An ethnobotanical study of medicinal plants used in Kilte Awulaelo District, Tigray Region of Ethiopia

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Abstract

Background: The Ethiopian people have been dependent on traditional medicine, mainly medicinal plants, from time immemorial for control of human and animal health problems, and they still remain to be largely dependent on the practice. The purpose of the current study was to conduct ethnobotanical study to document medicinal plants used to treat diseases of human and domestic animals in Kilte Awulaelo District in the Tigray Region of Ethiopia.

Methods: Ethnobotanical data were collected between July and September 2011 through semi-structured interviews, ranking exercises and field observations. For the interviews, 72 knowledgeable informants were sampled using purposive sampling method. For the different ranking exercises, key informants were identified with the help of elders and local administrators from informants that were already involved in the interviews.

Results: The study revealed 114 medicinal plant species belonging to 100 genera and 53 families. The plants were used to treat 47 human and 19 livestock diseases. Of the species, the majority (74%) were obtained from the wild. Herbs were the most utilized plants, accounting for 44% of the species, followed by shrubs (29%). Leaf was the most commonly used plant part accounting for 42.98% of the plants, followed by roots (25.73%). Preference ranking exercise on selected plants used against abdominal pain indicated the highest preference of people for Solanum marginatum. Direct matrix ranking showed Cordia africana as the most preferred multipurpose plant in the community. Preference ranking of selected scarce medicinal plants indicated Myrica salicifolia as the most scarce species, followed by Boscia salicifolia and Acokanthera schimperi. According to priority ranking, drought was identified as the most destructive factor of medicinal plants, followed by overgrazing and firewood collection.

Conclusion: Medicinal plants are still playing significant role in the management of various human and livestock diseases in the study area with herbs taking the lead in the number of plants used in the preparation of remedies, which may be an indication of their relatively better abundance as compared to other life forms. Recurrent drought was reported to have seriously threatened medicinal plant resources in the District. Awareness is thus needed be raised among local people on sustainable utilization and management of plant resources. Ex situ and in situ conservation measures should be taken to protect the medicinal plants of the District from further destruction and special attention should be given to the medicinal plants that were indicated by preference ranking exercise as the most threatened ones.

Keywords: Ethnobotany, Medicinal plants, Kilte Awulaelo District, Eastern Tigray, Ethiopia

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Background
About 80% of the Ethiopian population and 90% of livestock still depend on traditional medicinal plants to fight a number of diseases [1,2]. The reliance on medicinal plants is partly owing to the high cost of modern drugs, inaccessibility of modern health institutions and due to cultural acceptability of the system [3-5]. However, as time goes on, the traditional knowledge and the associated plants in the country are gradually being depleted for reasons mainly attributed to environmental degradation and deforestation, which in turn brought about the loss of some important medicinal plants [4,6]. On the other hand, documentation work related to traditional medical knowledge in the country still remains at minimum level calling for conduct of more ethnobotanical studies.

The people of Tigray Region, in general, and Kilte Awulaelo District, in particular, are also expected to have rich knowledge on traditional medicine involving medicinal plants. Such knowledge is, however, currently being threatened, as it is happening elsewhere in the country, due to environmental degradation and deforestation. On the other hand, published reports indicate that only few ethnobotanical studies have been conducted in Tigray to properly document the use of medicinal plants [7-10]. The studies conducted in the districts of Alamata [7], Enderta [8], Hawzen [9], and Asgede Tsimbila [10] documented 25, 27, 33 and 68 medicinal plants, respectively. However, no such study has far been conducted in Kilte Awulaelo District. The purpose of the current study was, therefore, to gather and document information on the use of medicinal plants by people in Kilte Awulaelo District, in Tigray Region of in Ethiopia, to manage diseases of humans and domestic animals. The study was expected to play a role in prioritizing medicinal plants in the District for further evaluation and conservation.

Materials and methods
Description of study district and people
Kilte Awulaelo District is located at 825 km north of the capital Addis Ababa, in the Eastern Zone of Tigray Regional State, Northern Ethiopia. It shares borders with the districts of Howzien and Sease Tsadamba in the north, Atsbi Womberta in the east, Dougla Tembien in the west and Enderta in the South (Figure 1). The District is composed of 18 kebeles. Kebele is the smallest administrative unit in Ethiopia. Altitude in the District ranges between 1900 and 2460 meters above sea level. It covers an area of 101,758 hectares, of which 21,620 hectares are farmlands, 101,758 hectares, of which 21,620 hectares are farmlands, 7,930.85 hectares are grazing areas, 44,134 hectares are enclosure areas and 28,073.15 hectares are occupied by hills and residential areas [11], Kilte Awulaelo Plan and Finance Office, unpublished data, 2010.

According to 2001-2010 rainfall data, the District has a high rainfall distribution between July and August and a smaller rainfall between March and June and in September. The mean monthly rainfall and mean annual rainfall of the District are 50.14 mm and 601.68 mm, respectively [National Metrological Service Agency, Mekele Branch Office, unpublished data].

Tigrigna, an official language in Tigray Region, is the language spoken by the people residing in Kilte Awulaelo District. The language belongs to the Semitic language family. Based on the population census of 2007 by the Ethiopian Central Statistical Agency [12], the total population of the District is 111,546, of which 48.89% are males and 51.11% are females.

The people in District mainly cultivate barely, wheat, teff, bean, pea, maize and sorghum. Of the domestic animals raised in the District, poultry has the population, estimated to be 62,610 heads, followed by cattle (61,864), sheep (56,042), honey bees (54,217) [11], Kilte Awulaelo Plan and Finance Office, unpublished data, 2010. Malaria, upper respiratory problems, skin infection, infestation of intestinal parasites, pneumonia, soft tissue injury, gastritis, diarrheal, arthritis and eye diseases have been reported as the ten most common diseases in the District. In 2010, there were five functional health centres in the District where the kebeles Agulae, Negash, Beati Akor, Tsige Reda and Abraha Atsbha had one each [Kilte Awulaelo Health Office, unpublished data, 2010].

Selection of study kebeles and informants
Ethnobotanical data were collected between July and September 2011 from nine kebeles that were purposively selected with the help of elders and local authorities of the District based on better availability of traditional healers and knowledgeable people. The kebeles were Ayne Alem, Negash, Tseada Neale, Agulae, Abraha Atsbha, Adi Kesandid, Genfel, Mahbere Weyni, and Mesanu.

For the interview, 72 healers and knowledgeable informants (eight from each sampled kebele) were selected using purposive sampling method [13], of which 61 were males and 11 were females. The informants selected from each sampled kebele were the most knowledgeable ones as suggested by respective kebele elders and administrators who participated in the selection process. The ages of the informants ranged between 20 and 82 years. Three key informant groups (one group containing nine individuals) were respectively involved in three different ranking exercises (two preference ranking exercises and one direct matrix ranking exercise). The key informants were selected from the already interviewed informants with help of elders and local administrators.

Ethnobotanical data collection
Ethnobotanical data were collected through semi-structured interviews and observations by following standard methods [13,14]. Series of individual interviews
were carried out to gather information regarding local names of plants used, their threats and management, part(s) used, preparations methods, routes of remedy administration, diseases treated and side effects of remedies. The same method was also used to collect data on habit, habitat, marketability and conservation status of the reported medicinal plants. Interviews were conducted using Tigrigna, language that is spoken by the people in the study District. For each reported plant species, specimen was collected, pressed, dried, and identified and voucher was kept at Jimma University Herbarium. Field observations were also used to record habit and habitat of each medicinal plant with the assistance of local guides and interviewed informants. The

