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 ethnobotanical knowledge and the associated plants in the Region [12-20]. So far, no such study has 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
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:

\[
ICF = \frac{\text{nur-nt/nur-1}}{\text{nur}}
\]

Where,

\[
ICF = \text{Informants Consensus Factor} \\
\text{nur} = \text{Number of use citations in each category} \\
nt = \text{Number of plant species used}
\]

**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 families with three or more species in the study area.

| Family name  | No of plant species | % of plant species | No of plant genera | % of plant genera |
|--------------|---------------------|-------------------|--------------------|-------------------|
| Asteraceae   | 10                  | 9.01              | 8                  | 8.25              |
| Lamiaceae    | 9                   | 8.11              | 8                  | 8.25              |
| Solanaceae   | 8                   | 7.21              | 6                  | 6.19              |
| Euphorbiaceae| 7                   | 6.31              | 4                  | 4.12              |
| Fabaceae     | 6                   | 5.41              | 6                  | 6.19              |
| Malvaceae    | 4                   | 3.6               | 4                  | 4.12              |
| Ranunculaceae| 4                   | 3.6               | 3                  | 3.09              |
| Apiceae      | 3                   | 2.7               | 3                  | 3.09              |
| Polygonaceae | 3                   | 2.7               | 1                  | 1.03              |
| Oleaceae     | 3                   | 2.7               | 2                  | 2.06              |
| Rosaceae     | 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                         |
(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), Gaizotia abyssinica (food), Lenis culinaris (food), Linum usitatissimum (food), Lycopersicum esculentum (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 moll, Gomphocarpus purpurascens, Leonotis ocymifolia, Lobelia rynchopetalum and Securidaca longepedunculata were also short-listed by the key informants as most preferred plant
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*, *Brueca antidysenterica*, *Carissa spinarum*, *Croton macrostachyus*, *Millettia 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).

**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                    | Leishmanias, 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, epigiottitis, tonsillitis, cough and asthma | 13  | 39  | 0.68|
| Others diseases                            | Epilepsy, urine retention, impotence, weaken babies and babies' sickness | 10  | 33  | 0.72|

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

| Plant species                          | Respondents (R<sub>1</sub>-R<sub>10</sub>) | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | R10 | Totaal | Rank |
|----------------------------------------|--------------------------------------------|----|----|----|----|----|----|----|----|----|-----|--------|------|
| Achyranthes aspera                    |                                            | 5  | 6  | 7  | 8  | 4  | 7  | 6  | 3  | 6  | 1    | 53     | 4th  |
| Capparis tomentosa                    |                                            | 7  | 7  | 8  | 9  | 7  | 6  | 7  | 8  | 9  | 7    | 75     | 3rd  |
| Carissa spinarum                     |                                            | 6  | 4  | 5  | 2  | 5  | 3  | 4  | 2  | 1  | 6    | 38     | 6th  |
| Clerodendrum myricoides              |                                            | 2  | 1  | 1  | 3  | 2  | 2  | 5  | 2  | 4  | 25   | 42     | 8th  |
| Cyphostemma molle                    |                                            | 1  | 1  | 2  | 1  | 2  | 1  | 3  | 1  | 5  | 2    | 21     | 9th  |
| Gomphocarpus purpurascens            |                                            | 8  | 9  | 6  | 5  | 9  | 8  | 8  | 9  | 7  | 8    | 77     | 2nd  |
| Leonotis ocymifolia                 |                                            | 4  | 2  | 4  | 1  | 5  | 1  | 4  | 3  | 3   | 31    | 31    | 7th  |
| Lobelia rhynchopetalum               |                                            | 9  | 8  | 9  | 7  | 8  | 9  | 6  | 8  | 9   | 82    | 82    | 1st  |
| Securidaca longipedunculata          |                                            | 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.

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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 [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 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 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 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].

