An ethnobotanical study of medicinal plants in Wayu Tuka District, East Welega Zone of Oromia Regional State, West Ethiopia

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Abstract

Background: This paper reports an ethnobotanical study that focused on the traditional medicinal plants used by local communities to treat human and livestock ailments. A cross-sectional study was undertaken from September 2009 to June 2010 in Wayu Tuka District of Oromia Region, Ethiopia. The aim of the study is to document medicinal plants used by local people of the study area and the threats currently affecting medicinal plants.

Methods: Ethnobotanical data were collected using semi-structured interviews, field observations and group discussion in which 63 (41 men & 22 women) randomly selected informants participated. Of which, 11 (10 male and 1 female) were local healers. Paired comparison method, direct matrix ranking and Informant consensus factors (ICF) were used to analyze the importance of some plant species.

Results: A total of 126 medicinal plant species, distributed in 108 genera and 56 families, were collected together with their medicinal uses. Of the 126 species of medicinal plants collected from the study area, eighty six (68%) were obtained from the wild whereas thirty three (26%) were from homegardens. The Fabaceae came out as a leading family with 15 medicinal species while the Solanaceae followed with eight species. Seventy eight (62%) of the medicinal plants were reported as being used for treating human ailments, 23 (18.2%) for the treatment of livestock ailments and 25 (20%) for both. The most frequently used plant parts were leaves (43%), followed by roots (18.5%) while crushing, which accounted for (29%) and powdering (28%) were the widely used methods of preparation of traditional herbal medicines.

Conclusion: The number of reported medicinal plants and their uses by the local people of the District indicate the depth of the local indigenous knowledge on medicinal plants and their application. The documented medicinal plants can serve as a basis for future investigation of modern drug.

Background

Since time immemorial, people have used plants as medicine. The investigation of plants and their uses is one of the most primary human concerns and has been practiced by all cultures for tens, if not hundreds, of thousands of years, though it wasn’t called ‘Ethnobotany’ [1]. Perhaps as early as Neanderthal humans, plants were believed to have healing powers [2]. The earliest recorded uses are found in Babylon about 1770 BC and in the code of Hamurabian ancient Egypt about 1550 BC. In the early 1500 s, Indian fever bark was one of the first medicinal plants to find appreciative consumers in Europe, which was taken from the cinchona tree (Cinchona officinalis), the bark of which was used as an infusion by native people of the Andes and Amazon highlands to treat fevers. Jesuit missionaries brought the bark to Europe and by the early 16th century the name of this medicine was transformed to “Jesuit fever bark” [2].

Traditional medicine comprises of therapeutic practices that have been in existence, for hundreds of years, before the development and spread of modern medicine and are in use today [3]. These practices vary widely, in keeping with the social and cultural heritage of different countries. Traditional medicine includes a diversity of health practices, approaches, knowledge, and beliefs incorporating plant, animal, and/or mineral-based medicines; spiritual therapies; manual techniques; and exercises, applied singly...
or in combination to maintain well-being, as well as to treat, diagnose, or prevent illness [4]. Traditional medicine was once again redefined in 2008 as the sum total of knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures that are used to maintain health, as well as to prevent, diagnose, improve or treat physical and mental illnesses [5].

A major component of traditional medicine is that which uses medicinal plants. Plant-based traditional medicine plays a key role in the development and advancement of modern studies by serving as a starting point for the development of novelties in drug discovery [6]. Various modern drugs were extracted from traditional medicinal plants through the use of plant material following the ethnobotanical leads from indigenous cures used by traditional medical systems [7]. On top of their use in fighting various ailments at local level, different medicinal plants are used as export commodities, which generate considerable income [8]. China takes the lead (45%) by importing the highest number of herbal medicines for preparation of drugs and this is followed by the United States of America (15.6%) and Australia (10.5%) [9].

In Ethiopia, the use of traditional medicinal plants is widely practiced. The wide spread use of traditional medicine in Ethiopia could be attributed to cultural acceptability, efficacy against certain type of diseases, physical accessibility and economic affordability as compared to modern medicine [10]. The size of the Ethiopian flora is estimated at 6,000 species of vascular plants of which about 10% are believed to be endemic [11-18]. Traditional remedies are the most important and sometimes the only source of therapeutics for nearly 80% of the Ethiopian population and 95% of the preparations are of plant origin [10]. Due to various reasons, such as knowledgeable people in the society, the knowledge on medicinal plants of the country is getting lost. Since the knowledge of traditional medicine is transferred orally from generation to generation, basic information on the use of the plants and the part used, drug preparation methods, the diseases treated and others may be lost and discarded in the knowledge transfer process. Therefore, documentation of medicinal plants and the indigenous wisdom associated with them is important in order to pass the knowledge to the next generation since the plant materials and the indigenous knowledge can be the basis for the invention of modern drugs on top of the heritage values of the resource. In addition, such studies are vital in order to identify threatened medicinal plant species to give due attention for proper management and conservation. Thus, this study was initiated to document the traditional medicinal plant knowledge of the people and the threats currently affecting medicinal plants in Wayu Tuka District.