Figure 1 Map of the Kilte Awlaelo District (modified based on GIS of Ethiopia); red and black dots showing selected study kebeles.
| Scientific name               | Family name    | Voucher No. | Tigrigna name | Habit | Part used | Used for                  | Preparation and application                                                                 |
|------------------------------|----------------|-------------|---------------|-------|-----------|---------------------------|-----------------------------------------------------------------------------------------------|
| *Acacia etbaica*             | Fabaceae       | AT00606     | Seraw         | Tree  | Leaf      | Swelling                  | Crush and mix with latex of *Euphorbia abyssinica* and rub the paste on the affected part      |
|                             |                |             |               |       | Leaf      | Eye infection (livestock) | Chew and spit on to the affected eye                                                            |
|                             |                |             |               |       | Stem      | Ring worm                 | Place it on fire and apply liquid on the affected part                                           |
|                             |                |             |               |       | Stem      | Haemorrhoids              | Burn and place it on the affected part                                                          |
|                             |                |             |               |       | Leaf      | Itching/ scabies          | Crush and rub                                                                                   |
|                             |                |             |               |       | Stem      | Anthrax (both)            | Burn and place it on the affected part                                                         |
|                             |                |             |               |       | Leaf      | Fire burn                 | Crushed and apply on the burn                                                                     |
| *Achyranthes aspera* L.      | Amaranthaceae  | AT00654     | Muchele       | Herb  | Root      | Eye infection (livestock) | Chew and spit the liquid onto the infected eye                                                  |
|                             |                |             |               |       | Root      | Anthrax (both)            | Crush it with roots of *Solanum incanum* and whole part of *Hypoestes forskoalli*, add water and drink with cup of glass |
|                             |                |             |               |       | Root      | Urine retention           | Tie around the sex organ                                                                         |
|                             |                |             |               |       | Leaf      | Eye infection             | Boil with leaves of *Eucalyptus globulus*, *Withania somnifera* and *Zehneria scabra* in water and inhale the vapour |
|                             |                |             |               |       | Root      | Snake bite                | Chew and swallow the fluid                                                                      |
|                             |                |             |               |       | Leaf      | Wound                     | Crush and place on the wound                                                                    |
|                             |                |             |               |       | Root      | Babesia (livestock)       | Crush and apply into the nose                                                                   |
|                             |                |             |               |       | Leaf      | Wound/sore                | Crush and rub the past on the wound                                                               |
|                             |                |             |               |       | Root      | Paralysis                 | Crush, dry and put it on fire for fumigation                                                     |
| *Aloe megalacantha* Bark.    | Aloaceae       | AT00707     | Ere           | Shrub | Root      | Dislocated bone (livestock)| Tie it on the ear                                                                                 |
|                             |                |             |               |       | Latex     | External wound            | Cut a leaf and spread latex on wound until healed                                               |
|                             |                |             |               |       | Leaf      | Malaria, amoeba           | Crush leaves and squeeze juice, filter and drink                                                |
|                             |                |             |               |       | Latex     | Ascariasis                | Squeeze latex, filter and drink                                                                  |
|                             |                |             |               |       | Leaf      | Abdominal pain            | Crush leaves, filter and drank the fluid                                                         |
|                             |                |             |               |       | Latex     | Ticks infestation (livestock)| Cut leaf and apply latex on skin                                                                 |
|                             |                |             |               |       | Leaf      | Evil eye                  | Place leaf on fire and fumigate                                                                   |
|                             |                |             |               |       | Root      | Impotence                 | Crush root and mix butter and smear it on the penis                                              |
|                             |                |             |               |       | Whole     | Snake bite (both)         | Crush the part and drink the juice                                                               |
|                             |                |             |               |       | Root      | Urine retention           | Tie it around the sex organ                                                                      |
| Plant Name                          | Family            | Code  | Part   | Preparation                                                                 |
|------------------------------------|-------------------|-------|--------|------------------------------------------------------------------------------|
| *Anethum graveolens* L.            | Apiaceae          | AT00677 | Whole  | Crush, filter and drink the fluid                                               |
| *Calotropis procera* (Aiton) W.T. Aiton | Asclepiadaceae   | AT00612 | Leaf & latex | Boil it in water and drink the fluid                                             |
| *Clematis hirsuta* Perr. & Guill.  | Ranunculaceae     | AT00680 | Root   | Crush roots with butter and apply the paste                                    |
| *Clutia abyssinica* Jaub. & Spach. | Euphorbiaceae     | AT00659 | Leaf   | Crush leaves and rub the paste on affected part while hot                      |
| *Chenopodium murale* L.            | Chenopodiaceae    | AT00650 | Leaf   | Crush and apply paste on skin                                                  |
| *Clerodendrum myricoides* (Hochst.) R.Br. ex Vatke | Lamiaceae        | AT00643 | Root   | Crushed, add water, filter and drink                                            |
| *Cluza abyssinica* Jaub. & Spach.  | Euphorbiaceae     | AT00659 | Leaf   | Rubbing the affected part by the leaf                                           |

(Continued)
| Plant Name                          | Family         | Code       | Type  | Part Used | Treatment                                                                 |
|------------------------------------|----------------|------------|-------|-----------|---------------------------------------------------------------------------|
| Cucumis ficifolius A. Rich.        | Cucurbitaceae  | AT00642    | Leaf  | & bark    | Leaf & bark, mix leaves with dried leaves of *Calpurnia aurea* and *Datura stramonium*, grind, add butter and spread paste on affected part |
|                                   |                |            |       |           | Leaf & bark, mix leaves with dried leaves of *Calpurnia aurea* and *Clutia abyssinica*, grind, add butter and spread paste on affected part |
|                                   |                |            |       |           | Crush, filter and drink                                                  |
|                                   |                |            |       |           | Crush and apply paste on affected part                                   |
| Leaf                              |                |            |       |           | Crush the part with leaves of *Dyschoriste radicans*, mix it with honey and placed on affected part |
|                                    |                |            |       |           | Crush and apply paste on affected part                                   |
|                                    |                |            |       |           | Crush and apply paste on affected part                                   |
| Cucumis ficifolius A. Rich.        | Cucurbitaceae  | AT00642    | Root  | Snake, scorpion and black spider bite | Grind the part, mix with honey and eat it |
|                                    |                |            | Fruit | Wound/sore | Apply fruit juice on the affected part                                   |
|                                    |                |            | Whole | Jaundice/ hepatitis | Crush, add water, filter and drink or Chew and swallow the product |
|                                    |                |            | Whole | Jaundice/ hepatitis | Crush, add water, filter and drink or Chew and swallow the product |
|                                    |                |            | Leaf  | Tonsillitis | Mix the leaves of the plant with leaves of *Achyranthes aspera*, crush and place the paste on shaved part of head of a sick child |
|                                    |                |            | Root  | Toothache | Chew part with the diseased teeth                                        |
|                                    |                |            | Root  | Joint pain | Crush, filter and drink the fluid                                        |
|                                    |                |            | Root  | Abdominal pain (both) | Mix root of the plant with bark of *Croton macrostachyus*, dry the paste, mix it with butter and drink it or chew the product and drink the fluid |
|                                    |                |            | Root  | Vomiting  | Crush and drink the fluid                                               |
|                                    |                |            | Root  | Snake bite (both) | Crush, filter and drunk the fluid                                        |
|                                    |                |            | Root  | Snake bite (both) | Crush, filter and drunk the fluid                                        |
|                                    |                |            | Root  | Snake venomation (repulsion) | Tie it on the body                                                       |
| Cyphostema adenocaula (Steud. ex A.Rich.) | Vitaceae | AT00681    | Climber | Aserkuca asergundi | Crush and drink the fluid                                               |
| Cyphostema junceum (Webb) Desc. Ex Wild & R.B. Drumm. | Vitaceae | AT00686    | Herb  | Root bark Snake bite (both) | Crush and eat the paste with honey                                       |
|                                    |                |            | Whole | Toothache | Chew and swallow the juice                                               |
|                                    |                |            | Whole | Spider bite | Chew and swallow fluid                                                   |
|                                    |                |            | Leaf  | Evil eye | Place part on fire for fumigation                                         |
|                                    |                |            | Leaf  | Itching/ scabies | Crush and apply on affected part                                         |
|                                    |                |            | Leaf  | External wound | Crush and apply on affected part                                         |
|                                    |                |            | Seed  | Toothache | Place it on fire and inhale the smoke through mouth                       |
|                                    |                |            | Leaf  | Herpes zoster | Dried leaves of the plant and *Calpurnia aurea* and *Clutia abyssinica* are ground mixed powder with butter and apply on affected part |
|                                    |                |            | Leaf  | Wound/sore | Crush and apply on affected part                                         |
|                                    |                |            | Leaf  | Anthrax (livestock) | Crush by mixing with leaves of *Solanum mariginatum* and *Malva verticillata* and apply paste on affected part |
Table 1 Medicinal plants used to treat both human and livestock diseases (Continued)

