finger-sized root chewed and fluid swallowed. Overdose causes severe stomach ache and vomiting	Oral	YS103
					Root	Cut/bleeding	Leaves are crushed, dried, powdered and smeared on the affected part	Dermal	
					Root	Retained placenta	Roots are crushed, filtered and fluid taken orally	Oral	
					Root	KELECHA	Roots are crushed, mixed with water, filtered and drunk for three days.	Oral	
					Root	Dysentery	Roots are chewed and fluid swallowed	Oral	
					Leaf, root	Stomach ache	Leavers and roots are crushed, filtered and fluid taken orally	Oral	
					Root	Febrile illness	Roots are chewed and fluid swallowed	Oral	
30	<i>Cynoglossum amplifolium</i> Hochst.	Boraginaceae	Shingug	Herb	Leaf	Tonsillitis/ENTIL MEWRED	Leaves are squeezed and fluid taken orally	Oral	YS027
					Leaf	Malaise/MICH	Leaves are squeezed and fluid taken orally	Oral	
					Leaf	Fever	Leaves are squeezed and fluid drunk; boil with water and fumigated	Oral/Dermal	
31	<i>Cyphostemma molle</i> (Bak.) Descoings	Vitaceae	Etse-zewie	Herb	Root	Snakebite	Roots are chewed and fluid swallowed	Oral	YS072
					Root	Donkey's wart	Roots are crushed, dried, powdered, mixed with butter and applied on the affected part	Anal	
					Root	Evil eye	Roots are chewed and fluid swallowed	Oral	
32	<i>Datura stramonium</i> L.	Solanaceae	Astenagir	Herb	Seed	Toothache	Seeds are burned and smoke inhaled via straw	Oral	YS068
					Root	Retained placenta	Roots are chopped, boiled and vapor inserted through the vagina	Vaginal	
					Leaf	Wound	Leaves are squeezed and solution applied	Dermal	
33	<i>Dichrostaachys cinerea</i> (L.) Wight et Arn.	Fabaceae	Ader	Tree	Root	Stomach ache	Roots are chewed and fluid swallowed	Oral	YS061
34	<i>Discopodium penninervium</i> Hochst.	Solanaceae	Aluma	Shrub	Leaf	Wound	Dry leaves are ground, powder pasted on the affected part	Dermal	YS053
35	<i>Dodonaea angustifolia</i> L.f.	Sapindaceae	Kitkita	Shrub	Shoot	Anthrax	Shoots are roasted, powdered, mixed with butter and applied on the affected part	Dermal	YS080
					Seed	LIFIE	Dry seeds are ground, mixed with water and applied on the affected part	Dermal	
36	<i>Dracaena steudneri</i> Mildbr.	Dracaenaceae	Merko	Shrub	Leaf	Evil spirit	Dry leaves are ground, powder burned on fire and fumigated	Dermal	YS015
37	<i>Echinops kebericho</i> Mesfin	Asteraceae	Kebercho	Herb	Root	Malaria	Roots are crushed with seeds of <i>Guizotia abyssinica</i> , mixed with water and solution taken orally	Oral	YS030
38	<i>Embelia schimperi</i> Vatke	Myrsinaceae	Enqoqo	Shrub	Seed	Tape worm	Dry seeds are ground, powder mixed with water and taken orally	Oral	YS057
39	<i>Euclea racemosa</i> Murr.	Ebenaceae	Dedeho	Shrub	Root	Snakebite	Roots are chewed and fluid swallowed to detoxify the poison	Oral	YS111

40	<i>Euphorbia abyssinica</i> G.F.Gmel.	Euphorbiaceae	Kulkual	Tree	Stem	Malaria	Stems are burned on fire and fumigated	Dermal	YS033
					Stem	Hepatitis	Stems are burned on fire and fumigated	Dermal	
					Root	Eczema	Roots are crushed, filtered, mixed with <i>Citrus aurantifolium</i> juice and cream applied on the affected part	Dermal	
					Root	Swelling	Roots are crushed and pasted on the swelling	Dermal	
41	<i>Euphorbia ampliphylla</i>	Euphorbiaceae	Kolkolchu	Shrub	Latex	Cancer	Latex is collected and applied as a cream	Dermal	YS035
					Latex	Leishmania	Latex is collected and applied as a cream	Dermal	