Materials and methods

Study area and the people

Wwayu Tuka District is situated at (8° 56’N and 9° 7’N) and (36° 32’E and 36° 48’E). It is located at about 322 km west of Addis Ababa, in the East Welega Zone of the Oromia National Regional State. The District covers an area of 28,952.795 ha and comprises 12 kebeles (smallest administrative unit) belonging to ten rural areas and two urban centers namely ‘Boneyo Molo’, ‘Gara Hudha’, ‘Gute Badya’, ‘Kichi’, ‘Komto’, ‘Migna Kura’, ‘Haro Chalchis’, ‘Gida Abalo’, ‘Gida Basaka’, ‘Wara Babo Miya’, ‘Gaba Jimata’ and ‘Gute’ (Figure 1).

According to Wayu Tuka District Agricultural Office [19], the altitude of the study area ranges from 1300–3140 m.a.s.l, and the District has various topographic features. About 17,950.8445 ha (62%) of the land area is plain, 4,922.00575 ha (17%) hilly, and mountains and cliffs account for 3,763.88675 ha (13%) and 2,316.238 ha (8%) respectively. The major soil types are clay loom, covering about 17371.68 ha (60%), sandy soil that stretches over an area of 10133.49 (35%) and clay constitutes 1447.64 ha (5%). The latter two soil types are suitable for agriculture including for cultivation of cereal crops including maize (Zea mays), sorghum (Sorghum bicolor) and ‘teff’ (Eragrostis tef) [19].

Based on the metrological data recorded at Nekemte station for 10 years (1998–2007), the rainfall distribution of the district is unimodal. The rainy season is locally called ‘Ganna’ and it extends from May to August with the highest peak in June and August. The highest average monthly rainfall was recorded in June (4,026.7 mm) and the lowest in January (99.9 mm), with the hottest months from March to October. The maximum mean temperature was recorded in February and March (27.9°C) and the coldest months of the year stretch from November to January, the lowest temperature having been recorded in December and January (12.2°C). In general, the mean annual temperature and mean annual rainfall of the District are 18.8°C and 2,067 mm, respectively (Figure 2).

The vegetation of the area belongs to the moist evergreen montane forest and this type of forest is known to occur in southwest Ethiopia, particularly in parts of Welega, Ilubabor and Kefa [20]. The common species in the area include Poutenia adolfi-friederici, Trilepisium madagascariense, Morus mesozygia, Minnusops kunnkel, Podocarpus falcatus, Coffea arabica and Galiniera saxifraga.

Based on the 2007 population and housing census, the population of Wayu Tuka District is projected to be 66394, with 63325 (95.4%) in the rural, directly living on agriculture and associated activities also by supplying its produce to the neighboring urban dwellers. The people of the District belong to the Oromo ethnic
community. Afaan Oromo (the Oromo language) is the widely spoken language in the area.

The District has three governmental clinics, four governmental health posts and one non-governmental health post. In the District, the leading ten human diseases are internal parasites (intestinal), rheumatism, upper respiratory diseases, skin diseases, diarrhea, malaria, gastritis, and fever of unknown causes, ear diseases and anemia [Wayu Tuqa Wereda Health Office: Report on diseases found in the Wereda, Unpublished].

There are two veterinary clinics in the District where the number of cattle and the number of clinics are not
The ten most serious livestock diseases in the District are trypanosomiasis, internal parasites, external parasites, pasteuriosis (ovine and bovine), blackleg, anthrax, African horse sickness, sheep and goat pox, New Castle disease, babesiosis and mastitis [19].

Methods
A reconnaissance survey of the study area was carried out from September 15 to 30, 2009 and resulted in the identification of nine study sites, namely Boneya Molo, Gaba Jimata, Gara Hudha, Gute, Gute Badya, Kichi, Komto, Migna Kura and Wara Babo Miya. The study sites were selected based on the availability of practice of traditional medicine, and on the recommendations of elders and local authorities in Wayu Tuka District. Moreover, the three agro-climatic zones were also considered to select the study sites (kebeles).

Ethnobotanical data collection
A total of 63 (41 males and 22 females) informants were selected out of 66394 population following [21]; 43 were selected randomly and 20 key informants were selected purposively and systematically based on the recommendations of knowledgeable elders, local authorities and development agents by taking 2–3 individuals from each study site. Out of which 11 were traditional healers (10 males and 1 female). The informants were local inhabitants aged between 19–102 years. The selection of key informants was also based on the quality of explanations that particular informants gave during an interview. Local healers automatically qualified as key informants being traditional experts who are custodians of indigenous knowledge on medicinal plants.

Ethnobotanical investigations were carried out to collect data on medicinal plants used to treat human and livestock ailments in Wayu Tuka District following standard methods [21,22]. The techniques used were semi-structured interviews, field observations, group discussion and guided field walk. The data were collected from October 1, 2009 to December 15, 2009 and March 26, 2010 to April 06, 2010. Interviews and discussions were undertaken based on checklist of questions prepared in English and translated to ‘Afaan Oromo’. Information was carefully recorded during an interview with an informant as well the knowledge of vegetation categorization was asked and recorded. Field observations were performed with the help of local guides on the morphological features and habitats of each medicinal plant species in the field.