| Plant Name                  | Family      | AT00610 | Medicinal Part | Disease Treated                                      | Application Method                                                                 |
|-----------------------------|-------------|---------|----------------|------------------------------------------------------|-------------------------------------------------------------------------------------|
| Dodonia angustifolia L.f.   | Sapindaceae |         | Leaf           | Herpes zoster                                        | Dry the leaf of the plant alone or mixed with the leaf of Clematis hirsuta on hot stove, grind, add butter and rub affected part |
|                            |             |         | Seed           | Malaria                                              | Grind and eat it with honey                                                          |
|                            |             |         | Leaf           | Dislocated bone (livestock)                         | Crush and apply on damaged part                                                      |
|                            |             |         | Leaf           | Eye infection                                        | Crush and apply droplets into the infected eye                                       |
|                            |             |         | Leaf           | Fire burn                                            | Dry it in oven, grind, and butter sulphur and spread it on the affected part         |
| Echinops Kebericho Mesfin   | Asteraceae  | AT00685 | Root           | Dislocated bone (livestock)                         | Tie it on damaged part                                                              |
|                            |             |         | Stem           | Haemorrhoids                                         | Place a burned stem and apply it on affected while hot                              |
| Euclea racamose            | Ebenaceae   | AT00611 | Whole          | Evil eye                                             | Crush and tie powder around the neck                                                |
| Mesfin, subsp. schimperi (ADC) F. White |          |         | Root bark      | Snake bite (both)                                   | Crush, add water and drunk the fluid                                               |
|                            |             |         | Root            | Paralysis                                            | Crush and drink juice with milk                                                    |
|                            |             |         | Root            | Black spider bite                                    | Chew and swallow the fluid                                                          |
|                            |             |         | Root bark       | Abdominal pain                                       | Boil it in water and drink the fluid                                               |
|                            |             |         | Root            | Toothache                                            | Chew part with the affect tooth                                                     |
|                            |             |         | Root            | Arnoeba                                              | Remove bark of the root, boil it and drink the fluid with mancheba, milk product   |
| Euphorbia abyssinica J.F.Gmel. | Euphorbiaceae | AT00706 | Latex          | Ascariasis                                           | Mix part with locally made beer and drink it or mix it enjera (local food) and eat it |
|                            |             |         | Latex           | Abdominal pain                                       | Mix it with tihni (made from flour of roasted barley) and eat it                    |
|                            |             |         | Flower          | External wound                                       | Crush, mix with honey and apply it on affected part                                |
|                            |             |         | Latex           | Leprosy                                              | Smear latex on affected part                                                        |
|                            |             |         | Latex           | Swelling (both)                                      | Smear latex on affected part                                                        |
| Euphorbia petithiana A.Rich.| Euphorbiaceae | AT00687 | Latex          | Leishmaniasis                                        | Rub leaf on affected part until cure                                                |
|                            |             |         | Root            | Dislocated bone (livestock)                         | Tie around the damage part                                                          |
| Euphorbia tirucali L.       | Euphorbiaceae | AT00682 | Latex          | Skin haemorrhoids                                    | Apply on affected part                                                              |
| Galium boreo-               | Rubiaceae   | AT00621 | Root           | Babesia (livestock)                                  | Crush and apply droplets through the nose                                           |
| aethiopicum Puff            |             |         | Root            | Toothache                                            | Chew root with affected tooth                                                       |
|                            |             |         | Root            | Evil eye                                             | Placing it on fire for fumigation                                                   |
|                            |             |         | Root            | Abdominal pain                                       | Chew and swallow fluid                                                             |
|                            |             |         | Latex           | Ring worm                                            | Apply latex on affected part                                                        |
|                            |             |         | Latex           | Swelling (livestock)                                 | Smear latex on swollen part                                                         |
| Medicinal plants used to treat both human and livestock diseases (Continued) |
|---------------------------------------------------------------|
| **Gomphocarpus purpurascens A. Rich.**                        |
| Asclepiadaceae | AT00690 | Tseba dimu | Herb | Root | Abdominal pain | Chew and swallow the fluid |
| Whole | Haemorrhoids | Crush and apply on affected part |
| Root | Wound (livestock) | Crush and apply on affected part |
| Root | Toothache | Mix part with honey and chew |
| Leaf | Michi | Place on fire for fumigation |
| **Hypoestes forskalii** (Vahl) Roem. & Schult. |
| Acanthaceae | AT00603 | Girbia | Herb | Root | Babesia (livestock) | Crush, mix with honey and eat |
| Whole | Anthrax | Crushed it alone or by mixing with seeds of *Lepidium sativum*, roots of *Solanum incanum*, *Achyranthes aspera* and *Verbascum sinaiticum*, filter and drink the fluid |
| Root | Abdominal pain | Chew and swallow the fluid |
| Leaf | Wound | Crush apply on affected part |
| Root | Ascariasis | Boiling in milk with leaves of *Lantana trifolia* and drunk |
| Root | Cough | Place it on fire for fumigation |
| **Hypericum annulatum** Moris. |
| Hypericaceae | AT00668 | Akti | Herb | Leaf | Eye infection (both) | Dry, Grind, add butter and apply on affected part |
| **Justicia schimperiana** (Hochst. ex Nees) T.Anders. |
| Acanthaceae | AT00632 | Shimieya | Shrub | Leaf | Dysentery | Crush, add water and drink |
| Leaf | Jaundice | Crush and eat it with enjera (local food) or add milk and drink it |
| Leaf | Wound | Boiling with roots of *Withania somnifera* and washing |
| Leaf | Arthritis | Boil it in water and wash body with it |
| **Laggera tomentosa** (Sch.Bip ex A.Rich.) |
| Asteraceae | AT00679 | Kash koshe | Shrub | Leaf | Leeches infestation (livestock) | Crush and add juice through the nose |
| Leaf | Ring worm | Rub it on affected part |
| **Lepidium sativum L.** |
| Brassicaceae | AT00708 | Shimfa | Herb | Seed | Wound/sore | Crush seeds leaves of *Dyschoriste radicans* and bulb of *Allium sativum* and tie on affected part |
| Seed | Itching/scabies | Crush seeds with leaves of *Rumex nervosus* and *Withania somnifera* and bulb of *Allium sativum*, soak it in water and wash body with it |
| Seed | Swelling (both) | Crush and apply it on affected part |
| Seed | Abdominal pain | Crush, add water and drink |
| Seed | Anthrax (both) | Crush it by mixing it with whole part of *Hypoestes forskalii*, roots of *Solanum incanum* and *Verbascum sinaiticum*, filter and drink the fluid |
| Stem | Haemorrhoids | Burn it on fire add apply it on affected part while hot |
| Leaf | Michi | Crush it with bulbs of *Allium sativum* and eat or rub it on the skin |
| Plant Name                        | Family         | Genus      | AT Code | Part     | Disease                     | Preparation                                                                 |
|----------------------------------|----------------|------------|---------|----------|------------------------------|-----------------------------------------------------------------------------|
| Malva verticillata L.            | Malvaceae      | Malva     | AT00625 | Herb     | External wound              | Crush and rub apply it on the affected part                                 |
|                                  |                |           |         | Leaf     | Anthrax                     | Crush it with leaves of *Datura stramonium* and *Solanum marginatum* and apply it |
| Melia azadachta L.               | Meliaceae      | Melia     | AT00695 | Leaf     | Anthrax                     | Place it on fire and apply it on affected part while hot                    |
| Opuntia ficus-indica (L.) Miller. | Cactaceae      | Opuntia   | AT00713 | Shrub    | Lice or fleas infestation (livestock) | Crush, rub on skin                                                          |
|                                  |                |           |         | Leaf     | Dandruff                     | Crush and rub it on affected part                                           |
| Otostegia integrifolia Benth.     | Lamiaceae      | Otostegia | AT00652 | Shrub    | Ascariasis                   | Crush, filter and drink the fluid                                           |
|                                  |                |           |         | Leaf     | Lice or flea infestation (livestock) | Place it on fire for fumigation                                             |
|                                  |                |           |         | Root     | Abdominal pain               | Chew and swallow the fluid                                                  |
|                                  |                |           |         | Leaf     | Lice or flea infestation (livestock) | Place it on fire for fumigation                                             |
| Prema oligotricha Baker          | Lamiaceae      | Premna    | AT00633 | Shrub    | Synerosis celebralis (livestock) | Place on fire for fumigation                                                |
|                                  |                |           |         | Leaf     | Toothache                    | Chew it with affected tooth                                                 |
| Ricinus communis L.              | Euphorbiaceae  | Ricinus   | AT00688 | Herb     | External wound (both)        | Crush and apply it on the wound                                             |
|                                  |                |           |         | Leaf     | Ring worm                    | Rub it on affected part                                                     |
| Rumex nepalensis Spreng.         | Polygonaceae   | Rumex     | AT00618 | Herb     | Jaundice                     | Crush, filter and drink the fluid                                           |
|                                  |                |           |         | Root     | Fire burn                    | Crush by mixing it with urine and apply it on damaged part                  |
|                                  |                |           |         | Leaf     | Tinea capitis                | Mix it with fruit of *Citrus aurantiifolia* and rub it affected part        |
| Schinus molle L.                 | Anacardiaceae  | Schinus   | AT00648 | Tree     | Jaundice                     | Crush, filter and drink the fluid                                           |
|                                  |                |           |         | Leaf     | Diarrheal                    | Crush, filter and drink the fluid                                           |
|                                  |                |           |         | Leaf     | Bloating (livestock)         | Crush and drink the fluid                                                   |
|                                  |                |           |         | Leaf     | Tonsillitis                  | Crush and drunk it with coffee                                              |
|                                  |                |           |         | Leaf     | Michi                        | Crush and apply it on shaved head of sick child                            |
| Sida schimperiana Hochst. ex A.Rich. | Malvaceae   | Sida      | AT00636 | Shrub    | Rh disease                   | Crush, filter and drink a cup of fluid                                      |
|                                  |                |           |         | Root     | Paralysis                    | Tie root around the affected part                                           |
|                                  |                |           |         | Root     | Dislocated bone (livestock)  | Tie it on tail of the affected animal                                      |
|                                  |                |           |         | Root     | Abortion (livestock)         | Tie it on tail of the animal                                               |
Table 1 Medicinal plants used to treat both human and livestock diseases (Continued)