42	<i>Euphorbia schimperiana</i> Scheele	Euphorbiaceae	Wotetie	Herb	Latex	Snakebite	Latex is collected and cream inserted in the anus	Anal	YS090
					Root	Weaken babies/ LIWISHA	Roots are crushed, filtered, mixed with milk and taken orally	Oral	
43	<i>Euphorbia tirucalli</i> L.	Euphorbiaceae	Yemdir kinchib	Shrub	Latex	Wart	Latex is collected and applied as cream after cutting the wart	Dermal	YS099
44	<i>Foeniculum vulgare</i> Miller	Apiaceae	Ansial	Herb	Leaf	Urine retention	Leaves are crushed, filtered and fluid taken orally	Oral	YS064
45	<i>Fuerstia africana</i> T.C.E. Fries	Lamiaceae	Ejamsil	Herb	Whole plant	Donkey's wart	The whole plant is washed with water, crushed, solution applied on the affected part	Anal	YS070
46	<i>Gladiolus candidus</i> (Rendle) Goldblatt	Iridaceae	Milas golgul	Herb	Root, seed	Anthrax	Roots and seeds are grounded, powder mixed with water and solution taken orally	Oral	YS017
47	<i>Gladiolus psittacinus</i> Hook	Iridaceae	Enzerez	Herb	Root	Evil eye	Roots are grounded together with seeds of <i>Allium sativum</i> and leaves of <i>Ruta chalepensis</i> , powder soaked in water and inhaled	Nasal	YS067
48	<i>Glinus lotoides</i> L.	Molluginaceae	Meterie	Tree	Leaf	Tape worm	Dry leaves are grounded with <i>Guizotia abyssinica</i> seed, powder mixed with water and solution taken orally	Oral	YS014
49	<i>Gomphocarpus purpurascens</i> A. Rich.	Asclepiadaceae	Tifrena	Shrub	Root	Bleeding after delivery	Roots are collected and tied in the neck	Dermal	YS127
					Root	Evil eye	Roots are crushed with seeds of <i>Allium sativum</i> and leaves of <i>Ruta chalepensis</i> , powder soaked in water and inhaled	Nasal	
50	<i>Guizotia abyssinica</i> (L.f.) Cass.	Asteraceae	Nug	Herb	Seed	Cough	Seeds are grounded, mixed with water and solution taken orally	Oral	YS051
51	<i>Guizotia scabra</i> Chiov.	Asteraceae	Mech	Herb	Root	Stomach ache	Roots are chewed and fluid swallowed	Oral	YS011
52	<i>Hoslundia opposita</i> Vahl.	Lamiaceae	Yemich Medihanit	Herb	Leaf	SHIL MAZAWER	Leaves are crushed and fluid taken orally	Oral	YS100
					Leaf	Enhanced labor	Leaves are crushed, filtered and fluid taken orally	Oral	
53	<i>Impatiens rothii</i> Hook. F.	Balsaminaceae	Gishrit	Herb	Root	LIFIE	Roots are crushed and pasted on the affected part	Dermal	YS119
54	<i>Inula confertiflora</i> A. Rich.	Asteraceae	Woynagift	Shrub	Leaf	Epilepsy	Leaves are squeezed and fluid sniffed	Nasal	YS088
55	<i>Jasminum abyssinicum</i> Hochst. Ex DC.	Oleaceae	Tero hareg	Climber	Leaf	Fire burn	Leaves are crushed and pasted on the affected part	Dermal	YS131
56	<i>Jasminum grandiflorum</i> L.	Oleaceae	Tembelel	Climber	Leaf	Tape worm	Leaves are crushed, boiled with water and taken on empty stomach	Oral	YS125
					Leaf	Eye infection	Cut the leaves from seven areas and put it on a dormant stone	-	
					Shoot	Stomach ache	Shoots are grounded with water, filtered and taken orally	Oral	
57	<i>Justicia schimperiana</i> (Hochst. Ex Nees) T. Anders.	Acanthaceae	Sensel	Shrub	Leaf	Evil eye	Leaves are grounded with seeds of <i>Allium sativum</i> and leaves of <i>Ruta chalepensis</i> , powder soaked in water and inhaled	Nasal	YS025
					Leaf	Anthrax	Leaves are collected from seven different areas, squeezed and fluid taken orally	Oral	
					Stem	Retained placenta	Stems are collected, bark removed and inserted in to the vagina	Vaginal	

58	<i>Kalanchoe petitiiana</i> A. Rich	Crassulaceae	Andawla	Herb	Root	Evil eye	Dry roots are grounded with seeds of <i>Allium sativum</i> and leaves of <i>Ruta chalepensis</i> , powder soaked in water and inhaled	Nasal	YS060