Discussions were conducted on threats to medicinal plants, conservation of the medicinal plants and transferability of knowledge in the community. Before collecting the data, written permission was secured from the office of the District and permission was obtained from the administrator of each selected kebele. Following this, the purpose of the study was explained to each informant and verbal prior consent was obtained.

Specimen collection and identification
The reported medicinal plants were collected from natural vegetation and homegardens during the field walks and habits of the plants were listed. Preliminary identification was done at the site (field) and the collected voucher specimens were taken to the National Herbarium of Ethiopia (Addis Ababa University). Specimen identification and confirmation was undertaken by using taxonomic keys and various volumes of the Flora of Ethiopia and Eritrea [11-18]. Finally, the identified specimens were reconfirmed by a taxonomic expert and the specimens with their label stored at the National Herbarium.

Data analysis
The collected ethnobotanical data were entered into Excel spreadsheet 2007 and summarized using descriptive statistical methods such as frequency and percentages. Paired comparison method [21] was used to determine the relative importance of plant species, which are used in the treatment of blackleg. In paired comparison, 9 informants were selected and asked to choose the best item from every pair according to personal perception in treating Blackleg. The total number of possible pairs (21) was obtained by applying the formula n (n-1)/2, where n is the number of medicinal plants being compared. A total rank of paired comparison was obtained by summing the number of times each item was chosen. An item with highest frequency of choices had the highest score.
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Direct matrix ranking [21,22] exercises were employed in order to compare the multiple uses of a given plant species based on information gathered from informants. The multipurpose species were selected out of the total medicinal plants and the uses of these plants were listed and 8 randomly selected key informants were asked to assign use values to each species. Each chosen key informant was asked to assign use values (5 = best, 4 = very good, 3 = good, 2 = less used, 1 = least used and 0 = not used). The values (average scores) of each species were summed up and ranked.

The Informant consensus factor (ICF) was calculated for each category to identify the agreements of the informants on reported cures for the group of ailments. The ICF [23] was calculated as follows

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

Where,

- \( ICF \) = Informants Consensus Factor
- \( \text{nur} \) = number of use citation in each category
- \( \text{nt} \) = number of species used

Results

Indigenous knowledge and local vegetation categories

People of the study area classify vegetation of their surroundings mainly based on density of plant species that cover the land. The following four categories of vegetation were used by the community to distinguish one vegetation type from another. They then describe the location of a medicinal or other useful plant distribution in terms of these categories.

‘Caffe’ is marshy vegetation where mostly plant species of the families Poaceae and Cyperaceae grew. The place is generally considered unsuitable for ploughing and crop cultivation but is suitable for grazing.

‘Luugoo-lagaa’ is equivalent to reverine vegetation which is found at the banks of rivers, mostly composed of Syzygium guineense subsp. guineense and Ficus sycomorus.

‘Bosona’ is a type of forest with densely populated plant species with many tall trees, making the home of wild animals. An example of such vegetation in the study area is ‘Bosona Komto’ (Komto Forest), which is found in Komto Kebele.

‘Daggala’ is the term used to refer to seasonal plants.

Medicinal plants of the study area

One hundred twenty six species, belonging to 108 genera and 56 families, were used by local people of the District to treat various human and livestock ailments (Tables 1, 2 and 3). There were seven endemic species of Ethiopia found among the reported traditional medicinal plants (Albizia malacophylla, Coccinia abyssinica, Impatiens tinctoria subsp. abyssinica, Lippia adoensis, Pycnostachys abyssinica and Saturegia paradoxa).

Among the families that contributed more medicinal species were the Fabaceae, represented by 15 species (12%), Solanaceae with 8 (6.3%) species, Asteraceae with 7 (5.6%), and other 44 families contributing 57 (45%) species are represented by 1 or 2 species (Table 4). Of the 126 species of medicinal plants collected from the study area, most of them (86, 68%) were obtained from the wild whereas 33 (26%) were from homegardens, and only 7 (5.5%) species were from both homegardens and wild habitats (Tables 1, 2 and 3).

The result of growth form analysis of medicinal plants showed that herbs constituted the highest proportion being represented by 55 (43.6%) species, while there were 34 (27%) tree species, 26 (20.6%) shrubs and 3 (2%) lianas (Figure 3).

Informants of the study area harvest different plant parts for preparation of traditional drugs (e.g. leaves, roots, seeds, barks and fruit). In the study area, the informants reported that more species (70, 43%) of medicinal plants were harvested for their leaves and these were followed by roots (30, 18.5%), seed and bark (18, 22.2%) each and 26 others (bulb, tuber, stem, fruit and flower) covered 16% (Figure 4).