| Plant Name                  | Family   | Accession | Common Name | Part Used | Condition | Description |
|----------------------------|----------|-----------|-------------|-----------|-----------|-------------|
| Solanum hastifolium Hochst. ex Dunal in DC. | Solanaceae | AT00641 | Alalmo kalbi | Shrub Root | Abortion (livestock) | Tie it on tail of the animal |
|                            |          |           |             |           | Root      | Evil eye    | Place it on fire for fumigation |
|                            |          |           |             |           | Leaf & fruit | Anthrax (livestock) | Crush and add honey and apply or squeeze it into affected part or crush, filter and drink |
|                            |          |           |             |           | Leaf      | Tonsillitis | Crush by mixing it with leaves of Solanum incanum and place on shaved head of sick child |
|                            |          |           |             |           | Fruit     | Ear diseases | Squeeze to produce juice, add goat butter and apply through the nose |
|                            |          |           |             |           | Leaf      | Cellulitis | Crush and apply |
|                            |          |           |             |           | Root      | Toothache   | Chew with affected part |
|                            |          |           |             |           | Fruit     | Cellulitis   | Chew with affected part |
| Solanum incanum L.         | Solanaceae | AT00617 | Niesheton engule | Shrub Root | Abdominal pain | Chew and swallow the fluid |
|                            |          |           |             |           | Root bark | External wound infection | Dry, grind and apply on affected part |
|                            |          |           |             |           | Leaf      | Tonsillitis | Crush by mixing leaves of Solanum hastifolium and place it on the shaved head of sick child |
|                            |          |           |             |           | Root      | Anthrax (both) | Crush by mixing with seeds of Lepidium sativum, whole part of Hypoestes forska coli, roots of Achyranthes aspera and Verbascum sinalicum, filter and drink fluid |
|                            |          |           |             |           | Seed      | External wound infection | Chew and swallow the fluid or boil and drink the fluid |
|                            |          |           |             |           | Seed      | Cough | Grind and apply on affected part |
|                            |          |           |             |           | Fruit     | Breathing problem (livestock) | Burn, grind, mix it with sugar or honey and swallow it |
|                            |          |           |             |           | Leaf      | Anthrax (both) | Crush by mixing leaves of Datura stramonium and Malva verticillata apply it on affected part or crush, filter and drink the fluid |
|                            |          |           |             |           | Root      | Ascariasis | Crush by mixing with roots of Zehnderia scabra, and Verbena officinalis, filter and drink the fluid |
| Trigonella foenum-graecum (Bunge) Gurke. | Fabaceae | AT00699 | Abeake | Herb Seed | Abdominal pain | Grind, add water and drink |
|                            |          |           |             |           | Seed      | Swelling (both) | Grind by mixing with beans and rub paste on affected part |

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| Verbascum sinaiticum Benth. | Scrophulariaceae | AT00634 | Timake (handega) | Herb | Leaf | Fire burn | Crush and apply fluid on the burned skin |
|-----------------------------|------------------|---------|------------------|------|------|----------|------------------------------------------|
| Root                        | Tonsillitis      | Crush, filter and drink with a cup |
| Root                        | Evil eye         | Place it on fire with sulphur for fumigation |
| Root                        | Toothache        | Chew it |
| Root bark                   | Haemorrhoids     | Crush, filter and drink |
| Leaf                        | External wound   | Crush and apply on affected part |
| Root                        | Anthrax (livestock) | Crush with seeds of Lepidium sativum, roots of Solanum incanum and whole part of Hypoestes forskoalli; filter and drink the fluid |
| Root                        | Anthrax (livestock) | Crush, mix with honey and eat it |
| Root                        | Dislocated bone  | Tie around the affected part |
| Withania somnifera (L.) Dunal | Solanaceae | AT00630 | Agol | Herb | Leaf | Eye infection | Boil it in water by mixing with leaves of Eucalyptus globulus, roots of Achyrnthes aspera and Cynoglossum lanceolatum and leaves of Zehneria scabra and inhale the vapour |
| Whole                       | Evil eye         | Crush by mixing with roots of Carissa spinarum and put it on for fumigation |
| Whole                       | Michi            | Soak in water by mixing with leaves of Rumex nervosus and juices of Citrus aurantiolia and wash body with it |
|                            |                  | Boil by mixing with Justicia schimperiana and wash the body with it |
|                            |                  | Place it on by mixing with leaves of Zehneria scabra and Eucalyptus globulus and fumigate |
| Leaf                        | Itching/ scabies | Crush by mixing with leaves of Rumex nervosus, seeds of Lepidium sativum and bulbs of Allium sativum, soak it in water and wash affected part with it |
| Root                        | Paralysis        | Place it on fire for fumigation |
| Root                        | Evil sprit       | Crush by mixing with roots of Clerodendrum myricoides, Carissa spinarum, Jasminum gratissimum and Maytenus senegalensis and place it on fire for fumigation |