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 |
|--------------------------|----------|-------------------|----------|--------------|-----------|----------|-------|--------|-------|------|
| Acacia sieberiana        | 3        | 3                 | 5        | 4            | 3         | 4        | 2     | 1      | 14    | 3rd  |
| Brucea antisynergetica   | 4        | 1                 | 3        | 3            | 2         | 1        | 1     | 4      | 19    | 7th  |
| Carissa spinarum         | 5        | 0                 | 3        | 2            | 2         | 3        | 2     | 3      | 20    | 6th  |
| Crotton macrostachyus    | 4        | 2                 | 5        | 5            | 4         | 3        | 5     | 1      | 29    | 2nd  |
| Milletia ferruginea      | 3        | 2                 | 5        | 5            | 3         | 3        | 3     | 27     | 4th   |
| Olea europeae            | 2        | 3                 | 4        | 5            | 5         | 2        | 5     | 3      | 30    | 1st  |
| Prunus africana          | 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 Spieces | Respondents (R_{R_{iso}}) | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | R10 | Total | Rank |
|---------------|---------------------------|----|----|----|----|----|----|----|----|----|-----|-------|------|
| Acokanthera schimperi |                           | 2  | 3  | 1  | 3  | 1  | 2  | 2  | 2  | 2  | 1   | 19    | 5th  |
| Dodonaea angustifolia    |                           | 3  | 2  | 3  | 2  | 2  | 3  | 4  | 3  | 3  | 28   | 4th   |
| Echinops kebericho       |                           | 4  | 4  | 2  | 5  | 4  | 5  | 3  | 6  | 4  | 5   | 43    | 3rd   |
| Embelia schimperi        |                           | 1  | 1  | 4  | 1  | 3  | 1  | 1  | 2  | 1  | 14   | 6th   |
| Prunus africana          |                           | 5  | 6  | 5  | 4  | 5  | 6  | 5  | 4  | 6  | 4   | 50    | 2nd   |
| Securidaca longipedunculata |                     | 6  | 5  | 6  | 6  | 6  | 4  | 6  | 5  | 5  | 5   | 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_{R_{iso}}) | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | R10 | Total | Rank |
|---------------------------|---------------------------|----|----|----|----|----|----|----|----|----|-----|-------|------|
| Acokanthera schimperi     |                           | 2  | 3  | 1  | 3  | 1  | 2  | 2  | 2  | 1  | 2   | 19    | 5th  |
| Dodonaea angustifolia     |                           | 3  | 2  | 3  | 2  | 2  | 3  | 4  | 3  | 3  | 28   | 4th   |
| Echinops kebericho       |                           | 4  | 4  | 2  | 5  | 4  | 5  | 3  | 6  | 4  | 5   | 43    | 3rd   |
| Embelia schimperi        |                           | 1  | 1  | 4  | 1  | 3  | 1  | 1  | 2  | 1  | 14   | 6th   |
| Prunus africana          |                           | 5  | 6  | 5  | 4  | 5  | 6  | 5  | 4  | 6  | 4   | 50    | 2nd   |
| Securidaca longipedunculata |                     | 6  | 5  | 6  | 6  | 6  | 4  | 6  | 5  | 5  | 5   | 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.

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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. *Clitia 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 abeoensis for the treatment of snakebite by a similar mechanism. These nature 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 Brucia antisyenterica (for eczema), Calpurina aurea (for QURIBA), Datura stramonium (for toothache), Dracaena steudneri (for evil eye), Glinus laticostus (for tapeworm), Justicia schimperiana (for evil eye), Kalanchoe petiolaris (swelling), Ocimum lamiiifolium (for malaria), Pytholacca dodcandra (for rashes, hepatitis, wound and QURIBA), Rumex nepalensis (for retained placenta), Verbenas officinales (for stomachache) and Zehneria scabra (for malaria) 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 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 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 administration 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 Kiltie 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 preference 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 ocymifolia, 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 Carissa spinarum, Capparis tomentosa, and Clerodendrum myricoides for treating evil eye [6,13,20,29], which supports our findings. Taking this in to 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 seberiana, Brueca 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 seberiana. 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 schimperi, 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 schimperi, Dodonaea angustifolia [30] 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 treats 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.

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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 templet 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   | Abutilon mauritianum (Jack.) Medic. | Malvaceae  | Yebeb medihant | Climber   | Root                          | Snakebite                        | Leaves are chewed and fluid swallowed | Oral             | YS096         |
| 2   | Acacia sieberiana                | Fabaceae   | Nech girar      | Tree      | Leaf                          | Epiglottitis/QOH                  | Leaves are crushed and pasted on the swelling | Dermal           | YS049         |
| 3   | Achyranthes aspera 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 Allium sativum and leaves of Ruta chalepensis and leaves of Artemisia abyssinica, burned on fire and fumigated | Dermal           |              |
|     |                                  |            |              |             | Leaf                          | Fire burn                        | Leaves are crushed, dried, powdered mixed with butter and smeread on the affected part | Dermal           |              |
|     |                                  |            |              |             | Leaf                          | Swelling                         | Leaves are crushed and pasted on the affected part | Dermal           |              |
| 4   | Acokanthera schimperi (A. DC) Schweinf. | Apocynaceae | Meriz  | Shrub       | Leaf                          | Fieberli 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           |              |