					Root	Swelling	Roots are crushed, mixed with water and taken orally for three days	Nasal	
59	<i>Laggera crispata</i> (Vahl) Hepper & Woo.	Asteraceae	Keskeso/ Alashum	Herb	Leaf	Febrile illness	Leaves are crushed, mixed with water, filtered and taken orally for three days	Oral	YS079
60	<i>Laggera tomentosa</i> (Sch. Bip. Ex A Rich) Olivo & Hiern	Asteraceae	Keskeso/ Gimie	Herb	Root	Evil eye	Dry roots are grounded with seeds of <i>Allium sativum</i> and leaves of <i>Ruta chalepensis</i> , powder soaked in water and inhaled	Nasal	YS083
					Leaf, root	Stomach ache	Leaves and roots are chewed and fluid swallowed	Oral	
					Leaf	Febrile illness	Dry leaves are grounded with <i>Lepidium sativum</i> seeds, mixed with water and solution taken orally	Oral	
					Leaf	LIFIE	Leaves are crushed and pasted on the affected part	Dermal	
					Leaf	Dysentery	Leaves are crushed with water and solution taken orally	Oral	
61	<i>Lantana camara</i> L.	Verbenaceae	Yewef kolo	Herb	Leaf	LIFIE	Leaves are crushed and pasted on the affected part	Dermal	YS104
62	<i>Lenis culinaris</i> Medic.	Fabaceae	Misir	Herb	Seed	Herpes zoster	Dry seeds are grounded, powder soaked in water and cream smeared on the affected part	Dermal	YS160
63	<i>Leonotis ocymifolia</i> (Burm. F.) Iwarsson	Lamiaceae	Yeferes zeng	Herb	Stem	Rh disease	The patient stood on the door of her house while one foot is in and the other outside the house, arm-length stem is rotated around the waist of the patient three times, then tied on house	-	YS095
					Root	Evil eye	Roots are crushed with seeds of <i>Allium sativum</i> and leaves of <i>Ruta chalepensis</i> , powder soaked in water and inhaled	Nasal	
64	<i>Lepidium sativum</i> L.	Brassicaceae	Feto	Herb	Seed	Dysentery	Dry seeds are grounded, powder mixed with water and solution taken orally	Oral	YS145
65	<i>Linum usitatissimum</i> L.	Linaceae	Telba	Herb	Seed	Eczema	Dry seeds are grounded, mixed with honey and cream applied on the affected part	Dermal	YS041
66	<i>Lobelia rhynchopetalum</i> Hemsl.	Lobeiaceae	Jibara	Herb	Root	Rabies	Roots are grounded, mixed with milk and solution drunk for five days	Oral	YS114
					Latex	Retained placenta	Latex is smeared on the buttock of the patient	Dermal	
					Latex	Donkey's wart	Latex is mixed with snake-head powder and smeared after cutting	Anal	
					Root	Evil eye	Roots are crushed together with seeds of <i>Allium sativum</i> and leaves of <i>Ruta chalepensis</i> , soaked with water and inhaled	Nasal	
67	<i>Lycopersicon esculentum</i> Mill.	Solanaceae	Timatim	Herb	Leaf	Urine retention	Leaves are crushed, filtered and solution taken orally	Oral	YS043
68	<i>Malva verticillata</i> L.	Malvaceae	Lut	Herb	Leaf, root	Retained placenta	Leaves and roots are collected from three different area, crushed and inserted through the vagina	Vaginal	YS008
69	<i>Milletia ferruginea</i> (Hoscht.) Bak	Fabaceae	Birbira	Tree	Seed	Eczema	Dry seeds are roasted, grounded, powder mixed with butter and cream applied on the affected part for three days	Dermal	YS038
70	<i>Nicotiana tabacum</i> L.	Solanaceae	Tinbaho	Herb	Leaf	LIFIE	Leaves are crushed and pasted on the affected part	Dermal	YS044

71	<i>Ocimum lamiifolium</i> Hochst. ex Benth.	Lamiaceae	Dama kesse	Shrub	Leaf	Malaise	Leaves are squeezed and solution taken with a cup of coffee	Oral	YS109