1Unless indicated, the disease is that of human.
| Scientific name                        | Family name | Voucher No. | Tigrigna name | Habit | Part used | Used for               | Preparation and application                                                                 |
|---------------------------------------|-------------|-------------|---------------|-------|-----------|------------------------|-----------------------------------------------------------------------------------------------|
| *Abutilon bidentatum* (Hochst.) A. Rich. | Malvaceae   | AT00635     | Neger negarito | Shrub | Leaf      | Michi                  | Crush, filter and drink                                                                      |
|                                       |             |             |               |       |           | Abdominal pain         | Crush, filter and drink by adding milk                                                        |
| *Acacia abyssinica* Hochstex Benth.   | Fabaceae    | AT00700     | Memona        | Tree  | Bark      | Herpes zoster          | Crush and apply on affected part                                                              |
|                                       |             |             |               |       | Root      | Evil eye               | Crush and place on fire for fumigation                                                        |
| *Acokanthera schimperi* (A.DC.) Schweinf. | Apocynaceae | AT00649     | Mebtie        | Tree  | Bark      | Itching/ scabies       | Boil it in water and wash body with it                                                          |
| *Ajuga integrifolia* Buch-Ham.        | Lamiaceae   | AT00675     | Endifdif      | Herb  | Leaf      | Tinea capitis          | Crush and rub on the affected part                                                             |
|                                       |             |             |               |       |           | Ascariasis             | Crush, filter and drink                                                                         |
|                                       |             |             |               |       |           | Tap worm               | Crush, filter and drink                                                                         |
|                                       |             |             |               |       |           | Abdominal pain         | Crush, filter and drink                                                                         |
| *Allium sativum* L.                   | Alliaceae   | AT00709     | Tsaeda shingurti | Herb | Bulb      | Wound/sore             | Crush by mixing with leaves of *Dyschoriste radicans* and *Lepidium sativum* and tie on the affected part |
|                                       |             |             |               |       | Bulb      | Cough                 | Eat or smell the part or crush and eat it with honey                                             |
|                                       |             |             |               |       | Bulb      | Paralysis             | Crush and rub on body                                                                           |
|                                       |             |             |               |       | Bulb      | Toothache             | Chew with the affected tooth                                                                     |
|                                       |             |             |               |       | Bulb      | Itching/scabies       | Crush by mixing with leaves of *Rumex nervosus* and *Withania somnilera* and seeds of *Lepidium sativum*, soak it in water and wash body with it |
|                                       |             |             |               |       | Bulb      | Malaria               | Crush it alone or by mixing with seeds of *Lepidium sativum* and eat it                          |
|                                       |             |             |               |       | Bulb      | Amoeba                | Grind and eat it with honey                                                                      |
|                                       |             |             |               |       | Bulb      | Rabies                | Eat the part                                                                                   |
|                                       |             |             |               |       | Whole     | Michi                 | Crush and apply the paste or place it on fire for fumigation                                  |
| *Amorphophallus abyssinicus* (Rich.) N.E.Br. | Araceae     | AT00637     | Hambagita     | Herb  | Leaf      | Tinea capitis          | Crush and apply on affected part                                                                |
|                                       |             |             |               |       |           | Leshimaniasis         | Apply it on the affected part until cure                                                          |
| *Agemone mexicana* L.                 | Papaveraceae| AT00615     | Eshok tilian, medafe | Herb | Latex     | Leshimaniasis         | Apply it on affected part until cure                                                              |
|                                       |             |             |               |       | Leaf      | Tinea capitis         | Crush and apply                                                                                  |
| *Artemisia abyssinica* Sch.Bip. ex A.Rich. | Asteraceae  | AT00678     | Chena baria   | Herb  | Whole     | Evil eye              | Mix with bulbs of *Allium sativum* and smell it                                                  |
|                                       |             |             |               |       | Leaf      | Michi                 | Crush by mixing with bulbs of *Allium sativum* and seeds of *Lepidium sativum*, add water and rub it on the skin |
| *Asparagus africanus* Lam.             | Asparagaceae| AT00658     | Kastanito     | Climber | Root      | Dislocated bone       | Tie it on affected part                                                                           |
|                                       |             |             |               |       | Root      | Evil eye              | Place on fire for fumigation                                                                     |
|                                       |             |             |               |       | Root      | Leshimaniasis         | Crush, mix it with honey and apply on affected part                                              |
### Table 2 Medicinal plants used to treat human diseases only (Continued)

| Plant Name                        | Family     | Code     | Part Used | Disease Treated          |
|----------------------------------|------------|----------|-----------|--------------------------|
| *Becium grandiflorum* (Lam.) Pic. | Lamiaceae  | AT00609  | Root      | Black spider bite        |
| *Bidens camporum* (Hutch.) Mesfin | Asteraceae | AT00604  | Herb      | Eye infection            |
| *Boscia salicifilia* Olliv.      | Capparaceae| AT00684  | Whole     | Paralysis                |
| *Capparis tormentosa* Lam.       | Capparaceae| AT00623  | Leaf      | Evil eye                 |
| *Carica papaya* L.               | Caricaceae | AT00710  | Tree      | Ring worm                |
| *Carissa spinarum* L.            | Apocynaceae| AT00607  | Root      | Evil eye                 |
| *Citrus aurantifolia* (Christm.)| Rutaceae   | AT00711  | Tree      | Tinea capitis            |
| *Colutea abyssinica* Kunth & Bouché | Fabaceae  | AT00674  | Root bark | Evil eye                 |
| *Cordia africana* Lam.           | Boraginaceae| AT00683 | Root      | Tonsillitis              |
| *Commicarpus pedunculosus* (A. Rich.) Cufod. | Nyctaginaceae | AT00646 | Root      | Dislocated bone          |

