Research
An ethnobotanical study of medicinal plants in Wonago Woreda, SNNPR, Ethiopia
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Abstract

Background: Medicinal plants are the integral part of the variety of cultures in Ethiopia and have been used over many centuries. Hence, the aim of this study is to document the medicinal plants in the natural vegetation and home gardens in Wonago Woreda, Gedeo Zone, Southern Nations, Nationalities and Peoples Regional State (SNNPR).

Materials and methods: Thirty healers were selected to collect data on management of medicinal plants using semi-structured interview, group discussion, and field observation. The distribution of plant species in the study areas was surveyed, and preference ranking, direct matrix ranking, priority ranking of factors and Informant consensus factor (ICF) were calculated.

Results: The informants categorized the vegetation into five community types based on plant density and associated landform: ‘Raqqa’, ‘Hakka cadanaba’, ‘Mancchha’, ‘Bullukko’, and ‘Wodae gido’. 155 plant species were collected from the natural vegetation and 65 plant species from the home gardens (‘Gattae Oduma’). Seventy-two plant species were documented as having medicinal value: Sixty-five (71%) from natural vegetation and 27 (29%) from home gardens. Forty-five (62%) were used for humans, 15 (21%) for livestock and 13 (18%) for treating both human and livestock ailments: 35 (43.2%) were Shrubs, 28 (34.5%) herbs, 17 (20.9%) trees and 1 (1.2%) climbers. The root (35.8%) was the most commonly used plant part. The category: malaria, fever and headache had the highest 0.82 ICF. Agricultural expansion (24.4%) in the area was found to be the main threat for medicinal plants followed by firewood collection (18.8%). Peoples’ culture and spiritual beliefs somehow helped in the conservation of medicinal plants.

Conclusion: Traditional healers still depend largely on naturally growing plant species and the important medicinal plants are under threat. The documented medicinal plants can serve as a basis for further studies on the regions medicinal plants knowledge and for future phytochemical and pharmacological studies.

Introduction
Ethiopians have used traditional medicines for many centuries, the use of which has become an integral part of the different cultures in Ethiopia. The indigenous peoples of different localities in the country have developed their
own specific knowledge of plant resource uses, management and conservation [1].

Traditional remedies are sometimes the only source of therapeutics for nearly 80% of human population and 90% of livestock in Ethiopia of which 95% are plant origin [2]. The majority of the population that lives in the rural and the poor people in urban areas rely mainly on traditional medicines to meet their primary health care needs.

In most scenarios, the traditional knowledge in Ethiopia is passed verbally from generation to generation and valuable information can be lost whenever a traditional medical practitioner passes without conveying his traditional medicinal plants knowledge. In addition, the loss of valuable medicinal plants due to population pressure, agricultural expansion and deforestation is widely reported by different workers [3,4]. As a result, the need to perform ethnobotanical research and to document the medicinal plants and the associated indigenous knowledge must be an urgent task [5,6].

The studies conducted on the traditional medicinal plants in Ethiopia are limited when compared with the multiethnic cultural diversity and the diverse flora of Ethiopia. Thus, this study was initiated to document the medicinal plants in the natural vegetation and home gardens in Wonago Woreda, which assume that the data could be used as a basis for further studies on medicinal plants in Wonago Woreda and for future phytochemical and pharmacological studies.

Materials and methods

Study sites

Wonago Woreda (N 6° 20' and E 38° 19') is located is 380 km from Addis Ababa in Gedeo Zone, Southern Nations, Nationalities and Peoples Regional State (SNNPR) and bordering with Oromia to the west and northwest, Yirgachef to the south and southeast, Dilla to the north and Bule to the east. It is approximately 248 sq. km (24,790 ha) and comprises of 19 Kebeles (Fig. 1).

The 2005 census indicates that Wonago Woreda has a total population of 162,663 of which 78,649 (48.3%) are males and 84,014 (51.6%) are females. The population density of the Woreda is 702 persons per km² at a national growth rate of 1.07 percent. Seventy percent of the population in the Woreda are the Gedeo people.

As the agricultural sector is the dominant means of livelihood for the majority of Wonago Woreda people, out of the total of 24,790 hectares of land in the Woreda, 22,871 hectares are known to have potential for agriculture. Annual crops cover 5.03 percent; perennial crops 84.77 percent, uncultivable land 0.65 percent and others are 3.52 percent. It has three main agro-climatic zones with the topography ranging from wide flat valley bottoms to steep mountain slopes. The rainfall distribution of the study area is bimodal. The main rainy season is from June to September (‘Kiremt’ or Mahar’) and the short rainy season is from February to April (‘Belg’). The average annual rainfall is 107.72 mm and, the mean annual average temperature of the Woreda is 20°C (Fig. 2).

The study was conducted in ten kebeles (farmers’ associations) in Wonago Woreda, SNNPR from November 1, 2006 to December 3, 2006. Prior to ethnobotanical data collection, discussions were made with elders and local authorities to select the kebeles where traditional healers were found. The kebeles were selected based on availability of traditional healers, and on the recommendations of elders and local authorities in the Wonago Woreda: 'Bankookoto', 'Balebukisa', 'Deko', 'Halemo', 'Hascher', 'Karasodity', 'Mokonisa', 'Sokicha', 'Sugale', and 'Tumata cherecha' (Fig. 1).

Ethnobotanical data collection

Thirty traditional healers (22 males and 8 females) were selected from Gedeo people in the Wonago Woreda based on the recommendation from elders and local authorities (Development Agents and Kebele administration leaders). The ages of the healers were between 35 years and 75 years. A brief group discussion was made with the informants at each kebele prior to ethnobotanical data collection to get their consent and to explain to them that their cooperation is a valuable contribution to the documentation of the traditional medicinal plants of the Wonago Woreda. Semi-structured interview, group discussion, and field observation were employed to collect data on knowledge and management of medicinal plants [7-9]. The group discussions were conducted to elaborate the methods of preparation, administration and conservation of the medicinal plants. Interviews were conducted in "Gedeofa" language with the help of local translator. During the study period, each informant was visited two to three times in order to confirm the reliability of the ethnobotanical information. The responses that were not in harmony with each other were rejected.

Plant specimens’ collections and identifications

The reported medicinal plants were collected from natural vegetation and home gardens during the field walks and trees, shrubs, herbs and climbers were listed. Voucher specimens were collected, pressed and deposited in the National Herbarium of Addis Ababa University (AAU). The plants identification was performed both in the field, and at the National Herbarium of AAU [10-16].

Data analysis

A descriptive statistical methods, percentage and frequency were used to analyze the ethnobotanical data on
Location of Wonago Woreda in Gedeo zone; Southern Nations, Nationalities and Peoples Regional State (SNNPR).

Figure 1
Location of Wonago Woreda in Gedeo zone; Southern Nations, Nationalities and Peoples Regional State (SNNPR).
reported medicinal plants and associated indigenous knowledge.

Preference ranking was computed to assess the degree of effectiveness of certain medicinal plants against most prevalent diseases in the area. Priority ranking of factors perceived as threats to medicinal plants based on their level of destructive effects (values 1-6 were given: 1 is the least destructive threat, and 6 is the most destructive threat) and Direct matrix ranking on uses perceived as threats to medicinal plants were conducted for multipurpose medicinal plants that were commonly reported by healers [7,9].

The Informant consensus factor (ICF) was calculated for each category to identify the agreements of the informants on the reported cures for the group of diseases. The ICF was calculated as follows: number of use citations in each category \(n_{ur}\) minus the number of species used \(n_s\), and divided by the numbers of use citations in each category minus one [17].