					Leaf	Dysentery	Leaves are crushed with water, filtered and taken orally	Oral	
					Leaf, stem, seed	Swelling	Leaves, stems and seeds are grounded together and applied on the swelling in the form of cream	Dermal	
72	<i>Olea europaea</i> (Wall. ex G. Don) Cif	Oleaceae	Woyra	Tree	Leaf	Stomach ache	Leaves are crushed, mixed with water, filtered and solution drunk	Oral	YS091
73	<i>Osyris quadripartita</i> Decn.	Santalaceae	Keret	Shrub	Leaf	Eye pain	Leaves are collected from seven different area, dried, grounded and powder inserted in the eye for three days	Ophthalmic	YS084
74	<i>Otostegia fruticosa</i> (Forssk.) Schweinf. Ex Penzing.	Lamiaceae	Tunjitie	Shrub	Leaf	Cut/bleeding	Cutting the leaf in to seven pieces by calling his Christianity name	-	YS132
75	<i>Otostegia integrifolia</i> Benth.	Lamiaceae	Tunjit	Shrub	Root	Evil spirit	Dry roots are grounded and burned on fire and inhaled	Nasal	YS134
76	<i>Pavonia urens</i> Cav.	Malvaceae	Ablalit	Herb	Root	Evil eye	Roots are grounded with seeds of <i>Allium sativum</i> and leaves of <i>Ruta chalepensis</i> , powder soaked in water and inhaled	Nasal	YS062
					Leaf, root	Eczema	Leaves and roots are crushed and pasted on the affected part	Dermal	
77	<i>Periploca linearifolia</i> Quart.-Dell. & A. Rich.	Asclepiadaceae	Moyder	Climber	Root	Cut/bleeding	Cut and put the roots on a dormant stone, wish the patient so that he/she to cure from the bleeding	-	YS019
78	<i>Phytolacca dodecandra</i> L'Herit.	Phytolaccaceae	Endod	Shrub	Root	Rabies	Roots are chewed and fluid swallowed; as antidote <i>Guizotia abyssinica</i> solution is taken orally	Oral	YS074
					Root	QURIBA	Roots are chewed after removing the root bark	Oral	
					Root	Hepatitis	Roots are chewed and fluid swallowed	Oral	
					Leaf, root	KELECHA	Leaves and roots are boiled with water and taken orally	Oral	
					Root	Epiglottitis	Roots are chewed and fluid swallowed	Oral	
79	<i>Plantago lanceolata</i> L.	Plantaginaceae	Wondie gorteb	Herb	Whole plant	Donkey's wart	The whole plant is washed with water, crushed and applied on the affected part	Anal	YS089
80	<i>Plantago major</i> L.	Plantaginaceae	Nech gorteb	Herb	Root	Babies sickness/ ZURIT	Roots are chopped, soaked in water for a while, filtered and taken orally	Oral	YS048
					Leaf	Eye pain	Leaves are chewed and spitted on the patient's eye	Ophthalmic	
					Leaf	Cut/bleeding	Cut the leaf near the patient by saying 'stop the bleeding'	-	
					Root	Snakebite	Roots are crushed, mixed with water, filtered and fluid drunk	Oral	
81	<i>Polygala abyssinica</i> Fres.	Polygalaceae	Etse-lebona	Herb	Leaf	Anthrax	Leaves are crushed, filtered, mixed with <i>Euphorbia abyssinica</i> latex and applied on the affected part	Dermal	YS066
82	<i>Premna schimperi</i> Engl.	Lamiaceae	Checho	Shrub	Leaf	Toothache	Leaves are chewed and hold paste on the affected tooth	Oral	YS140
83	<i>Prunus africana</i> (Hook. F.) Kalkm.	Rosaceae	Tikur enchet	Tree	Leaf	Anthrax	Leaves are crushed and fluid taken orally; crushed leaves are pasted on the affected part	Oral/Dermal	YS130
84	<i>Ranunculus multifidus</i> Forssk	Ranunculaceae	Etse-siol	Herb	Leaf	Leishmania	Leaves are crushed and used to rub the affected part	Dermal	YS077
85	<i>Rhamnus staddo</i> A. Rich.	Rhamnaceae	Teddo	Shrub	Leaf	Epilepsy	Leaves are squeezed and fluid is inserted through the nose	Nasal	YS126