Chew and swallow the fluid
Squeeze and apply liquid into the affected eye
Crush, filter and drink the fluid.
Dry, grind and place powder on fire for fumigation.
Chew and hold it on diseased tooth
Place it on fire for fumigation
Apply latex on affected part
Crush it and mix it with whole part of *Withania somnifera* and sulphur and put it on fire for fumigation.
Crush by mixing with roots of *Clodeoendrum myricoides*, *Withania somnifera*, *Jasminum GRATISSIMUM* and *Maytenus senegalensis* and place it on fire for fumigation.
Rub it on affected part
Soak it in water by mixing with leaves of *Rumex nervosus* and whole part of *Withania somnifera* and wash body with it
Crush by mixing with seeds of *Vicia faba* and apply on affected part
Rub it on the affected part
Tie around the neck
Chew it
Place it in oven, grind, mix it with butter apply it on affected part
Crush, filter and drink it alone or by mixing it with boiled coffee
Crush and drink it alone or by mixing it with boiled coffee
Chew and swallow the fluid in the morning before food
Rub on the affected part
Crush, filter and drink the fluid
Crush, boil with butter and apply it on affected part
Tie it on the affected part
| Medicinal plants used to treat human diseases only (Continued) |
|---------------------------------------------------------------|
| Croton macrostachyus Hochst. ex Delile | Euphorbiaceae | AT00671 | Tambok | Tree | Leaf | Jaundice | Boil it in water and drink it alone or with milk |
| | | | | | Latex | Tinea capitis | Apply latex on affected part |
| | | | | | Leaf | Malaria | Boil it in water and drink it with mancheba (milk product) |
| | | | | | Bark | Abdominal pain | Crush with roots of *Cucumis ficifolius*, dry and eat it with butter |
| | | | | | | | Crush and add the fluid through the ear |
| Cynoglossum lanceolatum Forsk. | Boraginaceae | AT00694 \& AT00624 | Ni michi, Dekik teneg | Herb | Leaf | Michi | Chew and swallow the fluid |
| | | | | | | | Place it on fire for fumigation |
| | | | | | Root | Eye infection | Crush and add the fluid into the affected eye |
| | | | | | | | Boil it in water inhale the vapour |
| Cyphostemma oxyphyllum (A. Rich.) Vollesen | Vitaceae | AT00601 \& AT00672 | Efchiche, reno | Climber | Root | External wound | Crush and apply it the wound |
| | | | | | | | Leaf and root | Snake bite | Eat it with honey |
| | | | | | | | | Crush or grind and eat it or drink it with mancheba (milk product) |
| | | | | | | | | Chew and swallow the fluid |
| | | | | | | | Tie it on the body |
| Dovyalis abyssinica (A.Rich.) Warb. | Flacourtiaceae | AT00656 | Mengolhats | Shrub | Fruit | Infection of amoeba, tape worm or ascariasis | Eat the fruit or drink its juice |
| Dyschoriste radicans (Hochst. ex A.Rich.) Nees. | Acanthaceae | AT00638 | Taetaeta bayta | Herb | Leaf | Anthrax | Crush it by mixing with leaves of *Cucumis ficifolius*, add honey and apply it affected part |
| | | | | | | | Leaf | Wound/sore | Crush it by mixing with saliva, salt, seeds of *Lepidium sativum* and bulbs of *Allium sativum* and apply or tie on the affected part |
| Erythrina abyssinica Lam. Ex DC. | Fabaceae | AT00602 | Zibabeo | Tree | Root bark | Tinea capitis | Crush, mix it with butter and apply on the affected part |
| Eucalyptus carmaldulensis Dehnh. | Myrtaceae | AT00673 | Keyh kalamites | Tree | Leaf | Eye infection | Boil it with water and inhale its vapour |
| Eucalyptus globules Labill. | Myrtaceae | AT00657 | Tseada kalamintos | Tree | Leaf | Eye infection /michi/ cough | Boil it with leaves of *Carica papaya* in water and inhale its vapour |
| | | | | | | | Place it on fire with whole part of *Withania somnifera* and leaves of *Zehneria scabra* for fumigation |
| | | | | | | | Boil it by mixing with leaves of *Zehneria scabra* *Cynoglossum lanceolatum* and whole part of *Withania somnifera* in water and inhale its vapour |
| Plant Name                  | Family       | Species Code | Part Used | Disease          | Treatment                                                                 |
|----------------------------|--------------|--------------|-----------|------------------|---------------------------------------------------------------------------|
| Euphorbia sp.              | Euphorbiaceae| AT00697      | Herb      | Root and leaf    | Abdominal pain: Chew and swallow the fluid                                  |
| Ficus palmata Forssk.      | Moraceae     | AT00665      | Shrub     | Root             | Ascariasis: Chew and swallow the fluid                                     |
| Ficus vasta Forssk.        | Moraceae     | AT00651      | Tree      | Bark             | Ascariasis: Crush and it with honey                                        |
| Hagenia abyssinica (Bruce) J.F. Gmel. | Rosaceae | AT00714      | Tree      | Leaf, fruit and flower | Tape worm: Crush, filter and drink the fluid alone or with milk            |
| Heliotropium cinerascens DC. & A.DC. | Boraginaceae | AT00639      | Herb      | Leaf             | Fire burn: Crush and squeeze liquid onto the damaged part                  |
| Hibiscus micranthus L.f.   | Malvaceae    | AT00620      | Shrub     | Leaf             | Wound/sore: Crush by mixing with saliva apply on the wound                |
| Jasminium gratissimum Deflers. | Oleaceae | AT00703      | Climber   | Root             | Evil spirit: Crush by mixing roots of Clerodendrum myricoides, Withania somnifera, Carissa spinarum and Maytenus senegalensis and place it on fire for fumigation |
| Kalanchoe quintiniana A.Rich. | Crassulaceae | AT00693      | Herb      | Leaf             | Paralysis: Crush, add water and wash water with it                          |
| Kniphofia pumila (Ait.) Kunth. | Asphodelaceae | AT00705      | Herb      | Bulb             | Evil eye: Soak it in water with leaves of Rumex nervosus and wash body with it |
| Lantana trifolia L.        | Verbenaceae  | AT00667      | Shrub     | Leaf             | Ascarasis: Boil it with milk or tea and drink                               |
| Maytenus arbutifolia (A. Rich.) Wilczek | Celastraceae | AT00670      | Shrub     | Root             | Itching/scabies: Boil it in water and washing body with it                 |
| Maytenus senegalensis (Lam.) Excell. | Celastraceae | AT00626      | Tree      | Root             | Evil spirit: Crush by mixing with roots of Clerodendrum myricoides, Withania somnifera, Carissa spinarum and Jasminum gratissimum and place it on fire for fumigation |
| Medicago polymorpha L.     | Fabaceae     | AT00644      | Herb      | Root             | Abdominal pain: Chew and swallow the fluid                                 |
| Merenda bengalenlsis (Roxb.) Benth. | Lamiaceae | AT00605      | Shrub     | Leaf             | Ascarasis: Crush, filter and drunk the fluid                               |
|                           |              |              |           |                  | Hypertension: Crush, filter and drunk the fluid                             |
| Plant Name | Family | Code | Part | Disease | Preparation |
|------------|--------|------|------|---------|-------------|
| Myrica salicifolia A.Rich. | Myricaceae | AT00661 | Root and bark | Evil eye | Tie it on the body; Crush and add liquid through the nose; Tie and place it on fire for fumigation; Crush or grind and add liquid through the nose |
| Ocimum lamifolium Hochst. ex Benth. | Lamiaceae | AT00645 | Leaf | Headache | Bark; Crush and grind; Apply liquid through the nose |
| Olea europaea L. subsp. cuspidata (Wall. ex G.Don) Cif., L'Olivicoltore | Oleaceae | AT00663 | Leaf | Toothache | Bark; Malaria; Boil in water and drink the fluid |
| Oxalis corniculata L. | Oxalidaceae | AT00640 | Herb | Tap worm | Bulb; Peel the external part and eat it alone or mixed with enjera (local food) |
| Phytolacca dodecandra L'Herit. | Phytolaccaceae | AT00662 | Whole | Abdominal pain | Crush, filter and drink the fluid; Crush, filter and drink with water or locally made beer or milk |
| Plantago lanceolata L. | Plantaginaceae | AT00631 | Leaf | External wound | Crush and apply it on the affected part |
| Polygonum abyssinica Fresen. | Polygonaceae | AT00669 | Root | Snake bite, Spider bite | Chew and swallow the fluid |
| Rhamnus prinoides L'Herit. | Rhamnaceae | AT00666 | Seed | Tinea capitis | Rub it on the affected part |
| Rumex abyssinicus Jacq. | Polygonaceae | AT00692 | Leaf and root | Headache | Adding to tea and drunk |
| Rumex nervosus Vahl. | Polygonaceae | AT00608 | L & Stem | Ascariasis | Crush, filter and drink the fluid; Crush and drink it with boiled coffee or tea |
| Ruta chalepensis L. | Rutaceae | AT00664 | Leaf | Tothache (tumour) | Root; Eat or chew and swallow the fluid |
| Salvia schimperi Benth. | Lamiaceae | AT00653 | Leaf & fruit | Ascariasis | Soak it in water together with whole part of Withania somnifera and fruit of Citrus aurantifolia and wash body with it |

**Table 2: Medicinal plants used to treat human diseases only (Continued)**
| Medicinal plants used to treat human diseases only (Continued) |
|---------------------------------------------------------------|
| **Sarcostemma viminale** (L.) R.Br. Asclepiadaceae AT00647 Halengi hibey Climber Root Paralysis Crush and apply on affected part |
| **Silene macrosolen** Steud. ex A. Rich. Caryophyllaceae AT00691 Saerosaero Herb Root Snake repulsion Place it on fire for fumigation |
| **Sorghum bicolor** (L.) Moench. Poaceae AT00698 Keyh leq Herb Seed Herpes zoster Boil it in water and wash body with it |
| **Thymus schimperi** Ronniger Lamiaceae AT00660 Tesne Herb Whole Toothache Chew it with the affected tooth |
| **Trichodesma trichodesmoides** (Bunge) Gurke. Boraginaceae AT00704 Ahimlto Herb Leaf Abdominal pain Crush and drink the fluid |
| **Verbena officinalis** L. Verbenaceae AT00619 Atush Herb Root Tonsilitis Chew it and spit juice into mouse of the sick child |
| **Vernonia bipontini** Asch. Asteraceae AT00616 Endigendig Shrub Root Child disease that break backbone Crush and drink the fluid |
| **Vicia faba** L. Fabaceae AT00702 Ater, alqay Herb Seed External wound Crush it by mixing with fruits of *Citrus aurantifolia* and apply on the affected part |
| **Zehneria scabra** (L.f.) Sond. Cucurbitaceae AT00655 Hafaflo Climber Leaf Paralysis Crush and tie it on the affected part |