Among the collected 126 medicinal plant species, 78 (62%) were claimed to treat human health problems (Table 1), 23 (18.2%) were claimed to treat livestock ailments (Table 2) and 25 (20%) were for both human and livestock ailments (Table 3).

People of the study area mostly administer traditional medicine orally. This accounted for 64%, followed by dermal administration (27.3%) and others (nasal, anal, optical, ear) accounting to 8.3%. Local people also reported that various additives were given during administration of traditional medicine.

Condition, dosage and effectiveness of traditional medicine in the study area

The majority of the remedies (74.2%) in the study area were prepared from fresh parts of medicinal plants followed by dried form (20.7%) and (5%) prepared either from dry or fresh plant parts. Most of the medicinal plant preparations involved the use of single plant species or a single plant part (85%) while those mixing different plants or plant parts (15%) were rarely encountered in the study area. Healers, usually prepare remedies by mixing various plants or plant parts. Lack of consistency regarding amount of medicines to be used was observed among informants during the interview.

Local people of the study area used various ways of measuring dosage which were generally categorized under three major classes. One is dosage used for those...
Table 1 List of medicinal plants for treating human diseases in the study area, Wayu Tuka District

| Scientific name                  | Local Oromo name | Family             | Hab | Ha | Plant part, preparation and application                                                                 | Disease treated     | V. No. |
|----------------------------------|------------------|--------------------|-----|----|----------------------------------------------------------------------------------------------------------|---------------------|--------|
| Acacia abyssinica Hochst. ex Benth. | Laaftoo          | Fabaceae           | T W |     | Juvenile leaves crushed and sniffed                                                                      | Bat urine           | MM072  |
| Acmella caulirhiza Del.           | Guuticha         | Asteraceae         | H   |     | Fresh flowers chewed and swallowed                                                                       | Tonsillitis         | MM038  |
| Albizia gummifera (J. F. Gmel.) C.A. Sm. | Muka arbaa      | Fabaceae           | T   |     | Leaves crushed, mixed in water. Put in cotton and rubbed on affected teeth.                             | Toothache           | MM068  |
|                                  |                  |                    |     |     | Bark chewed in order to get relief from Rheumatism                                                     | Rheumatism          |        |
| Albizia sp.                      | Ambaltaa         | Fabaceae           | T W |     | Dried bark powdered and applied on affected part                                                        | Wound               | MM077  |
| Allium sativum L.                | Qullubbii adii   | Alliaceae          | H   |     | The bulb taken with 'injera' and Capsicum annuum L. for 5 days before eating breakfast                  | Malaria             | MM013  |
| Asparagus africanus Lam.          | Sariiti          | Asparagaceae       | Sh  |     | Fresh leaves crushed and applied on the affected part                                                   | Spider poison       | MM092  |
| Bidens macroptera (Sch. Bip. ex Chiov.) Mesfin | Keeloo          | Asteraceae         | H   |     | Fresh leaves put on fire and rubbed on affected part                                                    | Athletes foot       | MM037  |
| Brassica carinata A. Br.         | Goommana         | Brassicaceae       | H   |     | Dried seed Powdered and mixed with water then drunk                                                     | Common cold         | MM002  |
| Bruea antisyntica J.F. Mill.     | Qormanyoo        | Simaroubaceae      | T   |     | Fresh leaves crushed and mixed with Leaves of Beresa abyssinica Fresen. and cooked With porridge and given for a person in need | Ascaris             | MM028  |
|                                  |                  |                    |     |     | Root powdered and mixed in water and drunk                                                              | Diarrhea            |        |
| Croton macrostachyus Del.        | Bakkanisa        | Euphorbiaceae      | T W |     | Exudates put on the cut skin to stop bleeding                                                            | Skin cut            | MM080  |
|                                  |                  |                    |     |     | Bark of croton put on fire and the smoke used as to protect mosquito bite                              | Mosquito repellant  |        |
|                                  |                  |                    |     |     | Juvenile leaves smashed and rubbed on affected part                                                     | Ring worm           |        |
|                                  |                  |                    |     |     | Dried root powdered and given to Dog with 'injera' which suffered by Rabies                             | Rabies              |        |
| Catha edulis (Vahl) Forss ex Endl. | Caatii            | Celastraceae       | T   |     | Fresh leaves crushed and boiled in water with leaves of Ruta chalepensis L. fresh leaves of Periploca linearifolia Quart. –Dill. & A. Rich. and fresh leaves of Englerina woodfordioidea Gilbert then sugar added while it is boiling, put off from the fire and make to cool finally a cup of tea will be taken for four days. | Cough               | MM020  |
|                                  |                  |                    |     |     |                                                                                                         | Stomach ache        | MM103  |
|                                  |                  |                    |     |     | The bark Chewed or hold in teeth for 5-10 min.                                                          | Tootache            |        |
| Canarina eminii Aschers ex Schweinf. | Maaraca           | Campanulaceae      | CI  |     | The whole plant crushed together, chewed and swallowed                                                  | Headache            | MM154  |
|                                  |                  |                    |     |     | Whole plants crushed and rubbed on affected part                                                        | Scabies             |        |
| Capparis tormentosa Lam.          | H.gurraacha      | Capparidaceae      | Sh  |     | Roots crushed and sniffed                                                                               | Fibril illness      | MM101  |
| Carica papaya L.                 | Paappaayya       | Caricaceae         | T Hg|     | When the leaves become yellow, that means getting to dry, powdered and boiled in water and a cup of tea will be taken for 5 days. | Malaria             | MM085  |
Table 1 List of medicinal plants for treating human diseases in the study area, Wayu Tuka District (Continued)