86	<i>Rhus retinorrhoea</i> Steud. Ex A. Rich	Anacardiaceae	Tilem	Herb	Leaf	Snakebite	Leaves are chewed and fluid swallowed	Oral	YS042
87	<i>Ricinus communis</i> L.	Euphorbiaceae	Chakima	Shrub	Seed	Eczema	Seeds are roasted, grounded, mixed with butter and applied as a cream on the affected part	Dermal	YS136

88	<i>Rosa abyssinica</i> Lindley	Rosaceae	Kega	Shrub	Bulb	Cough	Bulbs are grounded with water, filtered and taken orally	Oral	YS034
					Flower	Eczema	Flowers are squeezed and applied on the affected part	Dermal	
					Shoot	Stomach ache	Shoots are squeezed and fluid taken orally	Oral	
89	<i>Rubus steudneri</i> Schweinf.	Rosaceae	Amoch	Shrub	Leaf	Donkey's wart	Leaves are crushed, heated in a dish and inserted through the anus of the patient	Anal	YS069
					Leaf	LIFIE	Leaves are crushed and pasted on the affected part	Dermal	
90	<i>Rumex abyssinicus</i> Jack.	Polygonaceae	Mekmeko	Herb	Root	Anthrax	Dry roots are grounded, boiled in water and drunk with honey for five days	Oral	YS020
					Root	KELECHA	Dry roots are grounded, boiled in water and drunk with tea for three days	Oral	
91	<i>Rumex nepalensis</i> Spreng.	Polygonaceae	Tult	Herb	Root	Febrile illness	Roots are chewed and fluid swallowed	Oral	YS040
					Leaf	Retained placenta	Leaves are crushed and tied on the placenta; fluid is taken orally	Oral/vaginal	
92	<i>Rumex nervosus</i> Vahl.	Polygonaceae	Embuatie	Shrub	Leaf	Donkey's wart	Leaves are crushed, heated on a dish and inserted through the anus of the patient	Anal	YS059
					Leaf	Eye pain	Leaves are chewed and spat on the patient's eye	Ophthalmic	
					Leaf, root	Retained placenta	Leaves and roots are crushed and inserted via the left ear, and vagina	Vaginal/Auricular	
93	<i>Salvia nilotica</i> Jacq.	Lamiaceae	Hulegeb	Herb	Leaf	LIFIE	Leaves are crushed and pasted on the affected part	Dermal	YS001
94	<i>Schinus molle</i> L.	Anacardiaceae	Kundo berbere	Tree	Leaf	Evil spirit	Dry leaves are grounded and burned on fire in the patient house or inhaled	Nasal	YS032
95	<i>Securidaca longepedunculata</i> Fresen.	Polygalaceae	Temenahi	Tree	Root	Evil eye	Roots are grounded with seeds of <i>Allium sativum</i> , leaves of <i>Ruta chalepensis</i> and leaves of <i>Artemisia abyssinica</i> , powder soaked with water and inhaled; burned on fire and fumigated	Nasal/Dermal	YS123
96	<i>Sida schimperiana</i> Hochst. ex A. Rich.	Malvaceae	Chifrig	Shrub	Root	Impotence	Roots are chewed and fluid swallowed	Oral	YS046
					Root	Evil eye	Roots are grounded together with seeds of <i>Allium sativum</i> and leaves of <i>Ruta chalepensis</i> , powder soaked in water and inhaled	Nasal	
97	<i>Silene macrosolen</i> Steud. ex A. Rich.	Caryophyllaceae	Wogert	Herb	Root	Malaria	Roots are crushed with seeds of <i>Guizotia abyssinica</i> , mixed with water and taken orally	Oral	YS085
					Root	Hemorrhoids	Roots are grounded, powder mixed with butter and applied on the affected part	Anal	
98	<i>Solanecio gigas</i> (Vatke) C. Jeffrey	Asteraceae	Boz	Herb	Leaf, Shoot	Evil eye	Bulbs and leaves are grounded together with seeds of <i>Allium sativum</i> and leaves of <i>Ruta chalepensis</i> , powder soaked in water and inhaled; burned on fire and fumigated	Nasal/Dermal	YS036
					Stem	Swelling	Stems are grounded, mixed with water and pasted on the swelling	Dermal	
					Leaf	Hepatitis	Leaves are collected from seven different areas, grounded with <i>Guizotia abyssinica</i> seeds, mixed with water and solution taken orally	Oral	