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| No. | Plant Name                                      | Family      | Type           | Part Used          | Medical Uses                                                                 | Method of Use                                      |
|-----|------------------------------------------------|-------------|----------------|--------------------|-------------------------------------------------------------------------------|---------------------------------------------------|
| 5   | *Albizia gummifera* (J. F. Gmel.) C. A.Sm.    | Fabaceae    | Mukarba/Sessa  | Leaf               | Swelling                                                                     | Leaves are crushed, mixed with water, filtered and taken orally |
|     |                                               |             | Tree           | Leaf               | Anthrax/KIFUYIT                                                              | Leaves are crushed, filtered and taken orally, then pasted on the swelling |
| 6   | *Aloe caculirhiza* Del.                       | Aloaceae    | Eret           | Root               | Snakebite                                                                     | Roots are crushed, mixed with water, filtered and taken orally |
|     |                                               |             | Herb           | Leaf               | Eye infection                                                                 | Juice is prepared from the leaf and used in the form of ointment |
|     |                                               |             |               | Root               | Rh disease/SHETELAY                                                           | Roots are crushed, mixed with water and taken orally, lasting for six months |
| 7   | *Aloe pulcherrima* Gilbert & Sebebe           | Aloaceae    | Sete etet      | Root               | Evil spirit                                                                    | Roots are grounded together with seeds of *Allium sativum* and leaves of *Ruta chalepensis*, powder burned on fire in the patient's house or fumigated |
| 8   | *Artemisia abyssinica* Sch. Bip. ex A. Rich   | Asteraceae  | Chiqugne       | Leaf               | Evil eye                                                                      | Leaves are crushed with seeds of *Allium sativum* and leaves of *Ruta chalepensis*, powder soaked in water and inhaled; burned on fire and fumigated |
| 9   | *Arundo donax* L.                            | Poaceae     | Shenbeko       | Root               | Evil eye                                                                      | Roots are grounded with seeds of *Allium sativum* and leaves of *Ruta chalepensis*, powder soaked in water and inhaled, burned on fire and fumigated |
| 10  | *Asparagus africanus* Lam.                    | Asparagaceae| Yeset kest     | Root               | Bleeding after delivery                                                       | Roots are tied in the neck of the patient till bleeding stops |
|     |                                               |             | Shrub          | Leaf               | Stoma ache                                                                    | Leaves and stems are chewed and fluid swallowed |
|     |                                               |             |                | Root                | Febrile illness                                                               | Roots are chewed and fluid swallowed |
|     |                                               |             |                | Root                | Evil eye                                                                      | Roots are crushed together with seeds of *Allium sativum* and leaves of *Ruta chalepensis*, powder soaked in water and inhaled |
| 11  | *Brassica carinata* A. Braun                  | Brassicaceae| Gomenzer       | Seed               | Eczema                                                                        | Dry seeds are melted in a dish, water seed and smear it on the affected part |
| 12  | *Brucea antisynterica* J. F. Mill.           | Simaroubaceae| Abalo          | Tree                | Eczema                                                                        | Dry seeds are ground, powdered mixed with *Citrus aurantiifolium* juice and honey and applied on the affected part |
| 13  | *Calpurina aurea* (All.) Benth.               | Fabaceae    | Digita         | Leaf               | Snakebite                                                                     | Roots are chewed and fluid swallowed, mixed with water and taken orally |
|     |                                               |             | Shrub          | Leaf               | QURIBA                                                                        | Leaves are crushed, mixed with water, filtered and taken orally |
| 14  | *Capparis tomentosa* Lam.                    | Capparidaceae| Gumero         | Climber            | Epilepsy                                                                      | Roots are crushed together with seeds of *Allium sativum* and leaves of *Ruta chalepensis*, powder soaked in water and inhaled; burned on fire and fumigated |
|     |                                               |             |                | Root                | Evl eye                                                                       | Roots are burned on fire and fumigated |
| 15  | *Carissa spinarum* L.                        | Apocynaceae | Agam           | Leaf               | Snakebite                                                                     | Leaves are chewed and fluid swallowed, mixed with water and taken orally |
|     |                                               |             | Shrub          | Leaf               | Eye infection                                                                 | Leaves are crushed with water, filtered and three drops are taken as ointment for five days |

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| No. | Species & Genus | Family | Plant Parts | Disease | Description & Notes |
|-----|----------------|--------|-------------|---------|---------------------|
| 16  | Catha edulis (Vahl) Forsk. | Celastraceae | Leaf | Snakebite | Leaves are chewed and fluid swallowed |
|     |                 |         |             |         | Oral | YS142 |
| 17  | Centella asiatica L. | Apiaceae | Root | Rabies | A quarter of a finger-sized root is ground, mixed with water, filtered and taken orally |
|     |                 |         |             |         | Oral | YS102 |
| 18  | Cimicium auranti ifolia (Christm.) Swingle | Rutaceae | Root | Itching | Roots are crushed and pasted on the affected part |
|     |                 |         |             |         | Dermal | YS097 |
| 19  | Citrus aurantium | Rutaceae | Fruit | Cough | Juice is made, mixed with egg yolk, honey and taken orally |
|     |                 |         |             |         | Oral | YS007 |
| 20  | Clausena anisata (Wild.) Hook.f. ex Benth. | Rutaceae | Root | Evil eye | Roots are crushed with seeds of Allium sativum and leaves of Ruta chalepensis, powder soaked in water and inhaled; burned on fire and fumigated |
|     |                 |         |             |         | Nasal/Dermal | YS009 |
| 21  | Clematis hirsuta | Ranunculaceae | Leaf | Anthrax | Leaves are crushed, filtered and taken orally |
|     |                 |         |             |         | Oral | YS066 |
|     | Perr. & Guill. | Clematis simensis Fresen. | Whole plant | Donkey's wart | The whole plant is washed, crushed and applied on the affected part |
|     |                 | Ranunculaceae | Root | Swelling | Roots are crushed, dried, powdered in water and applied as cream on the swelling |
|     |                 |         |             |         | Dermal |
|     |                 | Azor aeg | Leaf | Epiglottitis | Leaves are squeezed and solution applied on the head or wash head |
|     |                 | Clematis hirsuta | Leaf | Leishmania | Leaves are crushed, filtered and applied on the affected part using cotton |
|     |                 | Ranunculaceae | Leaf | Eczema | Leaves are crushed and pasted on the affected part |
| 22  | Clerodendrum myricoides (Hochst) Valke | Lamiaceae | Root | Evil eye | Roots are crushed with seeds of Allium sativum and leaves of Ruta chalepensis, powder soaked in water and inhaled; burned on fire and fumigated |
|     |                 |         |             |         | Nasal/Dermal |
|     |                 | Misirich | Root | Retained placenta | Roots are crushed, filtered and taken orally with local beer (TELA) |
|     |                 |         |             |         | Oral | YS106 |
| 24  | Clitia abyssinica Jaub. & Spach. | Euphorbiaceae | Root | Snakebite | Roots are chewed and fluid swallowed |
|     |                 |         |             |         | Oral | YS151 |
|     |                 | Fiyele-fej | Leaf | Swelling | Leaves are squeezed and fluid taken orally |
|     |                 |         |             |         | Oral/Dermal |
|     |                 |         |             |         | Oral | YS016 |
|     |                 |         |             |         | Oral/Dermal |
|     |                 |         |             |         | Oral/Dermal |
|     |                 |         |             |         | Oral/Dermal |
|     |                 |         |             |         | Oral/Dermal |
| 25  | Commicarpus plumbagineus (Cav.) Standl. | Nyctaginaceae | Root | Asthma | Roots are crushed, filtered and taken orally |
|     |                 |         |             |         | Oral |
|     |                 | Yejib chama | Root | Retained placenta | Roots are crushed, filtered and taken orally with local beer (TELA) |
|     |                 |         |             |         | Oral | YS106 |
|     |                 |         |             |         | Oral/Dermal |
|     |                 |         |             |         | Oral | YS016 |
| 26  | Convolvulus steudneri Engl. | Convolvulaceae | Root | Snakebite | Roots are chewed and fluid swallowed |
|     |                 | Flatsat | Seed | Cough | Seeds are ground, mixed with water and solution taken orally |
|     |                 |         |             |         | Oral | YS112 |
| 27  | Coriandrum sativum L. | Apiaceae | Seed | Cough | Seeds are ground, mixed with water and solution taken orally |
|     |                 |         |             |         | Oral | YS112 |
|     |                 | Dimbilal | 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 | Fibrile 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 |