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ICF = \frac{n_{ur} - n_t}{n_{ur} - 1}
\]

Results

**Local categories of vegetation**

The local communities categorized the vegetation of the study area into five types based on plant density and associated landform.

I. 'Raqqa' refers to densely forested land. Currently, this type of vegetation has declined in the study area because of degradation by human activities, over grazing, and climate changes.

II. 'Hakka Cadanaba' refers to vegetation growing in marshy or water logged areas often characterized by salty soil. Plant species such as *Phoenix reclinata* and *Cyperus spp.* were more frequent.

III. 'Manccha' refers to a bare or with poor vegetation with some types of herbs and grasses appearing only during the rainy season.

IV. 'Bullukko' refers to the heterogeneous mixture of shrubs and grass communities not suitable for agriculture.

V. 'Wodae Gido' refers to wooded and under-growing herbaceous vegetation growing along riversides. Plant species like *Spatodea nilotica*, *Erythrina brucei*, *Ficus spp.* and *Arundo donax* were common.

**Plant species in the natural vegetation of the study area**

155 plant species were collected from the natural vegetation, which were distributed among 63 families and 136 genera. The leading family was Asteraceae with 18 species, followed by Fabaceae with 12 species, Euphorbiaceae with 9 species, Poaceae, Solanaceae and Rosaceae each with 6 species and Myrtaceae with 5 species. Fifty-seven (37%) were herbs, 53 (34%) were shrubs, 39 (25%) were trees, 5 (3%) were climbers, and one (1%) was epiphyte [see Additional file 1].

Forty-two percent of 155 plant species were medicinal plants. They were distributed among 39 families and 63 genera. The leading family was Asteraceae with 7 species, followed by Euphorbiaceae with 6 species, Fabaceae with 5 species, Solanaceae with 4 species: 31 (49%) were shrubs, 17 (27%) were herbs, and 15 (24%) were trees.

**Plant diversity of the 'Gattae Oduma' (Home garden)**

In the 'Gattae Oduma' (Home garden), the farmers grew diverse plant species with known uses. The number of plants recorded represents 65 species that belong to 33 families and 57 genera. In terms of species composition, Solanaceae had 6 species followed by Poaceae with 5 species, Asteraceae, Fabaceae, Lamiaceae and Rosaceae each with 4 species and Brassicaceae, Euphorbiaceae and Rutaceae each with 3 species (Table 1).

Out of the Sixty-five 'Gattae Oduma' plant species, 31(48%) were herbs, 23(35%) were shrubs, 7 (11%) were trees and 4 (6%) were climbers. The home gardens' flora were composed of 25 (38%) food, 10(15%) medicinal and 30(46%) other useful plant species. Majority of the

![Figure 2](http://www.ethnobiomed.com/content/5/1/28)

**Figure 2**

Climatogram of the study area from 1996 to 2005 at Kotty Weather Station, Wonago Woreda in Gedeo zone. Source: National Meteorological Service Agency.
Table 1: List of plant species in home garden in the study area, Wonago Woreda (Habit: T-tree, Sh-shrub, H-herb, and Cl-climber. Uses: Sp-spice, F-food, M-medicine, CI- cash income, Fn-fence, Or-ornamental, and St-stimulant)

| Family          | Plant species                                      | Local name | Habit | Use   | Voucher No. |
|-----------------|----------------------------------------------------|------------|-------|-------|-------------|
| Acanthaceae     | Justicia schimperiana (Hochst. ex Nees) T. Anders | Dhumuga    | S     | M, Fn | FM30        |
| Alliaceae       | Allium cepa L.                                     | Kagelicha  | H     | F     | FM14        |
| Alliaceae       | Allium sativum L.                                  | Dimoxoa    | H     | M, F  | FM15        |
| Anacardiaceae   | Mangifera indica L.                                | Mango      | T     | F, Cl | FM61        |
| Anacardiaceae   | Rhus vulgaris Meikle                                | Suggutae   | Sh    | M     | FM57        |
| Annonaceae      | Annona squamosa L.                                 | Gishta     | S     | F     | FM18        |
| Apiaceae        | Daucus carota L.                                   | Karoti     | H     | F     | FM36        |
| Araceae         | Calocasia esculenta (L.) Schott                    | Godarre    | H     | M     | FM43        |
| Areceae         | Phoenix reclinata Jacq.                            | Maxxaae    | T     | Or    | FM66        |
| Asteraceae      | Artemisia abyssinica Sch.Bip. ex A. Rich.          | Sugetieae  | H     | M     | FM17        |
| Asteraceae      | Artemisia afra Jack. ex Wild                       | Chugughee  | H     | M     | FM38        |
| Asteraceae      | Helianthus annuus L.                               | Suifi      | H     | F, M  | FM65        |
| Asteraceae      | Vernonia amygdalina Del.                           | Ebicha     | S     | M     | FM31        |
| Brassicaceae    | Brassica carinata A. Br.                           | Shaanna    | H     | F     | FM23        |
| Brassicaceae    | Brassica oleracea L.                               | Faragae    | H     | F     | FM70        |
| Brassicaceae    | Lepidium sativum L.                                | Faxxxo     | H     | M     | FM20        |
| Bromeliaceae    | Ananas comosus L.                                  | Annanassae | H     | F     | FM45        |
| Caricaceae      | Carica papaya L.                                   | Papaya     | T     | F, M  | FM46        |
| Celastraceae    | Catha edulis (Vahl) Forsk. ex Endl.                | Chatae     | S     | M, Cl | FM19        |
| Celastraceae    | Maytenus senegalensis (Lam.) Excell                | Shekko     | Sh    | M     | FM54        |
| Chenopodaceae   | Beta vulgaris L.                                   | Dammaoxaa  | H     | F     | FM24        |
| Convolvulaceae  | Ipomoea batatas L.                                 | Boynnaae   | C     | F     | FM41        |
| Cucurbitaceae   | Cucurbita pepo L.                                  | Buqe       | Cl    | F, M  | FM16        |
| Dioscoreaceae   | Dioscorea praeheinislii Benth.                     | Qoco       | Cl    | F     | FM28        |
| Dracennaceae    | Dracaena steudneni Engl.                           | Alarfuart  | T     | M, Or | FM37        |
| Euphorbiaceae   | Euphorbia candelabrum Kostshy                      | Addama     | Sh    | Fn    | FM48        |
| Euphorbiaceae   | Euphorbia pulcherrima (R. Grah.) Willd.            | Ababa      | S     | Or    | FM40        |
| Euphorbiaceae   | Ricinus communis L.                                | Qobo       | S     | Sp, Cl| FM71        |
| Fabaceae        | Cajanus cajan L.                                   | Atarra     | H     | F     | FM44        |
| Fabaceae        | Glycine max (L.) Merr.                             | Atara      | S     | F     | FM55        |
| Fabaceae        | Phaseolus lunatus L.                               | Coma       | Cl    | F     | FM34        |
| Fabaceae        | Vicia faba L.                                      | Baqqalleo  | H     | F     | FM59        |
| Flacourtiaceae  | Doyolis abyssinica (A. Rich.) Warb                 | Akuku      | S     | Fn, Or| FM13        |
| Lamiaceae       | Ocimum basilicum L.                                | Basobila   | H     | F     | FM67        |
| Lamiaceae       | Ocimum lamifolium Benth.                           | Damakase   | H     | M     | FM52        |
| Lamiaceae       | Otsotega tomentosa A.Rich.                         | Tunjuti     | S     | Fn    | FM63        |
| Lamiaceae       | Plectranthus edulis Vatke                          | Dinich-Oromo| H      | F     | FM60        |
| Lauraceae       | Persea americana Mill.                             | Abokado    | T     | F, Cl | FM75        |
| Malvaceae       | Gossypium herbaceum L.                             | Jirbi      | S     | M, Cl | FM29        |
| Moringaceae     | Moringa stenopetala L.                             | Shifferaw  | T     | M, Or | FM62        |
| Musaceae        | Ensete ventricosum (Welw.) Cheesman                | Warqo      | Sh    | M, O  | FM5         |
| Musaceae        | Musa paradisiaca L.                                | Musi       | H     | F, Or | FM33        |
| Poaceae         | Eragrostis tef (Zucc.) Trotter                     | Xxaaffae   | H     | F     | FM22        |
| Poaceae         | Hordeum vulgare L.                                 | Dinnaae    | H     | F     | FM21        |
| Poaceae         | Saccharum officinarum L.                           | Shunkora   | H     | F, Cl | FM72        |
| Poaceae         | Sorghum vulgare Pers.                              | Agadea     | H     | F     | FM35        |
| Poaceae         | Zea mays L.                                        | Beedeela   | H     | F, Cl | FM58        |
| Punicaceae      | Punic a granatum L.                                | Romanoo    | S     | F     | FM68        |
| Rhamnaceae      | Rhamnus prinoides L’Herit.                         | Geshae     | S     | Cl    | FM47        |
| Rosaceae        | Malus sylvestris Mill.                             | T          | F     |      | FM53        |
| Rosaceae        | Prunus persica (L) Batsch                          | Kokae      | S     | F     | FM32        |
| Rosaceae        | Rosa abyssinica Lindley                            | Xigeradao  | Sh    | Or    | FM6         |
| Rosaceae        | Rubus steudneri Shweinf.                           | Engorrei   | Sh    | F, Or | FM74        |
| Rubiaceae       | Coffea arabica L.                                  | Buno       | S     | M, Cl | FM1         |
| Rutaceae        | Citrus limon (L.) Burm.f.                          | Lomae      | S     | F, M  | FM64        |
| Rutaceae        | Citrus medica L.                                   | Trungo     | S     | F     | FM27        |
| Rutaceae        | Ruta chalepensis L.                                | Ciladamie  | H     | M     | FM50        |
| Solanaceae      | Capsicum annum L.                                  | Miximixio  | H     | F, M  | FM25        |
plant species in the home gardens (48%) provided at least two of the uses listed in Table 2.