99	<i>Solanum anguivi</i> Lam.	Solanaceae	Zerch enbuay	Shrub	Root	Impotence	Roots are chewed and fluid swallowed	Oral	YS093
100	<i>Solanum incanum</i> L.	Solanaceae	Embuay	Shrub	Leaf	Fire burn	Leaves are crushed and pasted on the affected part using cotton	Dermal	YS055
101	<i>Solanum marginatum</i> L.f.	Solanaceae	Geber embuay	Shrub	Seed	Cough	Dry sees are burned on fire and smoke inhaled using a straw	Oral	YS120

102	<i>Thalictrum rhynchocarpum</i> Dill & Rich.	Ranunculaceae	Sire-bizu	Herb	Root	Donkey's wart	Roots are crushed, dried, grounded with <i>Lepidium sativum</i> seeds and applied as cream on the affected part	Anal	YS024
103	<i>Thunbergia alata</i> Bojer ex Sims.	Acanthaceae	Hareg	Climber	Leaf	LIFIE	Leaves are crushed and pasted on the affected part	Dermal	YS003
104	<i>Trichodesma zeylanicum</i> (Brum.f.) R.Br.	Boraginaceae	Yewusha milas	Herb	Root	Tonsillitis	Roots are crushed, mixed with water, filtered and taken orally	Oral	YS101
					Root	Febrile illness	Roots are crushed, mixed with water, filtered and taken orally	Oral	
					Root	Stomach ache	Roots are chewed and fluid swallowed	Oral	
					Root	Dysentery	Roots are crushed, mixed with water, filtered and taken orally	Oral	
					Leaf	Retained placenta	Leaves are crushed and tied on the placenta	Vaginal	
					Root	Retained placenta	Roots are crushed and fluid taken with local beer (TELA)	Oral	
105	<i>Urtica simensis</i> Steudel	Urticaceae	Sama	Herb	Root	Cut/bleeding	Roots are collected and tied in the patient's arm	Dermal	YS021
106	<i>Verbascum sinaiticum</i> Benth.	Scrophulariaceae	Ketetina	Herb	Root	Snakebite	Roots are chewed and fluid swallowed to detoxify the poison	Oral	YS029
					Root	Bleeding after delivery	Roots are tied in the neck until the bleeding stops	Dermal	
					Leaf	Wound healing	Leaves are crushed and pasted on the affected part	Dermal	
					Leaf	Malaise	Leaves are crushed, filtered and fluid taken orally; body washed with the solution	Oral/dermal	
					Flower	QURIBA	Flowers are crushed, mixed with milk and taken orally	Oral	
					Leaf, Root	Retained placenta	Leaves and roots are chewed and fluid swallowed	Oral	
					Root	Hepatitis	Roots are burned on fire and smoke inhaled	Nasal	
					Root	Eye infection	Roots are crushed, filtered and three drops are added as ointment for three days	Ophthalmic	
107	<i>Verbena officinalis</i> L.	Verbenaceae	Atuch	Herb	Root	Nasal bleeding	Roots are tied in the neck; crushed and sniffed	Dermal/Nasal	YS052
					Root	Stomachache	Roots are chewed and fluid swallowed	Oral	
					Leaf	Hearing loss	Leaves are crushed, filtered, mixed with goat butter and inserted through the ear (while exposed to direct sun light)	Auricular	
108	<i>Vernonia amygdalina</i> Del.	Asteraceae	Girawa	Shrub	Leaf	Stomachache	Leaves are squeezed and fluid drunk	Oral	YS117
109	<i>Withania somnifera</i> (L.) Dun.	Solanaceae	Gizewa	Shrub	Leaf	Evil eye	Dry leaves are grounded, powdered, burn on fire and fumigated	Dermal	YS115
					Leaf	LIFIE	Leaves are crushed, mixed with butter and applied on the affected part	Dermal	
110	<i>Zehneria scabra</i>	Asteraceae	Haregressa	Climber	Leaf	Malaise	Leaves are boiled and fumigated	Dermal	YS002
111	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Zinjibil	Herb	Rhizome	Malaria	Rhizomes are grounded with <i>Allium sativum</i> , powder mixed with water and taken orally	Oral	YS094

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