| Plant Name                      | Part Used | Family     | Habitat | Use                                   | Disease       | Code |
|---------------------------------|-----------|------------|---------|---------------------------------------|---------------|------|
| Cayusea abyssinica (Fresen.) Fisch. and Mey. | Illancoo | Residaceae | H W     | The steam crushed and tied on affected part | Wound         |      |
| Centella asiatica (L.) Urban     | Baala buqee | Apliaceae  | H W     | Seed chewed and swallowed              | Internal parasite | MM110 |
| Citrus limon (L.) Burm.f.        | Loomii    | Rutaceae   | T Hg    | Leaves crushed and rubbed              | Tinea corporis | MM058 |
| Citrus aurantium L.              | Qomxaaxee | Rutaceae   | T Hg    | Crush the fruit and apply its content on skin burn. | Gum bleeding   | MM022 |
| Clausena anisata (Wild.) Benth.  | Ulmaayii  | Rutaceae   | Sh W    | Suck the content of the fruit when suffered by hypertension | Hypertension   | MM021 |
| Centella asiatica (L.) Urban     | Bala buqee | Apliaceae  | H W     | Leaves powderd and mixed with water and given immediately for the victimed | Snake bite     | MM090 |
| Clematis sinensis Fresen.        | Hidda fitii | Ranunculaceae | Cl W  | Bark of Clausena anisata, leaves of Sida rhombifolia, root of Cucumis ficifolius, bark root of Bruea antidysentrica powdered together and mixed in milk then drunk a cup of tea for three days in order to get cured from Rabies disease | Rabies         |      |
| Clutia abyssinica Joub. & Spach. | Ulee foonii | Euphorbiaceae | Sh W  | Fresh leaves cooked and eaten with ‘injera’/bread | Amoeba         | MM110 |
| Coffea arabica L.                | Buna      | Rubiaceae  | Sh Hg   | The dried coffee bean roasted and powdered then given to the patient by mixing with honey. | Dianthea       | MM017 |
| Coccinia abyssinica (Lam.) Cogn. | Ancootee  | Cucurbitaceae | H Hg  | Leaves powderd and mixed with water and given immediately for the victimed | Tuber closes   | MM100 |
| Cordia africana Lam.             | Waddeessa | Boraginaceae | T W    | Leaves of Cordia africana, leaves of Acanthus polystachius crushed together with Feces of goat then put on fire the ash mixed with butter and creamed on affected part. | Spider poison  | MM091 |
| Croton macrostachyus             | Cooked with leaves of Crotan macrostachyus and eaten with ‘injera’ for four days. | Croton macrostachyus |        |                                                                                              |                |
| Datura stramonium L.             | Asaangira | Solanaceae | Sh W    | Fresh leaves smashed and mixed with water and given immediately for the victimed | Rabies         | MM067 |
| Drynaria volkessionii Heiron.    | Baala balleessaa | Polypodiaceae | Ep B  | Fresh leaves smashed and mixed with water and given immediately for the victimed | Rabies         | MM067 |
| Echinops hispidus Fresen.        | Keberchoo | Asteraceae  | H W     | Dried bark put on fire and the smoke inhaled | Evil eye       | MM034 |
| Ehretia cymosa Thonn.            | Ulaagaa   | Boraginaceae | T W    | Fresh leaves chewed | Toothache       | MM009 |
| Embelia schimperi Vatke          | Hanquu    | Myrsinaceae | Li W    | Fruit eaten early in the morning | Tape worm       | MM047 |
| Ensete ventricossum Cheesman     | Baala warqee | Musaceae   | H Hg    | The latex half cup of tea taken to get relief from stomach ache | Stomach ache   | MM012 |
| Common Name                      | Scientific Name                  | Family     | Part Used | Route of Administration | Condition            | Code |
|----------------------------------|----------------------------------|------------|-----------|-------------------------|----------------------|------|
| Eucalyptus globulus Labill       | Eucalyptus globulus              | Myrtaceae  | T         | B                       | Fresh leaves boiled in water and then the patient laid down in it in order to inhale the smoke | Common cold | MM087 |
| Euphorbia tirucalli              | Euphorbia tirucalli              | Euphorbiaceae | Sh        | Hg                      | The milky latex dropped on affected part | Homeoide | MM005 |
| Gardenia ternifolia              | Gardenia ternifolia              | Rubiaceae  | T         | W                       | Fresh seed put in fire ad when it gets hot put on affected part | Homeoide | MM019 |
| Grewia ferruginea                | Grewia ferruginea                | Tiliaceae  | T         | W                       | The hair washed by leaves of Grewia ferruginea and used as a soap | Dandruff | MM048 |
| Hagenia abyssinica (Brace) J.F.Gmel. | Hagenia abyssinica               | Tiliaceae  | T         | W                       | The dried or fresh floral part powdered soaked in water and left for four days and taken with coffee before having break fast | Tape worm | MM089 |
| Indigofera arecta, ex A.Rich     | Indigofera arecta                | Fabaceae   | Sh        | W                       | Leaves powdered and mixed with butter and applied on the affected part for five days | Spider poison | MM078 |
| Indigofera spicata Forssk.       | Indigofera spicata               | Fabaceae   | H         | W                       | Leaves powdered and mixed in water and taken when need arise. | Diabetics | MM203 |
| Lagenaria siceraria (Molina) Standl. | Lagenaria siceraria              | Cucurbitaceae | H         | W                       | Put on fire and burn the affected part | Dandruff | MM099 |
| Leucas martixinensis (Jacq) R.Br. | Leucas martixinensis            | Lamiaeae   | H         | W                       | Steam put on fire and let the patient laid in it for smoke | Eye disease | MM065 |
| Lippia adoensis Hochst. ex Walp  | Lippia adoensis                  | Verbenaceae | H         | B                       | Fresh leaves chewed | Burn on chest | MM109 |
| Mirabilis jalapa L.              | Mirabilis jalapa                 | Nyctagnaceae | Sh        | W                       | Creamy powder of the fruit will be rubbed on affected part. | Homeoide | MM111 |
| Momordica foetida Schurman.      | Momordica foetida                | Cucurbitaceae | H         | W                       | Root washed, crushed and mixed with water and the exudates taken for five days one liter per a day. | Kidney problem | MM029 |
| Ocimum uticifolium Roth          | Ocimum uticifolium               | Lamiaceae  | Sh        | Hg                      | Fresh leaves crushed and smashed then the extracts rubbed on affected part | Fibril illness | MM133 |
| Olea europaea L. subsp. cuspidata (Wall. ex G. Don) Cif. | Olea europaea                   | Oleaceae   | T         | W                       | Fresh root chewed | Stomach ache | MM041 |
| Panicum hochstetteri Steud.      | Panicum hochstetteri             | Poaceae    | H         | W                       | Fresh leaves chewed | Kidney problem | MM127 |
| Pavonia umris Cav.               | Pavonia umris                    | Malvaceae  | H         | W                       | Powdered leaves tied on affected part | Wound | MM062 |
| Phytolacca dodocandra L’ Herit.  | Phytolacca dodocandra            | Phytolaccaceae | Li        | Hg                      | Few root powdered and mixed with water and drunk for two days | Gonorrhica | MM088 |
| Plantago lanceolata L.           | Plantago lanceolata              | Plantaginaceae | H         | W                       | Fresh leaves crushed and tied | Skin cut | MM044 |