**Medicinal plants**

**Medicinal plants used to treat human and livestock diseases**

The highest medicinal plant knowledge acquisition by the healers in this study site was from parents or close relatives (91%) followed by self trial and error method (9%). The healers have a very high intention to keep their traditional knowledge secret and less than 2% of them were ready to transfer their knowledge on incentive bases.

Seventy-two plant species distributed into 48 families and 70 genera were documented as having medicinal value in the study area. Sixty-five (71%) of the medicinal plants were collected from natural vegetation and 27 (29%) from home gardens. Of these 45(62%) were used as human medicines (Table 3), 15(21%) as livestock medicines (Table 4) and 13(18%) were used for treating both human and livestock diseases (Table 5).

The highest number of plant species was found in Asteraceae with 10 plant species followed by Solanaceae with 6 plant species, Euphorbiaceae and Fabaceae each with 5 plant species, Celastraceae and Cucurbitaceae with 3 plant species each (Table 3, 4, 5).

The shrubs were the most harvested for medicinal purpose and were represented with 35 (43.2%) plant species followed by 28(34.5%) herbs, 17 (20.9%) trees and 1(1.2%) climbers. The most commonly used plant parts for remedy preparations were roots (35.8%), followed by leaves (24.6%) (Fig. 3).

Remedies were mainly prepared in the form of powder, concoction and decoction (Table 6). Healers used various units of measurement such as fingered length (e.g. for root, root bark, and stem), pinch (e.g. for powdered plant parts) and numbers (e.g. for leaves, seeds, fruits and flowers) were used to estimate and fix the dosage of the medicine. The methods of administration of herbal medicines were 48(59.2%) internal, particularly oral, followed by 22(27.1%) dermal and 10(12.3%) nasal.

**Ranking of medicinal plants on their uses**

Malaria and diarrhea were the most common diseases for which large number of patients visits the traditional medicinal practitioners. *Vernonia amygdalina* was the most preferred as effective treatment against malaria (Table 7) and *Croton macrostachyus* was preferred among the medicinal plants that were reported by more informants as a remedy to diarrhea (Table 8).

**Informant consensus factor (ICF)**

Diseases that were found to be prevalent in the area were treated by variety of medicinal plants. The category: malaria, fever and headache have the highest 0.82 ICF followed by ascariasis and diarrhea, and intestinal parasite and stomachache each with 0.78 ICF (Table 9).

**Multiple uses of plants and effect on the conservation of the medicinal plants**

The people in the Woreda relied on naturally growing plant species for various purposes such as construction, firewood, washing, cash income and charcoal. *Croton macrostachyus* was used for variety of services by the community followed by *Milletta ferruginea*; however, each plant species was used for a given specific service such as *Phytolaccac dodendranda* was used for washing more often than the other plants (Table 10).

The medicinal plants in Wonago Woreda were threatened by natural and human made factors. Agricultural expansion was found to be the main threat followed by fire wood collection (Table 11).
### Table 3: List of medicinal plants for treating human diseases in the study area, Wonago Woreda

| Families      | Scientific name                                    | Local name | Habit | Preparation and application                                                                 | Diseases treated       | Voucher Number |
|---------------|----------------------------------------------------|------------|-------|-----------------------------------------------------------------------------------------------|------------------------|----------------|
| Acanthaceae   | Justicia schimperiana (Hochst.ex A. Nees) T. Anders | Dummiuggae | Sh    | Pounded fresh/dry leaves is concocted with bark of Croton macrostachys is taken orally for three days. | Intestinal parasites   | FM30           |
| Alliaceae     | Allium sativum L.                                  | ‘Sunkurtae’ | H     | Fresh or dry fruits is chewed and orally                                                      | Malaria                | FM15           |
| Apiaceae      | Foeniculum vulgare Mill                           | Melloo     | H     | Pounded dry/fresh root is taken with coffee or tea as drink                                  | Abdominal pain         | FM193          |
| Araceae       | Colocasia esculenta (L.) Schott.                  | Godarre    | H     | Crushed/pounded dry/fresh concocted with Zingiber officinale rhizome is taken with coffee as drink. | Diarrhea               | FM43           |
|               |                                                    |            |       | Fine powder of plant part mixed with water and mixture drunk or thick paste applied to affected part | Trachoma               |                |
| Asclepiadaceae| Gomphocarpus purpurascens A. Rich                  | Mexxino    | Sh    | Pounded fresh/dry root bark with water is taken as a drink                                   | Febrile illness        | FM142          |
| Asclepiadaceae| Kanahala laniflora (Forssk.) R. Br.               | Wundiffio  | Sh    | Pounded fresh/dry root concocted with roots of Croton macrostachys and Senna occidentalis is taken orally and mixed with butter | Amoebas                | FM136          |
|               |                                                    |            |       | Pounded fresh/dry root concocted with roots of Croton macrostachys and Senna occidentalis is taken orally | Bronchitis             |                |
|               |                                                    |            |       | Fresh/dry root powder mixed with honey is taken orally before breakfast for three days.      | Hepatitis              |                |
| Asparagaceae  | Asparagus africanus L.                             | ‘Uffae ’   | Sh    | Powder of dry root with butter is applied on wound                                           | Wound                  | FM206          |
| Asteraceae    | Artemisia abyssinica Sch.Bip. ex A. Rich           | Sugetieae  | H     | Crushed or pounded fresh stem with butter is applied topically                             | Eye infection          | FM17           |
| Asteraceae    | Artemisia afra Jack. ex Wild                       | Chugughee  | H     | Crushed or pounded fresh or dry leaves are boiled in water and the filtrate is taken hot; orally | Abdominal pain         | FM38           |
|               |                                                    |            |       | Fresh leaves are chewed and taken orally                                                     | Headache               |                |
|               |                                                    |            |       | Powdered fresh/dry leaves mixed with butter is taken with coffee orally before breakfast for three days | Malaria                |                |
| Asteraceae    | Carduus leptacanthus Fresen.                      | Guccino    | H     | Powdered dry stem mixed with butter is taken with coffee or tea.                            | Ascariasis             | FM86           |
| Asteraceae    | Helianthus annuus L.                               | Suffae     | H     | Crushed/pounded dry stem concocted with Vernonia amygdalina leaves mixed with water is taken orally | Haemorrhoid            |                |
| Asteraceae    | Vernonia amygdalina Del.                           | Ebicha     | Sh    | Mix the powder with water and drink                                                          | Food poison            | FM65           |
|               |                                                    |            |       | Crushed, pounded and mix with little water then drink for five days.                        | Diarrhea               | FM31           |
|               |                                                    |            |       | Wash the patient body with the plant part and drink for three days.                          |                        |                |
| Asteraceae    | Vernonia auriculifera Hiern                       | Dangireto  | H     | Crushed, pounded and mix with cold water, one cup of the filtrate is given for adult, one-half of the cup for children for three days | Snake poison           | FM144          |
Table 3: List of medicinal plants for treating human diseases in the study area, Wonago Woreda (Continued)