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| No. | Species Name                      | Family        | Genus     | Uses                          | Part Used                  | Route | Preparation                                                                 |
|-----|----------------------------------|---------------|-----------|-------------------------------|----------------------------|-------|----------------------------------------------------------------------------|
| 29  | Cucumis ficifolius A. Rich.      | Cucurbitaceae | Yemdir embuay | Snakebite                     | Root                        | Oral  | A quarter of a finger-sized root chewed and fluid swallowed. Overdose causes severe stomach ache and vomiting |
|     |                                  |               | Climb      |                               |                            |       |                                                                            |
| 29  |                                  |               |            | Cut/bleeding                  | Root                        | Dermal| Leaves are crushed, dried, powdered and smeared on the affected part        |
| 29  |                                  |               |            | Retained placenta             | Root                        | Oral  | Roots are crushed, filtered and fluid taken orally                         |
| 29  | KELECHA                          |               |            |                               | Root                        | Oral  | Roots are crushed, mixed with water, filtered and drunk for three days.    |
| 29  |                                  |               |            |                               | Root                        | Oral  | Roots are chewed and fluid swallowed                                       |
| 29  |                                  |               |            |                               | Leaf, root                  | Oral  | Leavers and roots are crushed, filtered and fluid taken orally             |
| 29  |                                  |               |            |                               | Root                        | Oral  | Roots are chewed and fluid swallowed                                       |
| 29  |                                  |               |            |                               | Root                        | Oral  | Roots are crushed together with seeds of Allium sativum and leaves of Ruta chalepensis, powder soaked in water and inhaled |
| 30  | Cynoglossum amplifolium Hochst.  | Boraginaceae  | Shingug    | Tonsillitis/ENTIL             | Leaf                        | Oral  | Leaves are squeezed and fluid taken orally                                 |
|     |                                  |               | Herb       |                               |                            |       |                                                                            |
| 30  |                                  |               |            | Malaise/MICH                  | Leaf                        | Oral  | Leaves are squeezed and fluid taken orally                                 |
| 30  |                                  |               |            |                               | Leaf                        | Oral  | Leaves are squeezed and fluid drunk; boil with water and fumigated        |
| 30  |                                  |               |            |                               | Root                        | Oral  | Roots are chewed and fluid swallowed                                       |
| 31  | Cyphostemma molle (Bak.) Descoings| Vitaceae      | Etse-zewie | Snakebite                     | Root                        | Oral  | Roots are chewed and fluid swallowed                                       |
|     |                                  |               | Herb       |                               |                            |       |                                                                            |
| 31  |                                  |               |            | Donkey’s wart                 | Root                        | Oral  | Roots are crushed, dried, powdered, mixed with butter and applied on the affected part |
| 31  |                                  |               |            |                               | Root                        | Anal  |                                                                            |
| 31  |                                  |               |            | Evil eye                      | Root                        | Oral  | Roots are chewed and fluid swallowed                                       |
| 32  | Datura stramonium L.             | Solanaceae    | Astenagir  | Toothache                     | Seed                        | Oral  | Seeds are burned and smoke inhaled via straw                              |
|     |                                  |               | Herb       |                               |                            |       |                                                                            |
| 32  |                                  |               |            | Retained placenta             | Root                        | Vaginal| Roots are chopped, boiled and vapor inserted through the vagina           |
| 32  |                                  |               |            |                               | Leaf                        | Dermal| Leaves are squeezed and solution applied                                   |
| 33  | Dichrostaechys cinerea (L.) Wight et Am. | Fabaceae | Ader | Stomach ache                  | Root                        | Oral  | Roots are chewed and fluid swallowed                                       |
|     |                                  |               | Tree       |                               |                            |       |                                                                            |
| 34  | Discopodium penninervium Hochst. | Solanaceae    | Aluma      | Wound                         | Leaf                        | Dermal| Dry leaves are grounded, powder pasted on the affected part                |
|     |                                  |               | Shrub      |                               |                            |       |                                                                            |
| 35  | Dodonaea angustifolia L.f.       | Sapindaceae   | Kikita     | Anthrax                       | Shoot                       | Dermal| Shoots are roasted, powdered, mixed with butter and applied on the affected part |
|     |                                  |               | Shrub      |                               |                            |       |                                                                            |
| 35  |                                  |               |            |                               | Seed                        | Dermal| Dry seeds are grounded, mixed with water and applied on the affected part  |
| 36  | Dracaena steudneri Mildbr.       | Dracaenaceae  | Merko      | Evil spirit                   | Leaf                        | Dermal| Dry leaves are grounded, powder burned on fire and fumigated               |
|     |                                  |               | Shrub      |                               |                            |       |                                                                            |
| 37  | Echinops kebericho Mesfin        | Asteraceae    | Kebercho   | Malaria                       | Root                        | Oral  | Roots are crushed with seeds of Guizotia abyssinica, mixed with water and solution taken orally |
| 38  | Embelia schimperi Vallk          | Myrsinaceae   | Emqopo     | Tape worm                     | Seed                        | Oral  | Dry seeds are grounded, powder mixed with water and taken orally           |
|     |                                  |               | Shrub      |                               |                            |       |                                                                            |
| 39  | Eucllea racemosa Murr.           | Ebenaceae     | Dedeho     | Snakelite                     | Root                        | Oral  | Roots are chewed and fluid swallowed to detoxify the poison                |