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| Plant Name                  | Family        | Species Code | Part Used | Disease(s)                  | Preparation/Method                                                                 |
|----------------------------|---------------|--------------|-----------|-----------------------------|-----------------------------------------------------------------------------------|
| Zingiber officinale Rosco. | Zingiberaceae | AT00715      | Leaf      | Eye infection               | Boiled it in water by mixing with leaves of Eucalyptus globulus, *Withania somnifera*, *Achyranthes aspera* and *Bidens camporum* and inhale the vapour |
|                            |               |              | Root      | Abdominal pain              | Chew and swallow the fluid before food                                             |
|                            |               |              | Root      | Ascariasis                  | Crush by mixing it with *Verbena officinalis*, filter and drink the juice         |
|                            |               |              | Root      | Abdominal pain              | Chew and swallow the fluid                                                        |
|                            |               |              | Bulb      | Vomiting and diarrhea       | Chew and swallow the fluid                                                        |
| Ziziphus spina-christi (L.) Desf. | Rhamnaceae   | AT00622      | Leaf      | Dandruff                    | Dry, grind, mix it with butter and rub it on the affected part                      |
|                            |               |              | Leaf      | Head wound infection        | Crush and rub it on the affected part                                              |
| Scientific name                  | Family name       | Voucher No. | Tigrigna name | Habit | Part used | Used for                                      | Preparation and application                                                                 |
|----------------------------------|-------------------|-------------|---------------|-------|-----------|-----------------------------------------------|---------------------------------------------------------------------------------------------|
| Buddleja polystachya Fresen.     | Budlejaceae       | AT00628     | Metere        | Shrub | Leaf      | Leeches                                       | Crush and add liquid through the nose                                                      |
| Dregea schimperi (Decne.) Bullock.| Asclepiadaceae    | AT00689     | Shanqoq       | Climber | Leaf      | Rabbis                                        | Crush and drink the fluid                                                                   |
| Leucas abyssinica (Benth.) Briq. | Lamiaceae         | AT00629     | Siwa karni    | Shrub | Leaf      | Eye infection                                 | Chew it and spit juice into the affected eye                                               |
|                                  |                   |             |               |       | Root      | Urine retention                               | Tie it on the tail                                                                           |
| Lycopersicum esculentum Mill.    | Solanaceae        | AT00712     | Komodere      | Herb  | Leaf      | Leeches                                       | Crush and add fluid through their nose                                                     |
| Nicotiana glauca Graham          | Solanaceae        | AT00613     | Chenawi (tegegwe) | Shrub | Leaf      | Lice and ticks infestation (livestock)         | Crush by adding water and smear on affected part or wash with it                           |
|                                  |                   |             |               |       |           |                                               |                                                                                             |
| Nicotiana tabacum L.             | Solanaceae        | AT00676     | Timbako       | Herb  | Leaf      | Leeches infestation (livestock)               | Crush and add fluid through the nose                                                       |
|                                  |                   |             |               |       |           |                                               |                                                                                             |
| Plumbago zeylanica L.            | Plumbaginaceae    | AT00701     | Afthi         | Herb  | Root      | Wound (livestock)                             | Grind and apply on affected part                                                             |
| Pterolobium stellatum (Forssk.) Brenan. | Fabaceae    | AT00696     | Qentefefe     | Shrub | Root      | Dislocated bone                               | Operate the damaged part and put remedy mixed with butter into it                           |
study was ethically approved (before its commencement) by the Graduate Program Evaluation Committee of the College of Natural Science, Jimma University.

Data analysis
The data were summarized using Microsoft Office Excel 2007 computer programme. Descriptive statistical methods were employed to analyze and summarize the ethnobotanical data.

Preference ranking exercise [13] was conducted by nine key informants on six medicinal plants used to treat abdominal pain in the District. Abdominal pain was the disease against which the highest number of medicinal plants was prescribed by informants. The plants used in such exercise were short-listed by the key informants following group discussion on their importance to manage abdominal pain. The informants were given the plants and asked to arrange them based on their personal level of efficacy. Medicinal plant that was believed to be the most effective was given the highest value, i.e. 6, and the one with the least effectiveness a value of 1 and rank was determined based on the total score of each species.

Preference (priority) ranking exercise [13] was conducted by nine key informants on six medicinal plants, short-listed by the same, to rank them based on informants’ perceived level of threat. A value of 6 was given for the most scarce medicinal plant and 1 for the least scarce ones, and scores of each species were finally summed and ranked.

Direct matrix ranking exercise [13] was employed on seven medicinal plants that were most frequently reported as multipurpose medicinal plants in the study District. A group of nine key informants were asked to rank the plants with different uses (including their use as medicinal plants) through discussion based on their perceived level of usefulness using a numerical scale (0 for no value, 1 for lowest value and 7 the highest value). Values assigned for each plant were added together to determine its rank. Medicinal plant having the highest values is ranked first, an indication of its highest level of threat.

Table 4 Preference ranking to medicinal plants used to treat abdominal pain

| List of medicinal plants                  | Informants |
|------------------------------------------|------------|
|                                          | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | Total | Rank |
| *Cucumis ficifolius*                     | 5  | 6  | 2  | 4  | 2  | 6  | 4  | 6  | 4  | 39    | 2nd  |
| *Solanum marginatum*                     | 6  | 5  | 4  | 5  | 6  | 4  | 5  | 2  | 6  | 43    | 1st  |
| *Euclea racemosa subsp. schimperi*       | 2  | 3  | 1  | 3  | 4  | 1  | 6  | 5  | 2  | 27    | 5th  |
| *Abutilon bidentatum*                    | 1  | 1  | 3  | 6  | 1  | 2  | 3  | 1  | 1  | 19    | 6th  |
| *Olea europaea subsp. cuspidata*         | 4  | 2  | 6  | 2  | 5  | 3  | 1  | 4  | 5  | 32    | 3rd  |
| *Thymus schimperi*                       | 3  | 4  | 5  | 1  | 3  | 5  | 2  | 3  | 3  | 29    | 4th  |

*Key: Where R represented respondents.*

Results
Medicinal plants reported
The study conducted in Kilte Awlaelo District recorded 114 medicinal plant species (Tables 1, 2 and 3). The species belonged to 100 genera and 53 families. The family Lamiaceae was represented 9% of the reported species, followed by Fabaceae (8%), Solanaceae (7%), Euphorbiaceae (6%) and Asteraceae (4%). Of the total plants, 44% were herbs, 29% were shrubs, 19% were trees and 8% were climbers.

Diseases treated
The plants were used to treat 47 human and 19 livestock diseases. Of the total medicinal plants, 56% were used to treat human diseases only (Table 1), 37% were used against diseases of both human and domestic animals (Table 2) and 7% were employed to treat diseases of domestic animals only (Table 3). With regard to human diseases, abdominal pain was the one against which a high number of medicinal plants (26 species) were prescribed, followed by wound (21 species), febrile illnesses (19 species), evil eye (19 species), toothache (15 species), ascariasis (15 species), anthrax (14 species), Tinea capitis (12 species), snake bite (10 species), tonsillitis (10 species), eye infection (10 species) and itching (10 species). Preference ranking exercise on six medicinal plants used to treat abdominal pain revealed *Solanum marginatum* as the most preferred medicinal plant, followed by *Cucumis ficifolius* and *Olea europaea subsp. cuspidata* (Table 4).

Plant parts used and modes of remedy preparations
According to interview results, leaf was the most commonly used plant part accounting for 43% of the total reported medicinal plants, followed by roots (26%) and whole part (6%). It was found out that most remedies were processed by crushing (34%), chewing (12%) or boiling (8%) or used in unprocessed form (8%). The majority (59%) of remedies were prepared from fresh materials only. Some remedies were prepared from either dried or fresh materials (30%) while few (11%) were...
prepared from dried materials only. Water and different additives such as honey, sugar, butter, salt, coffee, tea and milk were often used in the preparation of remedies. The additives were claimed to either reduce poisoning or improve flavour.

Routes of remedy administration and dosage
More than half (55%) of the remedy preparations were applied externally by spreading them directly on the affected part of the skin, tying or fumigation, and 45% of preparations were applied internally, of which oral was the most commonly used route of application accounting for 36% of the total remedies, followed by local (5%), nasal (3%) and auricular (1%).

Result shows that there was no agreement in measurement or unit used among the informants. Most informants used measuring units such as cup, spoon, drops and fingers but still differed in the doses they administered. Most of the remedies were reported to have no adverse effects except for some species such as Phytolacca dodecandra, Euphorbia abyssinica and Nicotiana glauca that were indicated to be poisonous both to human and domestic animals.

Multipurpose medicinal plants
Result of direct matrix ranking conducted by nine key informants on seven selected multipurpose medicinal plants showed Cordia africana as the most preferred multipurpose plant, followed by Eucalyptus globules, Opuntia ficus-indica and Dodonia angustifolia (Table 5).