| Family       | Genus                  | Species                      | Part Used          | Preparation                                                                                      | Disease                | Reference |
|--------------|------------------------|------------------------------|--------------------|--------------------------------------------------------------------------------------------------|------------------------|-----------|
| Asteraceae   | Xantium strumarium     | L. Dehanekayae H             | The plant part squeezing it through clean locally made cloth for five days on affected part or wash the affected part for both diseases. Crushed, pounded and mix with water and drink. | Skin infection         | FM9       |
| Boraginaceae | Cynoglossum lanceolatum| Forsk. Kirchibae H           | Handful root is crushed by hand, small amount of cold water is added to squash, the mixture is inhaled and few drops are drunk. | Fertility & abnormal growth Mental problems | FM114 |
| Boraginaceae | Cordia africana        | Lam. Waddissa T              | Powdered dry root bark is sprinkled on burning charcoal and smoke is inhaled covered by cloth. | Evil eye               | FM167     |
| Brassicaceae | Lepidium sativum       | L. Feaxxo H                  | Dry seed powder is taken as with coffee as drink. Pounded seeds mixed with Allium sativum bulbs and honey is taken orally for five days before breakfast. After each dose, one glass of melted butter is recommended for immediate recovery. | Intestinal parasites   | FM20      |
| Caricaceae   | Carica papaya          | L. Papaya T                  | Chewed and swallowed fresh seed. | Amoebas Intestinal parasite | FM46 |
| Caryophyllaceae | Stellaria senii   | Chiov. Chatae Sh             | Crushed/pounded fresh stem concocted with leaves of Vernonia amygdalina is boiled and one glass of the filtrate is taken orally | Decoction root Hepatitis | FM188 |
| Celastraceae | Maytenus senegalensis  | lam. Shexell Sh              | Powdered fresh/dry seed with water or butter is taken with coffee or tea as drink for five days. Powdered fresh/dry seed with Ocimum lamifolium seed is take with coffee as drink | Epilepsy               | FM54  |
| Cucurbitaceae | Lagenaria siceraria    | (Molina) Standl. Botto H     | Ripe fruits including seeds are immersed in water for overnight; the water is taken orally in the morning before breakfast. | Gonorrhea              | FM205     |
| Cucurbitaceae | Monardica foetida      | Schumach Yubarrae Sh         | Crushed/pounded fresh/dry root mixed with Allium sativum bulb is taken orally before breakfast for three days. Infusion of fresh/dry root powder is taken orally | Bronchitis             | FM108     |
| Dracaenaceae | Dracaena steudneri     | Engl. Afrafartu T            | Powder of dry root is applied to wound. Crushed/pounded fresh/dry leaves boiled with water is concocted with Allium sativum (bulb) roasted with butter and left over night outside home is taken orally at the morning. Rubbing affected part by exudates of old leaves | Wound Malaria          | FM37 FM162 |
| Euphorbiaceae | Croton macrostachyus   | Del. Bissano T               | | | |
Table 3: List of medicinal plants for treating human diseases in the study area, Wonago Woreda (Continued)

| Family          | Genus                    | Species                        | Type of Use                                                                                     | Disease                        | Formula |
|-----------------|--------------------------|--------------------------------|------------------------------------------------------------------------------------------------|--------------------------------|---------|
| Euphorbiaceae   | Euphorbia candelabrum    | Kostshy                        | Milky latex from plant mixed with roots powder of Rutaceae chalepensis and paste applied to affected area | Ringworm                      | FM48    |
| Euphorbiaceae   | Euphorbia tirucalli L.   | Kinchibae                      | Rubbing affected part with crushed fresh/dry root concocted with crushed leaves of Coffea arabica | ‘Kintarot’                    | FM40    |
| Euphorbiaceae   | Ricinus communis L.      | Gulloo                         | Crushed/pounded leaves with coffee, tea or milk is taken as a drunk before copulation           | Impotency                      | FM71    |
| Euphorbiaceae   | Trojia cinerea (Pax)     | Alelebatiae                    | Fine powder of plant part mixed with butter and drink before sexual intercourse with his partner. | ‘Kintarot’                    | FM87    |
| Euphorbiaceae   | Euphorbia tirucalli L.   | Kinchibae                      | Rubbing affected part with crushed fresh/dry root concocted with crushed leaves of Coffea arabica | Skin infection                 | FM190   |
| Euphorbiaceae   | Euphorbia candelabrum    | Addama                         | Milky latex from plant mixed with roots powder of Rutaceae chalepensis and paste applied to affected area | Skin infection                 | FM190   |
| Euphorbiaceae   | Euphorbia tirucalli L.   | Kinchibae                      | Rubbing affected part with crushed fresh/dry root concocted with crushed leaves of Coffea arabica | Skin infection                 | FM190   |
| Euphorbiaceae   | Ricinus communis L.      | Gulloo                         | Crushed/pounded leaves with coffee, tea or milk is taken as a drunk before copulation           | Impotency                      | FM71    |
| Euphorbiaceae   | Trojia cinerea (Pax)     | Alelebatiae                    | Fine powder of plant part mixed with butter and drink before sexual intercourse with his partner. | ‘Kintarot’                    | FM87    |
| Fabaceae        | Millettia ferruginea     | Berberae                       | Fresh/dry fruits powder with butter is applied topically                                         | Skin infection                 | FM190   |
| Fabaceae        | Senna occidentalis (L.)  | Assenmeka                      | Fresh root powder mixed with water is taken as a drink for three days                            | Bleeding nose                  | FM103   |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Pounded fresh leaves mixed with butter is taken with coffee as drink at the morning              | Tonsilitis                     | FM52    |
| Lamiaceae       | Ocimum lamifolium        | Damakase                       | Poun...
Table 3: List of medicinal plants for treating human diseases in the study area, Wonago Woreda (Continued)