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|   | **Species** | **Family** | **Part** | **Method**                                                                 | **Symptom** | **Site** | **Ref** |
|---|-------------|------------|---------|---------------------------------------------------------------------------|-------------|---------|---------|
| 40 | *Euphorbia abyssinica* | Euphorbiaceae | Root | Crushed and pasted | Malaria | Stem | YS033 |
| 41 | *Euphorbia ampliphylla* | Euphorbiaceae | Koicolchu | Crushed | Swelling | Latex | Dermal | YS035 |
| 42 | *Euphorbia schimperiana* | Euphorbiaceae | Wortete | Latex | Snakebite | Latex | Anal | YS090 |
| 43 | *Euphorbia tirucalli* | Euphorbiaceae | Yemdir | Root | Weaken babies | Yemdir | Oral |       |
| 44 | *Foeniculum vulgare* | Apiaceae | Wart | Leaf | Urine retention | Leaf | Dermal | YS099 |
| 45 | *Fuseria africana* | Lamiaceae | Ejamsi | Whole plant | Donkey's wart | Whole plant | Oral | YS064 |
| 46 | *Gladis candidus* | Iridaceae | Milas golgi | Root, seed | Anthrax | Root | Oral | YS017 |
| 47 | *Gladis psittacinus* | Iridaceae | Enzeres | Root | Evil eye | Root | Nasal | YS067 |
| 48 | *Glilus lotoides* | Molluginaceae | Meterie | Leaf | Tape wound | Leaf | Oral | YS014 |
| 49 | *Gomphocarpus purpurascens* | Asclepiadaceae | Tifrena | Root | Bleeding after delivery | Root | Nasal | YS127 |
| 50 | *Guizotia abyssinica* | Asteraceae | Nug | Seed | Cough | Seed | Oral | YS051 |
| 51 | *Guizotia scabra* | Asteraceae | Mech | Root | Stomach ache | Root | Oral | YS011 |
| 52 | *Hoalndia opposita* | Lamiaceae | Yenin Mehdian | Leaf | SHIL MAZAWER | Leaf | Oral | YS100 |
| 53 | *Impatiens rothii* | Balsaminaceae | Gishrit | Root | LIFIE | Root | Oral | YS119 |
| 54 | *Inula confertiflora* | Asteraceae | Woynagift | Leaf | Epilepsy | Leaf | Nasal | YS088 |
| 55 | *Jasminum abysinicum* | Oleaceae | Tero hareg | Leaf | Fire burn | Leaf | Dermal | YS131 |
| 56 | *Jasminum grandiflorum* | Oleaceae | Tembelel | Leaf | Tape wound | Leaf | Oral | YS125 |
| 57 | *Justicia schimperiana* | Acanthaceae | Sensel | Leaf | Evil eye | Leaf | Oral | YS025 |