Marketability of medicinal plants
There were no reports of medicinal plants being sold in open markets solely for their medicinal use. But, some medicinal plants were indicated to be sold in local markets but for their uses as food, spices and beverages. These include Allium sativum (spice), Carica papaya (food), Citrus aurantifolius (food), Lepidium sativum (spice), Lycopersicum esculentum (food), Opuntia ficus-indica (food), Rhamnus prinoides (additive for fermented beverages), Ruta chalepensis (spice), Sorghum bicolor (food), Trigonella foenum-graecum (spice), Vicia faha (food), Zingiber officinale (spice) and Ziziphus spin-a-christi (food).

Habitats and conservation status of medicinal plants
Out of the total medicinal plants, 84 (74%) were obtained from wild, 16 (14%) were cultivated in home gardens, and 14 (12%) were either grown in homegardens or harvested from the wild.

According to informants, nowadays search for some medicinal plants, especially trees and some shrubs, required a lot of time and travelling long distances. Of the total reported medicinal plants, 48% were rarely encountered, while 43% were commonly found and the rest (9%) were moderately or occasionally encountered. Result of preference ranking exercise on six medicinal plants, reported by the most informants in the District as threatened species, shows that that Myrica salicifolia was among the highly threatened species, followed by Boscia salicifolia, Acokanthera schimperi, Acacia abyssinica, Olea europaea subsp. cuspidata and Acacia abyssinica. The principal threats of medicinal plants in the area were reported to include drought, overgrazing and firewood collection. Informants ranked drought as the most serious threat to medicinal plants followed by overgrazing, firewood collection, agricultural expansion, soil erosion and collection of other different factors.

Discussion
Despite the large scale environmental degradation and recurrent droughts, there is still rich knowledge on the use of medicinal plants in Kilte Awlaelo District. A total of 114 medicinal plants are in use in the study District to treat various human and animal diseases. Similar studies undertaken in Ofa District, Tigray Region, Ethiopia, came up with 113 medicinal plants [15]. As compared to human diseases, diseases of domestic animals in the District were treated with a relatively fewer number of plant species, which could be due to the less

| Species use       | Acacia abyssinica | Acacia etbaica | Olea europaea subsp. cuspidata | Cordia africana | Dodonia angustifolia | Opuntia ficus-indica | Eucalyptus globulus |
|-------------------|-------------------|----------------|-------------------------------|----------------|----------------------|----------------------|---------------------|
| Medicine          | 1                 | 3              | 5                             | 6              | 4                    | 2                    | 7                   |
| Fire wood         | 2                 | 3              | 4                             | 7              | 5                    | 1                    | 6                   |
| Construction      | 2                 | 3              | 4                             | 5              | 6                    | 0                    | 7                   |
| Fence             | 6                 | 7              | 1                             | 2              | 3                    | 5                    | 4                   |
| Forage            | 6                 | 4              | 5                             | 2              | 3                    | 7                    | 0                   |
| Edible fruit      | 0                 | 0              | 0                             | 0              | 0                    | 0                    | 0                   |
| Total             | 17                | 20             | 19                            | 28             | 21                   | 22                   | 24                  |
| Rank              | 7th               | 5th            | 6th                           | 1st            | 4th                  | 3rd                  | 2nd                 |

Table 5 Direct matrix ranking exercise on seven multiple purpose medicinal plants
number of diseases affecting the later. Similar findings were reported by studies conducted elsewhere in Ethiopia [16,17]. High number of medicinal plants is used in the treatment of abdominal pain and this may suggest the high importance or prevalence of the disease in the study district. The fact that Solanum marginatum is the most frequently used plant to treat abdominal pain could indicate better efficacy of the plant or its higher abundance in the study District.

Most of the plant species reported were also mentioned by authors in studies conducted elsewhere in Ethiopia; Of the medicinal plants reported by the current study, 59 were mentioned in Abdurhman [15], 50 in Senai [18], 46 in Giday and Ameni [19], 29 each in Getahun [20] and Teklehaymanot and Giday [21], 19 in Mesfin et al. [22], 16 in Abebe and Hagos [23], 15 in Yirga [7], 14 in Giday [24] and nine in Ragunathan and Abay [6].

Leaf was the most used plant part in the preparation of remedies in the District as compared to other parts. Many studies conducted elsewhere in Ethiopia also showed the dominance of leaves in the preparation of remedies [8,19,24-27]. In contrast, another study [28] indicated root as the most commonly harvested plant part in a study carried out in five Districts of Tigray Region, Ethiopia. A study conducted in Mana Angetu District, in Oromia Region of Ethiopia also witnessed the common usage of root [29]. Harvesting root of a plant poses more threat to survival of plant than collecting other parts such as fruits, seeds and leaves [6].

According to current results, herbal remedies are largely prepared using fresh materials. There were also many plants from which parts were claimed to either be used as dried or fresh materials. The fact that both forms are used in the preparation of remedies in a given community creates a better opportunity for people to have access to materials used in medicine preparation across the different seasons of the year.

The current study indicated that there was no agreement in measurement or unit used among informants. Most informants reported use of measuring units such as cup, spoon, drops and fingers but still there was difference in doses. The variation in quantity, unit of measurement, and duration of treatment of prescribed plant preparations was also noted in a study conducted elsewhere in the country [28]. A study reported that lack of precision and standardization of preparations are two of the drawbacks of traditional health care system [20].

The greater proportions of remedies were applied externally, which is in agreement with result of a study conducted in Bench District, south-western Ethiopia [30]. However, studies conducted in Mana Angetu District, south-eastern Ethiopia [29] and Konta Special District, Southern Ethiopia [27] revealed that most medicinal plant preparations were taken internally, out of which drinking takes the highest proportion.

Nearly half of the medicinal plants recorded were herbs which may indicate their relatively better abundance as compared to other life forms. Other studies conducted elsewhere in Ethiopia also indicated the dominance of herbs [16,21,27,28]. However, a study conducted in Mana Angetu District, Oromia Region of Ethiopia, reported the dominance of shrubs in medicinal plant preparations [29]. The fact that most of the woody plants in the current study area are depleted could have forced the local people to dwell more on herbaceous medicinal plants. It is not a common practice in the District to sell medicinal plants in local markets, which is in agreement with the finding of study carried out in Bench District, south-western Ethiopia [30].

The majority of medicinal plants in the study District were obtained from the wild. This result agrees with that of other studies conducted elsewhere in the country [14,19,24,26,27,31]. As most of medicinal plants in the District are harvested from the wild, they are highly exposed to various anthropogenic and natural factors and as a result many of them are rarely encountered. Special attention is needed to be given to the medicinal plants that were indicated by preference ranking exercise as the most threatened ones.

There is little practice of cultivating medicinal plants in the area, which is in agreement with other studies conducted elsewhere in the country [15,24,26]. The local community in the study District is not giving much attention for management of medicinal plants. This could be explained by the lack of knowledge among ordinary people about the importance of medicinal plants as most of them are only known by few knowledgeable people.

**Conclusion**

Despite the large scale environmental degradation and recurrent drought, medicinal plants are still playing significant role in the management of various human and livestock diseases in Kilte Awulaelo District. In the District, 114 medicinal plants were reported to be used to treat various human and livestock diseases. Relatively higher number of medicinal plants was used in the treatment of human diseases as compared to that used against livestock diseases, which might be attributed to the higher number of diseases affecting the former. Result demonstrated the usage of high number of medicinal plants to treat abdominal pain, probably suggesting high importance or prevalence of the disease in the study District. Solanum marginatum was the most frequently used plant to treat abdominal pain and this could indicate better efficacy or higher abundance of the plant in the study District. Leaf was the most
frequently used plant part in the preparation of remedies in the District. Herbs took the higher proportion of the reported medicinal plants, which could be an indication of their relatively better abundance as compared to other life forms. Recurrent drought was reported to have seriously threatened medicinal plant resources in the study area. Despite this fact, there is little effort in the District to cultivate or manage medicinal plants. Thus awareness is needed be raised among local people on sustainable utilization and management of the plant resources. *Ex situ* and *in situ* conservation measures should be taken to protect the medicinal plants of the District from further destruction and special attention should be given to the medicinal plants that were indicated by preference ranking exercise as the most threatened ones.

**Competing interests**

The authors declare that they have no competing interests.

**Authors’ contributions**

The three authors had significant intellectual contribution towards the design of the study, data collection and analysis and write-up of the manuscript. The authors read and approved the final manuscript.

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