| Family         | Genus                        | Species                      | Use                                                                 | Disease          | Code |
|----------------|------------------------------|------------------------------|---------------------------------------------------------------------|------------------|------|
| Phytolaceae    | Phytolacca                   | dodecandra L’Herit           | Pounded fresh/dry leaves mixed with water is taken orally before breakfast for three days. | Malaria          | FM176|
|                | Podocarpaceae                | Podocarpus falcatus (Thunb.) | Fresh/dry root powder mixed with water is taken orally               | Febrile illness  | FM11 |
|                | Polygonaceae                 | Rumex nepalensis             | Paste of fresh/dry stem powder with butter is applied topically      | Wound            | FM10 |
| Resedaceae     | Caylusea abyssinica (Fresen.)| Sheggicte Fish. & Mey.        | Crushed/pounded fresh/dry root water is taken orally                 | Ascariasis       | FM131|
| Rosaceae       | Hagenia abysinica (Brucic.)  | Kossae J. F. Gmel            | Mix the powder with honey and a little bit of water and then boil and drink before breakfast for five days. Mix the powder with local '텔라' and leave for overnight and drink before breakfast for three days | Ascariasis       | FM120|
| Rosaceae       | Prunus africana (Hook.F.)    | T/kaka                       | Crushed/pounded dry root bark mixed with water is taken as a drink.  | Ascariasis       | FM209|
|                |                                |                              | Dry root powder concocted with *Parthenium hysterophorus* root powder is taken orally for three days. |                  |      |
| Rubiaceae      | Coffea arabica L.            | Buno                         | Smoke inhalation of dried leaves and infusion of leaves is taken orally | Vomiting         | FM1  |
| Rubiaceae      | Pentas schimperiana (A. Rich)| Dibexxo                      | Fresh/dry root bark powder mixed with water is taken orally          | Epilepsy         | FM78 |
| Rutaceae       | Citrus limon (L.)Burm.F.     | Lomae                        | Chew and swallow fresh fruits                                       | Cough            | FM123|
| Rutaceae       | Ruta chalepensis L.          | Xenadamae                    | Crushed/pounded fresh leaves with water of coffee is taken orally    | 'Dingetega'      | FM50 |
|                |                                |                              | Chewing and swallowing fresh leaves                                 |                  |      |
| Sapindaceae    | Dodonaea angustifolia L.F.   | Ittechhae                    | Decoction of dry fruit is applied topically                          | Ectoparasite     | FM83 |
| Simaroubaceae  | Brucea antidysenterica J.F.Mill | Kapparro                    | Powdered fresh root bark mixed with water is taken orally            | Lymphatic swelling | FM202|
| Solanaceae     | Capsicum annuum L.           | Miximixo                     | Chew and swallow fresh/dry fruits                                   | Ascariasis       | FM25 |
| Tiliaceae      | Gewria ferruginea Hochst ex A. Rich | Ogomdii                   | Crushed/pounded fresh/dry root bark concocted with root of *Ensete ventricosum* and mixed with water is kept over night and taken orally as a drink before breakfast. | Cough            | FM121|
|                | Triumfetta tomentosa Boj.    | Kombocho                     | Pounded fresh/dry root bark mix with butter is taken as drink before breakfast for three days. Mix the powder with a little bit of local 'araq' and then apply the paste to wound | Evil eye         | FM171|
|                |                                |                              | Chewing fresh leaves using the jaw with toothache                     |                  |      |
|                | Lantana camara L.            | Yewef kollo                  | Dry stem powder mixed with water is taken orally                     | Diarrhea         | FM146|
| Zingeberaceae  | Zingiber officinale Rosc.    | Jaanjiibeello                | Chewed and swallowed                                                  | Stomach-ache     | FM51 |
|                |                                |                              |                                                                    |                  |      |
| Families         | Scientific name                              | Local name | Habit | Preparation and application                                                                 | Diseases treated                                      | Voucher Number |
|------------------|----------------------------------------------|------------|-------|---------------------------------------------------------------------------------------------|--------------------------------------------------------|----------------|
| Acanthaceae      | Justicia schimperiana (Hochst.ex A. Nees). Anders | Dumiuggae | Sh    | Crushed, pounded fresh/dry leaf concocted with Croton macrostachyus in cold water is given as a drink for three days. | Intestinal parasites                                    | FM30           |
| Amaranthaceae    | Achyranthes aspera L.                         | Derrgu     | H     | Powdered dry/fresh leaf with water is applied externally                                      | Ectoparasite                                           | FM115          |
| Anacardiaceae    | Rhus vulgaris Meikle                         | Suggutae   | Sh    | Powder of root mixed with water is given orally                                              | Diarrhea                                               | FM57           |
| Apocynaceae      | Maytenus arbutifolia (A. Rich) Wilczek        | Kombollechae | Sh    | Crushed, pounded fresh/dry root mixed with Croton macrostachyus in cold water; kept outside for overnight is given as drink in the morning | Blackleg                                               | FM138          |
| Asparagaceae     | Asparagus africanus L.                        | Uffae      | Sh    | Powder of dry root is applied topically                                                      | Wound                                                  | FM206          |
| Asteraceae       | Cirsium englerianum O. Hoffm.                | Galigloo   | H     | Concoction of fresh/dry root mixed with residue of local ‘tella’ or ‘areqie’ is given as drink. | Urine with blood                                        | FM64           |
| Asteraceae       | Vernonia auriculifera Hiern                  | Dangireto  | Sh    | Crushed, pounded root mixed with cold water is administered orally                            | Snake poison                                           | FM144          |
| Asteraceae       | Xantium strumanium L.                        | Dehanekaye | H     | Squeezing leaf through clean locally made cloth for five days on affected part or wash the affected part | Wart, Skin infection                                    | FM9            |
| Boragnaceae      | Cordia africana Lam.                         | Waddissa   | T     | Root bar is smoked in the barn                                                               | Evil eye                                               | FM167          |
| Casuarinaceae    | Casuarina cunninghamiana Miq.                | Shewshewae | T     | Crushed, pounded fresh/dry root mixed with Croton macrostachyus and water is given as drink. | Lymphatic swelling/Urine retention                     | FM76           |
| Celastraceae     | Maytenus senegalensis (Lam.) Excell           | Shekko     | Sh    | Root powder mixed with leaf of Ocimum lamifolium is administered orally                         | Febrile Disease                                        | FM54           |
| Clusiaceae       | Hypericum revolutum Vahl                     | Buqe       | CI    | Seed powder mixed with butter is applied on infected eye.                                    | Eye infection                                           | FM98           |
| Fabaceae         | Calpurnia aurea (Alt.) Benth.                | Chekketa   | Sh    | Powdered fresh/dry root with water is given orally                                           | Urine retention Black leg                               |                |
|                  |                                               |            |       | Powdered fresh/dry root with butter is given orally                                           | Black leg                                               |                |
|                  |                                               |            |       | Crushed, pounded fresh root with fresh leaf of Vernonia amygdalina mixed with residue of local areqie or tella is given orally | Anthrax                                                |                |
|                  |                                               |            |       | Crushed, pounded fresh root with fresh leaf of Parthenium hysterophorus mixed with residue of local areqie or tella is given orally | Blackleg                                                |                |
| Malvaceae        | Sida schimperiana Hochst. ex A.Rich           | Gebresede  | Sh    | Leaf powder is mixed with water is administered orally for three days before grazing          | Mental problem                                         | FM170          |
Table 4: List of medicinal plants for treating livestock diseases in the study area, Wonago Woreda (Continued)