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| No. | Species                                                                 | Family          | Part(s)          | Disease(s)                                                                                          | Preparation                                                                 | Part(s) treated | Reference |
|-----|------------------------------------------------------------------------|-----------------|------------------|-----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|----------------|-----------|
| 58  | Kalanchoe petiolaris A. Rich                                            | Crassulaceae    | Root             | Evil eye                                                                                             | Dry roots are ground with seeds of Allium sativum and leaves of Ruta chalepensis, powder soaked in water and inhaled | Nasal          | YS060     |
| 59  | Laggera crispata (Vahl) Hepper & Woo.                                   | Asteraceae      | Leaf             | Febrile illness                                                                                     | Leaves are crushed, mixed with water, filtered and taken orally for three days | Oral           | YS079     |
| 60  | Laggera tomentosa (Sch. Bip. Ex A Rich) Olliv & Hiern                   | Asteraceae      | Leaf             | Stomach ache                                                                                        | Dry leaves are ground with Lepidium sativum seeds, mixed with water and solution taken orally | Oral           | YS083     |
| 61  | Lantana camara L.                                                      | Verbenaceae     | Leaf             | LIFIE                                                                                               | Dry seeds are ground, powder mixed with honey and cream applied on the affected part | Dermal         | YS104     |
| 62  | Lenis culinaris Medic.                                                 | Fabaceae        | Seed             | Herpes zoster                                                                                        | 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 | Dermal         | YS160     |
| 63  | Leonotis ocymifolia (Burm. F.) Iwarsson                                 | Lamiaceae       | Stem             | Rh disease                                                                                          | Dry seeds are ground, powder mixed with water and solution drunk for five days | Oral           | YS095     |
| 64  | Lepidium sativum L.                                                   | Brassicaceae    | Seed             | Dysentery                                                                                           | Dry seeds are ground, powder mixed with water and solution taken orally | Oral           | YS145     |
| 65  | Linum usitatissimum L.                                                 | Linaceae        | Seed             | Eczema                                                                                              | Dry seeds are ground, mixed with honey and cream applied on the affected part | Dermal         | YS041     |
| 66  | Lobelia rhynochopteryum Hemsl.                                          | Lobiaceae       | Root             | Rabies                                                                                              | Roots are ground, mixed with milk and solution drunk for five days        | Oral           | YS114     |
| 67  | Lycopersicon esculentum Mill.                                          | Solanaceae      | Leaf             | Urine retention                                                                                     | Leagues are crushed, filtered and solution taken orally                   | Oral           | YS043     |
| 68  | Malva verticillata L.                                                  | Malvaceae       | Leaf, root       | Retained placenta                                                                                    | Leaves are collected from three different area, crushed and inserted through the vagina | Vaginal        | YS008     |
| 69  | Millettia ferruginea (Hoscht.) Bak                                      | Fabaceae        | Tree             | Eczema                                                                                              | Dry seeds are roasted, ground, powder mixed with butter and cream applied on the affected part for three days | Dermal         | YS038     |
| 70  | Nicotiana tabacum L.                                                   | Solanaceae      | Leaf             | LIFIE                                                                                               | Leaves are crushed and pasted on the affected part                      | Dermal         | YS044     |
| No. | Genus and Species | Family | Common Name(s) | Part(s) Used | Use(s) | Route of Administration | Code |
|-----|-------------------|--------|----------------|-------------|--------|------------------------|------|
| 71  | Ocimum lamillifolium  | Lamiaceae | Dama kesse | Shrub | Leaf | Malaise | Oral | YS109 |
|     | Hochst. ex Benth.   |        |                |             |        | Leaves are squeezed and solution taken with a cup of coffee |      |
|     |                    |        |                | Root | Leaf | Dysentery | Oral |      |
|     |                    |        |                | Leaf, stem, seed | Leaf | Swelling | Oral |      |
|     |                    |        |                |        |        | Leaves are crushed with water, filtered and taken orally |      |