| Plectranthus edulis (Vatke) Agnew | Plectranthus edulis              | Solanaceae  | Sh        | Hg                      | Root cooked and eaten | Loss of appetite | MM108 |
| Prunus africana (Hook. f.) Kalkm. | Prunus africana                 | Rosaceae   | T         | W                       | Powdered and tied for five days | Wound | MM016 |
| Prunus persica (L.) Batsch        | Prunus persica                   | Rosaceae   | T         | Hg                      | Juvenile leaves dried and powdered then mixed with butter and creamed on affected part in Wednesday and Friday | Tinea corporis | MM007 |
| Pycnostachys abyssinica Fresen.   | Pycnostachys abyssinica         | Lamiaceae  | H         | W                       | Fresh leaves crushed, smashed and the extracts dropped in the eye | Eye disease | MM129 |
| Rhamnus prinoides L. Herit.      | Rhamnus prinoides                | Rhamnaceae | Sh        | Hg                      | Fresh leaves chewed | Tonsillitis | MM081 |
| Ricinus communis L.              | Ricinus communis                 | Euphorbiaceae | H         | B                       | Fresh leaves crushed and mixed with water and taken one cup of tea for 3 consecutive days. | Rabies | MM006 |
| Plant Name                                      | Habitat     | Part Used                  | Preparation and Administration                                                                                                                                                                                                 | Disease                        | Voucher Number |
|------------------------------------------------|-------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------------|
| *Rumex abyssinicus* Jacq.                      | H           | Root                       | Fresh root crushed and mixed with root of *Justicia schimperiana* and put in cup of tea and mixed with water and drunk.                                                                                                                | Liver disease                 |                |
| *Ruta chalepensis* L.                          | H Hg        | Leaves                     | Leaves crushed and smashed then applied on affected part                                                                                          | Scabies MM053                 |                |
| *Rytignia neglecta* (Hiern) Robyns            | T           | Fresh leaves and roots     | Fresh leaves and roots chewed                                                                                                                  | Sache MM083                  |                |
| *Saccharum officinarum* L.                     | Sh          | Steam put in fire and eaten| Steam put in fire and eaten when get hot in order to get relief from common cold.                                                                                   | Common cold MM093             |                |
| *Schinus molle* L.                             | T W         | Fresh seed                 | Fresh seed chewed                                                                                                                                  | Tonsillitis MM023             |                |
| *Saturega paradoxa* (Vatke) Engl. ex Seybold  | H W         | Dried leaves               | Dried leaves crushed and put on fire then the smoke sniffed                                                                                   | Bat urine MM200               |                |
| *Securidaca longipedunculata* Fresen.          | T H         | Fresh leaves and roots     | Fresh leaves and roots chewed                                                                                                                   | Evil eye MM112                |                |
| *Senna septemtrionalis* (Viv) Irwin & Barneby | Sh           | Root                       | Root crushed and taken with coffee                                                                                                                  | Rabies MM202                 |                |
| *Solanum gigantum* Jacq.                       | Sh Hg       | Root                       | Root crushed and taken with coffee                                                                                                                  | Wound MM118                  |                |
| *Solanum incanum* L.                           | Sh Hg       | Dried leaves               | Dried leaves crushed and the extracts dropped on the cut skin.                                                                                     | Skin cut MM303                |                |
| *Vernonia auriculifera* Hiern                  | Sh          | Fresh leaves               | Fresh leaves crushed and rubbed on affected part.                                                                                                 | Tinea corporis MM063          |                |
| *Vicia faba* L.                                | Sh          | Root                       | Root crushed and taken with coffee                                                                                                                  | Rabies MM202                 |                |
| *Vigna unguiculata* (L.) Walp.                 | Cl          | Fresh leaves               | Fresh leaves smashed and mixed with water then one cup of tea taken.                                                                         | Common cold MM040             |                |
| *Vigna vexillata* L. A. Rich.                 | Cl          | Fresh leaves               | Fresh leaves smashed and mixed with water then one cup of tea taken.                                                                         | Common cold MM040             |                |
| *Stephania abyssinica* (Dillon & A. Rich.) Walp.| H           | The whole part of *Stephania* | The whole part of *Stephania abyssinica* crushed and boiled in water then the smoke will be inhaled until the patient getting sweat.                                                                 | Common cold MM040             |                |
| *Solanum incanum* L.                           | Sh Hg       | Root                       | Root crushed and taken with coffee                                                                                                                  | Wound MM118                  |                |
| *Solanum incanum* L.                           | Sh Hg       | Dried leaves               | Dried leaves crushed and the extracts dropped on the cut skin.                                                                                     | Skin cut MM303                |                |
| *Vernonia auriculifera* Hiern                  | Sh          | Fresh leaves               | Fresh leaves crushed and rubbed on affected part.                                                                                                 | Tinea corporis MM063          |                |
| *Vigna unguiculata* (L.) Walp.                 | Cl          | Fresh leaves               | Fresh leaves smashed and mixed with water then one cup of tea taken.                                                                         | Common cold MM040             |                |
| *Zingiber officinale* Roscoe                   | H Hg        | Chewed                     | Chewed and swallowed                                                                                                                           | Tonsillitis MM011             |                |