| Family         | Genus                          | Species Details                  | Tribe/Area   | Use                                                                                           | Disease          | Code  |
|----------------|--------------------------------|----------------------------------|--------------|-----------------------------------------------------------------------------------------------|------------------|-------|
| Myrsinaceae    | Maesa                          | lanceolata Forssk.               | Kaggano T    | Powdered fresh/dry root mixed with residue of local 'areqie' or 'tella' is given as drink.       | Anthrax          | FM210 |
|                 |                                |                                  |              | Powdered fresh/dry root and Vernonia amygdalina leaf mixed with residue of local 'areqie' or 'tella' is given as drink. | Blackleg         |       |
| Oleaceae       | Olea                           | europea L.                       | Wayrro T     | The root powder is smoke in livestock fence.                                                    | Mental problem   | FM187 |
| Papaveraceae   | Argemone                       | mexicana L.                      | Kossalae H   | Crushed and pounded fresh leaf mixed with roots of Solanum indicum in cold water is given as a drunk. | Bloody Urine     | FM81  |
|                |                                |                                  |              | Powdered fresh leaf mixed with residue of local 'tella' or 'areqie' is given orally.             | Diarrhea         |       |
|                |                                |                                  |              | Crushed and pounded fresh leaf mixed with leaf of Vernonia amygdalina is given orally.          | Intestinal parasites |     |
| Polygonaceae   | Rumex                         | nepalensis Spreng.               | Dangago H    | Powdered fresh/dry stem mixed with butter is applied topically.                                | Wound            | FM10  |
| Rubiaceae      | Pentas                         | schimperiana (A. Rich)           | Dibexxo Sh   | Root bark fine powder is mixed with water given orally.                                        | Mental problem   | FM78  |
| Santalaceae    | Osyris                         | quadripalate Decn.               | Watto Sh     | Powdered fresh/dry fruit mixed with water is given orally for three days and applied topically on infected body part | Skin infection   | FM105 |
| Sapindaceae    | Dodonaea                       | angustifolia L.F.                | Ittechhae Sh | Crushed, pounded dry fruit with water is applied.                                              | Ectoparasite     | FM83  |
| Simaroubaceae  | Brueca                        | antidysenterica J.F.Mill         | Kapparro Sh  | Powdered dry fruit with water is given orally.                                                 | Lymphatic swelling |     |
| Solanaceae     | Datura                        | stramonium L.                    | Atsefarecae H| Crushed, pounded fresh/dry root mixed with Parthenium hysterophorus leaf applied topically.   | Wound            | FM202 |
|                |                                |                                  |              |                                                  | Wound            | FM47  |
| Solanaceae     | Discopodium                   | penninervum                      | Serbae T     | Rubbing affected part with fresh/dry crushed leaf. N A cup of fresh/dry root powder concocted with Vernonia amygdalina leaf with seven cups of water is boiled until only one cup of mixture remains then mixed with the residue of 'tella' and 'areqie' is given for as drink for three days. | Inability to walk properly | FM198 |
|                |                                |                                  |              | A cup of fresh/dry root powder concocted with Vernonia amygdalina leaf with seven cups of water is boiled until only one cup of mixture remains then mixed with the residue of 'tella' and 'areqie' is given for as drink for three days. | Blackleg         | FM104 |
|                |                                |                                  |              | Powdered fresh/dry root and root of Rhus vulgaris mixed with water is given as drink for 2 to 3 days. | Anurachx         |       |
|                |                                |                                  |              | Concoction of crushed, pounded fresh/dry root with Vernonia amygdalina leaf is given as drink   | Cough            |       |
|                |                                |                                  |              | Crushed, pounded fresh/dry root bark with roots of Ensete ventricosum and mixed with water and kept overnight is given orally | Cough            | FM121 |
| Tiliaceae      | Grewia                        | ferruginea Hochst ex A. Rich     | Ogomdii Sh   | Crushed, pounded fresh/dry root bark with roots of Ensete ventricosum and mixed with water and kept overnight is given orally | Cough            |       |
| Verbenaceae    | Lantana                       | camara L.                        | Yewof kollo Sh | Dry stem powdered mixed with water is given orally.                                              | Diarrhea         | FM146 |

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Table 5: List of medicinal plants for treating both human and livestock diseases in the study area, Wonago Woreda

| Families   | Scientific name                          | Local name | Habit  | Preparation and application                                                                 | Diseases treated                  | Voucher Number |
|------------|------------------------------------------|------------|--------|----------------------------------------------------------------------------------------------|-----------------------------------|----------------|
| Acanthaceae| Justicia schimperiana (Hochst.ex A. Nees) T.Anders | Dummiuggae Sh |        | Pounded fresh/dry leaves is concocted with bark of Croton macrostachyus is taken orally for three days. | Intestinal parasites                | FM30           |
| Asparagaceae| Asparagus africanus L. 'Uffae ' Sh        |            |        | Powder of dry root with butter is applied on wound                                            | Wound                             | FM206          |
| Asteraceae | Vernonia auriculifera Hiern              | Dangireto Sh |        | Crushed, pounded and mix with cold water, one cup of the filtrate is given for adult, one-half of the cup for children for three days. For livestock Crushed, pounded root mixed with cold water is administered orally | Snake poison                       | FM144          |
| Asteraceae | Xantium strumarium L.                    | Dehanekayae H |    | The plant part squeezing it through clean locally made cloth for five days on affected part or wash the affected part for both diseases. | Skin infection                      | FM9            |
| Boragnaceae| Cordia africana Lam.                     | Waddissa T  |        | Powdered dry root bark is sprinkled on burning charcoal and smoke is inhaled covered by cloth. For livestock root bark is smoked in the barn | Evil eye                           | FM167          |
| Celastraceae| Maytenus senegalensis (Lam.) Excell      | Shekko Sh   |        | Powdered fresh/dry seed with water or butter is taken with coffee or tea as drink for five days. Powdered fresh/dry seed with Ocimum lamifolium seed is taken with coffee as drink For livestock root powder mixed with leaf of Ocimum lamifolium is administered orally | Epilepsy                           | FM54           |
|            |                                          |            |        |                                                                                               | Headache                          |                |
|            |                                          |            |        |                                                                                               | Feverile Disease                  |                |
| Malvaceae  | Sida schimperiana Hochst. ex A.Rich      | Gebresede Sh |        | Crushed, pounded, and boiled with water and cooled for 2 hours and 2 glasses are served as a drink. For livestock leaf powder is mixed with water is administered orally for three days before grazing | Epilepsy                           | FM170          |
| Polygonaceae| Rumex nepalensis Spreng.                 | Dangago H   |        | Paste of fresh/dry stem powder with butter is applied topically                               | Wound                             | FM10           |
| Rubiaceae  | Pentas schimperiana (A. Rich) Vatke      | Dibexxo Sh  |        | Fresh/dry root bark powder mixed with water is taken orally                                   | Epilepsy(human) Mental problem (livestock) | FM78          |
| Sapindaceae| Dodonaea angustifolia L.F.               | Itechhae Sh |        | Crushed, pounded dry fruit with water is applied Powdered dry fruit with water is given orally | Entoparasite                       | FM83           |
|            |                                          |            |        |                                                                                               | Lymphatic swelling                |                |
| Simaroubacea e | Brucea antidysenterica J.F.Mill | Kapparro Sh  |        | Powdered fresh root bark mixed with water is applied topically                               | Wound                             | FM202          |
| Tiliaceae  | Grewia ferruginea Hochst ex A. Rich      | Ogomdii Sh  |        | Crushed, pounded fresh/dry root bark with roots of Ensete ventricosum and mixed with water and kept overnight is given orally | Cough                             | FM121          |
| Verbenaceae| Lantana camara L.                       | Yewef kollo Sh |        | Dry stem powder mixed with water is taken orally                                             | Diarrhea                          | FM146          |
Distribution of medicinal plants in the study area