|     |                    |        |                |        |        | Leaves, stems and seeds are ground together and applied on the swelling in the form of cream | Dermal |
| 72  | Olea europea (Wall. ex G. Don) Cif | Oleaceae | Woyra | Tree | Leaf | Stomach ache | Oral | YS091 |
|     |                    |        |                |        |        | Leaves are crushed, mixed with water, filtered and solution drunk |      |
| 73  | Osyris quadripartita Decn. | Santalaceae | Keret | Shrub | Leaf | Eye pain | Oral | YS084 |
|     |                    |        |                |        |        | Leaves are collected from seven different area, dried, ground and powder inserted in the eye for three days | Ophthalmic |
| 74  | Otoestegia fruticosa (Forsk.) Schweinf. Ex Penzing | Lamiaceae | Tunjite | Shrub | Leaf | Cut/bleeding | Oral | YS132 |
|     |                    |        |                |        |        | Cutting the leaf in to seven pieces by calling his Christianity name | - |
| 75  | Otoestegia integrifolia  | Lamiaceae | Tunjite | Shrub | Root | Evil spirit | Nasal | YS134 |
|     | Berth. |        |                |        |        | Dry roots are ground and burned on fire and inhaled |      |
| 76  | Pavonia urenis Cav. | Malvaceae | Ablatif | Herb | Root | Evil eye | Nasal | YS062 |
|     |                    |        |                |        |        | Roots are ground with seeds of Allium sativum and leaves of Ruta chalepensis, powder soaked in water and inhaled |      |
|     |                    |        |                |        |        | Leaves and roots are crushed and pasted on the affected part | Dermal |
| 77  | Periploca linearifolia  | Asclepiadaceae | Moyder | Climber | Root | Cut/bleeding | Oral | YS019 |
|     | Quart.-Delt. & A. Rich. |        |                |        |        | Cut and put the roots on a dormant stone, wish the patient so that he/she to cure from the bleeding |      |
| 78  | Phytolacca dodecandra | Phytolaccaceae | Endod | Shrub | Root | Rabies | Oral | YS074 |
|     | L’Herit. |        |                |        |        | Roots are chewed and fluid swallowed; as antidote Guizotia abyssinica solution is taken orally |      |
|     |                    |        |                |        |        | Roots are ground after removing the root bark | Oral |
|     |                    |        |                |        |        | Roots are chewed and fluid swallowed | Oral |
|     |                    |        |                |        |        | Roots and roots are burnt with water and taken orally | Oral |
|     |                    |        |                |        |        | Roots are chewed and fluid swallowed | Oral |
| 79  | Plantago lanceolata L. | Plantaginaceae | Wondie gorteb | Herb | Whole plant | Donkey’s wart | Anal | YS089 |
|     |                    |        |                |        | The whole plant is washed with water, crushed and applied on the affected part |      |
| 80  | Plantago major L. | Plantaginaceae | Nech gorteb | Herb | Root | Babies sickness/ ZURIT | Oral | YS048 |
|     |                    |        |                |        | Roots are chopped, soaked in water for a while, filtered and taken orally |      |
|     |                    |        |                |        | Leaf | Eye pain | Ophthalmic |      |
|     |                    |        |                |        | Leaves are chewed and spitted on the patient’s eye |      |
|     |                    |        |                |        | Leaf | Cut/bleeding | Oral |      |
|     |                    |        |                |        | Cut the leaf near the patient by saying ‘stop the bleeding’ | - |
|     |                    |        |                |        | Root | Snakebite | Oral |      |
|     |                    |        |                |        | Roots are crushed, mixed with water, filtered and fluid drunk |      |
| 81  | Polygala abyssinica | Polygalaceae | Else-lebona | Herb | Leaf | Anthrax | Oral | YS066 |
|     | Fres. |        |                |        | Leaves are crushed, filtered, mixed with Euphorbia abyssinica latex and applied on the affected part |      |
| 82  | Premna schimperi Engl. | Lamiaceae | Checho | Shrub | Leaf | Toothache | Oral | YS140 |
|     |                    |        |                |        | Leaves are chewed and hold paste on the affected tooth |      |
| 83  | Prunus africana (Hook. F.) Kalkm. | Rosaceae | Tikur enchet | Tree | Leaf | Anthrax | Oral/Dermal | YS130 |
|     |                    |        |                |        | Leaves are crushed and fluid taken orally; crushed leaves are passed on the affected part |      |
| 84  | Ranunculus multifidus Forsk. | Ranunculaceae | Etsi-siol | Herb | Leaf | Leishmania | Dermal | YS077 |
|     |                    |        |                |        | Leaves are crushed and used to rub the affected part |      |
| 85  | Rhamnus staddo A. Rich. | Rhamnaceae | Teddo | Shrub | Leaf | Epilepsy | Nasal | YS126 |
|     |                    |        |                |        | Leaves are squeezed and fluid is inserted through the nose |      |
| 86  | Rhizocron rhinorhoea Steud. Ex A. Rich | Anacardiaceae | Tilerm | Herb | Leaf | Snakebite | Oral | YS042 |
|     |                    |        |                |        | Leaves are chewed and fluid swallowed |      |
| 87  | Ricinus communis L. | Euphorbiaceae | Chakima | Shrub | Seed | Ecema | Dermal | YS136 |
|     |                    |        |                |        | Seeds are roasted, grounded, mixed with butter and applied as a cream on the affected part |      |