Key: Hab: Habit; H Herb, Sh Shrub, T Tree, Cl Climber and Li Liana; Ha habitat: W Wild, H Homegarden, B Both, V. No. Voucher number.
| Scientific name | Local Oromo name | Family | Hab | Ha | Plant part, preparation and application | Disease treated | V. No. |
|-----------------|------------------|--------|-----|----|----------------------------------------|----------------|-------|
| Acacia persiciflora | Garbii | Fabaceae | T | W | The powdered bark mixed in water and given for the cattle forcefully | Stomach ache | MMO64 |
| Acanthus polystachius | Kosorruu | Achantaceae | Sh | W | Fresh leaves crushed and rubbed on affected part (wound) | ‘Madaa gatiti’ | MM106 |
| Albizia malcophylla | Arganboobee | Fabaceae | T | W | Bark powdered and given for treatment of Blackleg | Blackleg | MM070 |
| Buddleja polystachya | Hanfaarree | Logandaceae | Sh | W | Fresh leaves mixed and the extracts dropped in the eyes of affected cattle | Eye disease | MM024 |
| Colocasia esculenta | Goodarree | Araceae | H | B | Tuber crushed and mixed with water then given to the cow | Delayed placenta | MM027 |
| Combretum callinum | Unnuunu | Combretaceae | T | W | A bottle of mixed fresh crushed bark given for treatment of Blackleg | Breast ulcer | MM102 |
| Combretum malle | Dabaqaa | Combretaceae | T | W | Steam put on the fire and rubbed the affected tongue | Tongue infection | MM149 |
| Girardinia bullosa | Gurgubbee | Urticaceae | Sh | W | Root powdered and mixed in water and applied orally | Blackleg | MM046 |
| Girardinia bullosa | Harooreessa | Tiliaceae | T | W | Bark of Grewia bicolor ground and mixed in water and salt added for the cattle which placenta is delayed during delivery | Delayed placenta | MM151 |
| Guizotia scabra | Tuufoo | Asteraceae | H | W | Fresh leaves of Guizotia scabra and leaves of Calpium aura crushed and rubbed | External Parasite/silmii | MM191 |
| Helinus mystacinus | Hidda hoomoo | Euphorbiaceae | Cl | W | Leaves crushed and smashed and rubbed for external parasite | External parasite | MM097 |
| Hymenodictyon floribundum | Altadhahaa | Rubiaceae | T | W | Fresh leaves smashed and the exudates dropped in the eyes of affected cattle | Eye disease | MM156 |
| Impatiens tinctoria | Qicuu | Balsaminaceae | H | W | Powedered root taken | Blackleg | MM153 |
| Rhus ruspolii | Xaaxessaa | Anacardaceae | T | W | Fresh leaves crushed and rubbed on affected part | External parasite | MM051 |
| Rhus ruspolii | Hidii seexanaa | Solanaceae | Sh | W | Root of Rhus ruspolii Eng. powdered and mixed with water and drunk | Hyena bite | |
| Solanum anguivi | Bisingaa caabbi | Poaceae | H | | Seed mixed in remnants of local beer and given | Delayed placenta | MM094 |
| Thalictrum rhyncocalpas | Mararree | Ranunculusaceae | H | W | The whole part crushed and given | Blackleg | MM045 |
| Teclea nobilis | Hadheessa | Rutaceae | Sh | W | Leaves crushed and mixed with water and given for the thin cattle | Thinnness | MM025 |
| Verbascum sinaticum | Gurra harree | Scrophulariaceae | H | W | Fresh leaves powdered and mixed in water then given orally for external parasite | External parasite | MM125 |