Most of the shrubs were collected from woodlands, rocky surfaces, secondary forests and home gardens. The herbs were mostly found in woodland, grazing land and farmlands. The tree species were found in open woodland, farm borders, roadsides, live fences and in coffee plantation areas. Medicinal plants like *Allium sativum*, *Artemisia abyssinica*, *Capsicum annuum*, *Lepidium sativum*, *Ensete ventricosum*, *Nicotiana tabacum*, *Ocimum lamiifolium*, *Ruta chalepensis*, and *Zingiber officinale* were restricted to farmlands, farm boarders, live fences and home gardens. Hunde [18], Mohammed [19], Tollosa [20] and Awas and Asfaw [21] used similar approaches to identify sites of collection of medicinal plants.

Natural vegetation and home garden diversity

In this study, the number of medicinal plants collected from the natural vegetation is more than home gardens. This is also true to the studies conducted in different parts of the country. 90.43% of medicinal plants in Mana Angetu District, southeastern Ethiopia [22]; 92% of medicinal plants around ‘Dheeraa’ town, Arsi Zone, Ethiopia [23]; 71% of the medicinal plants of the ‘Berta’ people in western Ethiopia [24] and 85.71% of medicinal plants of Sekoru District, Jimma Zone, Southwestern Ethiopia [25] are obtained from the natural vegetation. Asfaw [26] reported that only 6% of the plants maintained in home gardens in Ethiopia are primarily cultivated for their medicinal value. Some of the medicinal plants cultivated provided a number of services to the local people because the primary function of these home gardens was to produce foodstuffs. This might be because of high population density and shortage of land for cultivation in the area [27].

Medicinal plants

The medicinal plant species recorded in Wonago are also used as remedies in other parts of Ethiopia and Africa. Among the total of Seventy-two medicinal plant species investigated in this study, 22 species are mentioned in Taddese [28]; 20 species in Wondimu et al. [23]; 11 species in Taddese and Demissew [29]; 23 species in Tamene [30]; 21 species in Hunde [18]; 11 species in Balemi et al. [31]; 39 species in Lulekal et al. [22]; 21 species in Teklehaimanot and Giday [32] and 17 species in Teklehaimanot et al. [33]. In Africa, 13 medicinal plant species are documented by Anokbongo [34] and 16 by Iwn [35]. Some of the medicinal plants in this study were used to treat specific diseases: *Vernonia amygdalina* Del., *Momordica foetida* Schumach, *Ocimum lamifolium* Hochst. Ex Benth., and *Lantana camara* L. are used as treatment for malaria and associated illness in Budiope county Uganda [36]. *Croton macrostachyus* Del., *Datura stramonium* L., *Eucalyptus globules* Labill, *Euphorbia candelabrum* Koottsh, *Euphorbia tirucalli* L., *Prunus africana* (Hook.F.) Kalkam, and *Ricinus communis* L. in Central Kenya [37], and *Calpurnia aurea* (Alt.) Benth. and *Phytolacca dodecandra* L’Herit in Ethiopia [38] are used for treatment of skin disorders.

Table 6: Preparation methods of traditional medicine in the study area, Wonago Woreda

| Preparation methods | Preparations | Percent |
|---------------------|--------------|---------|
| Powder              | 46           | 37.3    |
| Crushing and pounding| 42           | 34.1    |
| Chewing             | 10           | 8.1     |
| Concoction          | 7            | 5.6     |
| Decoction           | 2            | 1.6     |
| Others              | 6            | 13.0    |

Table 7: Preference ranking of medicinal plants used for treating malaria in the study area, Wonago Woreda

| List of medicinal plants | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | Total | rank |
|--------------------------|----|----|----|----|----|----|----|----|-------|------|
| *Allium sativum*         | 3  | 2  | 5  | 3  | 3  | 2  | 3  | 3  | 24    | 3rd  |
| *Lepidium sativum*       | 2  | 1  | 2  | 2  | 1  | 3  | 2  | 2  | 15    | 4th  |
| *Croton macrostachyus*   | 4  | 5  | 3  | 4  | 4  | 5  | 4  | 5  | 34    | 2nd  |
| *Phytolacca dodecandra*  | 1  | 4  | 1  | 1  | 2  | 1  | 1  | 1  | 12    | 5th  |
| *Vernonia amygdalina*    | 5  | 3  | 4  | 5  | 5  | 4  | 4  | 5  | 35    | 1st  |
Allium sativum L., Lagenaria siceraria (Molina) Standl., Zingiber officinal Rosc., Capsicum annum L, and Ricinus communis L. are used as anthelmintics in traditional veterinary practices in Sahiwal district of Punjab, Pakistan; and the anthelmintic activity of the first three medicinal plants is scientifically validated through in vitro and in vivo tests [39].

The medicinal plants that were presumed to be effective in treating a certain disease had higher ICF values, which indicated that these diseases were more common than those with low ICF: malaria and headache (82.3%), ascariasis and diarrhea (78.2%), and intestinal parasite and stomachache (77.7%).

The most widely used plant remedies by people of Wonago were obtained from shrubs (43.2%) followed by herbs (34.5%). The documented data showed that the majority of medicinal plants from natural vegetation were shrubs and herbs; they were relatively common in the study area compared to medicinal tree species. This finding agrees with the findings of Tamene [30], Hunde [18] Yineger and Yewhalaw [25], Giday and Amani [40] and Lulekal et al. [22]. However, the finding of Birhanu [41]; Mohammed [19]; Gebre [42] and Teklehaymanot and Giday [32] shows that herbs are the primary habit form.

The most widely sought plant parts in the preparation of remedies were the root [22], root bark, leaves and stems. The popularity of these parts has serious consequences from both ecological point of view and from the survival of the medicinal plant species [41]. Tesfu et al. (Tesfu CB, Mengistu B/W/Aregay G: Women lead in protecting food germplasm and herbs for health in Ethiopia, Submitted) reported that some plant species such as Dracaena steudneri, Hagenia abyssinica and Securidaca longepedunculata that are harvested for their roots, barks or whole plants in many parts of Ethiopia have become scarce and so diffi-

| List of medicinal plants | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | Total | Rank |
|--------------------------|----|----|----|----|----|----|----|----|-------|------|
| Ensete ventricosum       | 112| 47 | 52 | 26 | 19 | 12 | 10 | 7  | 105   | 1st  |
| Vernonia amygdalina      | 29 | 12 | 29 | 12 | 29 | 12 | 29 | 12 | 105   | 1st  |
| Croton macrostachyus     | 29 | 12 | 29 | 12 | 29 | 12 | 29 | 12 | 105   | 1st  |
| Hagenia abyssinica       | 29 | 12 | 29 | 12 | 29 | 12 | 29 | 12 | 105   | 1st  |