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| No. | Scientific Name                          | Family   | Common Name         | Part Used       | Description                                                                                                                                                                                                 | Route   | Code |
|-----|----------------------------------------|----------|---------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|------|
| 88  | *Rosa abyssinica* Lindley              | Rosaceae | Kega                | Shrub           | Bulbs are grounded with water, filtered and taken orally                                                                                                                                                        | Oral    | YS034|
|     |                                        |          |                     | Flower           | Flowers are squeezed and applied on the affected part                                                                                                                                                        |         |      |
|     |                                        |          |                     | Shoot            | Shoots are squeezed and fluid taken orally                                                                                                                                                                   | Oral    |      |
| 89  | *Rubus steudneri* Schweinf.            | Rosaceae | Amoch               | Shrub           | Leaves are crushed, heated in a dish and inserted through the anus of the patient                                                                                                                             | Anal    | YS069|
|     |                                        |          |                     | Leaf             | Leaves are crushed and pasted on the affected part                                                                                                                                                          |         |      |
|     |                                        |          |                     |                  |                                                                                               |         |      |
| 90  | *Rumex abyssinicus* Jack.              | Polygonaceae | Mekmeko            | Herb            | Root Anthrax Dry roots are grounded, boiled in water and drunk with honey for five days                                                                                                                       | Oral    | YS20 |
|     |                                        |          |                     | Root             | KELECHA Dry roots are grounded, boiled in water and drunk with tea for three days                                                                                                                            |         |      |
| 91  | *Rumex nepalensis* Spreng.             | Polygonaceae | Tult               | Herb            | Root Fibrile illness Roots are chewed and fluid swallowed                                                                                                                                                     | Oral    | YS40 |
|     |                                        |          |                     | Leaf             | Retained placenta Leaves are crushed and tied on the placenta; fluid is taken orally                                                                                                                         | Oral/vaginal |    |
| 92  | *Rumex nervosus* Vahl.                 | Polygonaceae | Embuatie           | Shrub           | Leaf Donkey’s wart Leaves are crushed and pasted on a dish and inserted through the anus of the patient                                                                                                       | Anal    | YS059|
|     |                                        |          |                     |                  |                                                                                               |         |      |
|     |                                        |          |                     | Leaf             | Eye pain Leaves are chewed and spitted 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  | *Salvia nilotica* Jacq.                | Lamiaceae | Hulegeb             | Herb            | Leaf LIFIE Leaves are crushed and pasted on the affected part                                                                                                                                                | Dermal  | YS001|
| 94  | *Schinus molle* L.                     | Anacardiaceae | Kundo berbene      | Tree            | Leaf Evil spirit Dry leaves are ground and burned on fire in the patient house or inhaled                                                                                                                        | Nasal   | YS32 |
| 95  | *Securidaca longepedunculata* Fresen.  | Polygalaceae | Temenahi           | Tree            | Root Evil eye Roots are grounded with seeds of *Allium sativum*, leaves of *Ruta chalepensis* and leaves of *Artemisia absyssinica*, powder soaked with water and inhaled; burned on fire and fumigated | Nasal/Dermal | YS123|
| 96  | *Sida schimperiiana* Hochst. ex A. Rich.| Malvaceae | Chifrig             | Shrub           | Root Impotence Roots are chewed and fluid swallowed                                                                                                                                                        | Oral    | YS46 |
|     |                                        |          |                     |                  |                                                                                               |         |      |
|     |                                        |          |                     | Root             | Evil eye Roots are grounded together with seeds of *Allium sativum* and leaves of *Ruta chalepensis*, powder soaked in water and inhaled                                                                 | Nasal   |      |
| 97  | *Silene macrosolen* Steud. ex A. Rich. | Caryophyllaceae | Wogert             | Herb            | Root Malaria Roots are crushed with seeds of *Guizotia absyssinica*, 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  | *Solanecio gigas* (Valke) C. Jeffrey   | Asteraceae | Boz                 | Herb            | Leaf, Shoot Evil eye Bulbs and leaves are grounded together with seeds of *Allium sativum* and leaves of *Ruta chalepensis*, 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 *Guizotia absyssinica* seeds, mixed with water and solution taken orally                                                                  | Oral    |      |
| 99  | *Solanum anguivi* Lam.                 | Solanaceae | Zerch enbuay        | Shrub           | Root Impotence Roots are chewed and fluid swallowed                                                                                                                                                        | Oral    | YS093|
| 100 | *Solanum incanum* L.                   | Solanaceae | Embuay              | Shrub           | Leaf Fire burn Leaves are crushed and pasted on the affected part using cotton                                                                                                                             | Dermal  | YS055|
| 101 | *Solanum marginatuum* L.f.             | Solanaceae | Geber embuay        | Shrub           | Seed Cough Dry sees are burned on fire and smoke inhaled using a straw                                                                                                                                      | Oral    | YS120|
| No. | Species | Family | Part Used | Application Details | Part Used Details | Disorders | Additional Details |
|-----|---------|--------|-----------|---------------------|------------------|----------|-------------------|
| 102 | *Thalictrum rhynchocarpum* Dill & Rich. | Ranunculaceae | Root | Root are crushed, dried, ground with *Lepidium sativum* seeds and applied as cream on the affected part | Anal | YS024 |
| 103 | *Thunbergia alata* Bojer ex Sims. | Acanthaceae | Leaf | Leaves are crushed and pasted on the affected part | Dermal | YS003 |
| 485 | *Trichodesma zeylanicum* (Brum.f.) R.Br. | Boraginaceae | Leaf | Leaves are crushed and tied on the placenta | Vaginal | |
| 105 | *Urtica simensis* Steudel | Urticaceae | Root | Roots are collected and tied in the patient's arm | Dermal | YS021 |
| 106 | *Verbascum sinaiticum* Benth. | Scrophulariaceae | Root | Roots are chewed and fluid swallowed to detoxify the poison | Oral | YS029 |
| 107 | *Verbena officinalis* L. | Verbenaceae | Leaf | Leaves are squeezed and fluid drunk | Oral | YS117 |
| 108 | *Vernonia amygdalina* Del. | Asteraceae | Leaf | Leaves are boiled and fumigated | Dermal | YS002 |
| 109 | *Withania somniera* (L.) Dun. | Solanaceae | Leaf | Dry leaves are ground, powdered, burn on fire and fumigated | Dermal | YS015 |
| 110 | *Zehneria scabra* | Asteraceae | Leaf | Leaves are boiled and fumigated | Dermal | YS002 |
| 111 | *Zingiber officinale* Roscoe | Zingiberaceae | Rhizome | Rhizomes are grounded with *Allium sativum*, powder mixed with water and taken orally | Oral | YS094 |
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