Table 8: Preference ranking of medicinal plant species used to treat diarrhea in the study area, Wonago Woreda

| List of medicinal plants | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | Total | Rank |
|--------------------------|----|----|----|----|----|----|----|----|-------|------|
| Ensete ventricosum       | 41 | 1  | 2  | 2  | 1  | 2  | 2  | 13  | 4th   |
| Vernonia amygdalina      | 1  | 2  | 1  | 2  | 1  | 2  | 13  | 4th   |
| Colocasia esculenta      | 1  | 1  | 1  | 1  | 1  | 11 | 2  | 18   | 2nd   |
| Croton macrostachyus     | 2  | 1  | 3  | 2  | 3  | 1  | 3  | 21   | 5th   |
| Hagenia abyssinica       | 1  | 1  | 3  | 2  | 3  | 1  | 3  | 16   | 1st   |

Table 9: Informant consensus factor by categories of diseases in the study area, Wonago Woreda

| Category                          | Species | (% all species) | Use citations | (% All use citations) | ICF |
|-----------------------------------|---------|-----------------|---------------|-----------------------|-----|
| Malaria, Fever and headache       | 10      | 19%             | 52            | 39%                   | 0.82|
| Ascariasis and diarrhea           | 11      | 20%             | 47            | 35%                   | 0.78|
| Intestinal parasite and stomachache | 5     | 9%              | 19            | 14%                   | 0.78|
| Gonorrhea & sexual impotence in men | 5     | 9%              | 16            | 12%                   | 0.73|
| Abdominal pain and amoebas        | 6       | 11%             | 19            | 14%                   | 0.72|
| Ring worm and wounds              | 7       | 13%             | 16            | 12%                   | 0.60|
| Bronchitis and cough              | 6       | 11%             | 12            | 9%                    | 0.55|
| Cancerous Swelling                | 5       | 9%              | 9             | 7%                    | 0.50|

Table 10: Direct matrix ranking of medicinal plants with different uses other than medicinal value (total score of ten informants) in the study area, Wonago Woreda

| Uses                      | Croton macrostachyus | Phytolacca dodecandra | Coffea arabica | Cordia africana | Millettia ferruginea |
|---------------------------|----------------------|------------------------|----------------|----------------|----------------------|
| Construction              | 31                   | 9                      | 26             | 24             | 23                   |
| Cash income               | 29                   | 12                     | 27             | 13             | 19                   |
| Washing                   | 21                   | 26                     | 0              | 19             | 29                   |
| Firewood                  | 13                   | 16                     | 23             | 22             | 19                   |
| Charcoal                  | 18                   | 7                      | 19             | 11             | 15                   |
| Total                     | 112                  | 70                     | 95             | 89             | 105                  |
| Rank                      | 1st                  | 5th                    | 3rd            | 4th            | 2nd                  |
were anxious to have their own agricultural land; hence, The other factor was the number of young farmers who contributing factors for the expansion of agriculture. arabica as medicinal plants by growing them in home gardens. Such Some traditional practitioners had started to conserve Conservation and threats of medicinal plants

The route of application, oral (42%), is popular as in the finding of Abebe and Ayehu [43] who reported as the leading route of application used in northern Ethiopia. It is also in agreement with the result of various ethnobotanical studies conducted elsewhere in Ethiopia [18,21,22,31,40,41,44,45] and indicates oral as the predominant route of application.

The informants' responses indicated that there were variations in dosages of remedies, unit of measurement of remedies, duration and time that were prescribed for the same kind of health problems. The major factors that determine the amount to be given were age, physical fitness, stage of illness, pregnancy and presence or absence of any disease other than the disease to be treated. Getahun [46], Sofowara [47] and Abebe [2] have also discussed lack of precision and standardization as a drawback of the traditional health care system.

Conservation and threats of medicinal plants

Some traditional practitioners had started to conserve medicinal plants by growing them in home gardens. Such as Ruta chalepensis, Rhus vulgaris, Ocimum lamiifolium, Artemisia abyssinica and Artemisia afra similar to the observation made by Kansheiae [27]. In most scenarios, the home gardens are fenced and protect the medicinal plants from grazing and unwise harvesting [48].

The main threat for medicinal plants in the natural vegetation was agricultural expansion (24.4%). Most of the respondents perceived urbanization and construction as the least destructive factors contributing to 11.8% and 10.2% of the total score, respectively. The rise in Coffea arabica and Catha edulis price on the market were some of the contributing factors for the expansion of agriculture. The other factor was the number of young farmers who were anxious to have their own agricultural land; hence, clearing of natural vegetation and expanding agricultural land was almost a daily activity in the study area. Nevertheless, during the field study, it was observed that large number of big trees of Macaranga capensis, Olea europaea, Pouteria adolfi-friederici, and Syzygium guineense were removed by the local people to prepare the forestlands for agricultural purpose. These factors combined with the natural vulnerability of the area may lead to further reduction in natural habitats of the medicinal plants. Pressure from agricultural expansion, wide spread cutting for fuel wood combined with seasonal drought is also reported in Balemie et al [31]. Lulekal et al. [22]. Nanyingi et al., [48]. Kelbessa et al. [49] and Yineger et al. [50] as main factor for environmental degradation.

The conservation of medicinal plants in the study area was limited except in Juniperous- Eucalyptus dominated plantation, which was the only protected natural vegetation areas. Rather, the peoples' culture and spiritual beliefs somehow had helped in the conservation of medicinal plants. For instance, the claim of the traditional healers that medicinal plants will be effective only if cut and administered by the healers or healers' relatives had helped in the conservation of the medicinal plants. Also, the collection of medicinal plants in specific season, for example, at the end of the Ethiopian calendar year in 'Pagume' enabled the plants to regenerate and complete their life cycle. This is true mostly for annuals, those whose leaves, fruits and seeds are used, if other destructive pressures are kept at low level.

Conclusion

Traditional medicinal plants were harvested mostly from natural vegetation area followed by home gardens. They were also obtained from roadsides, farmlands and live fences. The medicinal plants in the natural vegetation were under threat and to tackle these problems traditional healers had turned their face towards home gardens. However, traditional healers still depend largely on naturally growing species because of their belief that those species in the natural vegetation are more effective in the prevention and treatment of diseases and health prob-

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Table 11: Priority ranking of factors perceived as threats to medicinal plants based on their level of destructive effects in the study area, Wonago Woreda (values 1-6 were given: 1 is the least destructive threat and 6 is the most destructive threat)

| Factors                | R1 | R2 | R3 | R4 | R5 | R6 | Total | Percent | Rank |
|------------------------|----|----|----|----|----|----|-------|---------|------|
| Drought                | 3  | 4  | 2  | 3  | 6  | 3  | 21    | 16.5    | 4th  |
| Grazing                | 5  | 1  | 3  | 5  | 4  | 5  | 23    | 18.1    | 3rd  |
| Urbanization           | 1  | 5  | 4  | 1  | 3  | 1  | 15    | 11.8    | 5th  |
| Agricultural expansion | 6  | 2  | 6  | 6  | 5  | 6  | 31    | 24.4    | 1st  |
| Fire wood              | 4  | 6  | 5  | 4  | 1  | 4  | 24    | 18.8    | 2nd  |
| Construction           | 2  | 3  | 1  | 2  | 2  | 3  | 13    | 10.2    | 6th  |
lems. Furthermore, the documented medicinal plants can be used as a basis for further studies on the regions medicinal plants knowledge and for future phytochemical and pharmacological studies.

Declaration of competing interests
The authors declare that they have no competing interests.

Authors’ contributions
The authors have made substantive intellectual contributions to this study in data collection, identification of plants, preparation of the manuscript and proof reading.

Additional material

Additional file 1
List of plant species collected from natural vegetation in the study area. It shows plants collected from the natural vegetation and those that are used as medicine in the community.

Click here for file
[http://www.ethnobiomed.com/content/supplementary/1746-4269-5-28-s1.pdf]

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