Key: 
- **Hab**: Habit: **H** Herb, **Sh** Shrub, **T** Tree, **Cl** Climber and **Li** Liana, **Ho** habitat, **W** Wild, **Hg** Homegarden, **B** Both, **V. No.** Voucher number.
| Scientific name               | Local Oromo name | Family       | Hab | Ha | Plant part, preparation and application                                                                 | Disease treated | V. No. |
|------------------------------|-----------------|--------------|-----|----|----------------------------------------------------------------------------------------------------------|-----------------|-------|
| Calpurnia aurea (Ait.) Benth.| Ceekaa          | Fabaceae     | Sh  | W  | Fresh leaves soaked in water and wash the body of calf                                                   | External parasite | MM074 |
|                              |                 |              |     |    | 9 juvenile leaves of Calpurnia aurea, 9 leaves of Senna occidentalis and 9 juvenile leaves of Clausena anisata smashed and the extracts taken. | Ascaris          |       |
|                              |                 |              |     |    | One cup of tea is given for man and half cup for Children                                               |                 |       |
|                              |                 |              |     |    | Leaves crushed and mixed in water given by bottle forcefully                                            | Snake bite      |       |
| Cucurbita pepo L.            | Buqqee          | Cucurbitaceae | H   | Hg | The dried seed roasted and eaten                                                                         | Tape worm       | MM018 |
|                              |                 |              |     |    | Fruit cooked and rubbed on affected part                                                               |                 |       |
| Cucumis ficifolius A. Rich.  | Faca’aa         | Cucurbitaceae | H   | W  | Very few fresh root chewed with salt                                                                       | Gonorrhea       | MM026 |
|                              |                 |              |     |    | Very few root powdered and mixed with one litter of water then given to the cattle forcefully            | Blackleg         |       |
| Guizotia abyssinica (L.f.) Cass. | Nuugii      | Asteraceae   | H   | Hg | Seed roasted powdered and the decoction drunk                                                           | Swelling        | MM036 |
|                              |                 |              |     |    | Seed powdered and rubbed on madaa gatiiti of oxen                                                      | Madaa gatiiti   |       |
| Hordeum vulgare L.           | Garbuu          | Poaceae      | H   | Hg | Seed of Hordeum vulgare powdered with seed of Brassica carinata and drunk                               | Swelling        | MM082 |
|                              |                 |              |     |    | Seed covered and left to let germinate then grinded and mixed with remnants of local beer or ‘tella’ and given orally | Blotting        |       |
| Justicia schimpehiana (Hochst. ex Nees) T. Anders. | Dhummuugaa    | Acanthaceae  | Sh  | Hg | Fresh leaves crushed and given for hen or cock                                                          | Coccidiosis     | MM008 |
|                              |                 |              |     |    | Leaves put on fire with leaves of Bruea antidyssentric and rubbed on head                              |                 |       |
| Lepidium sativum L.          | Shinfaa         | Brassicaceae  | H   | Hg | Dried seed powdered and eaten with injera to get cure from malaria or rubbed the body for protection from mosquito bite | Malaria         | MM015 |
|                              |                 |              |     |    | Seed powdered in water and given by the bottle forcefully                                             | Blackleg        |       |
| Linum usitatissimum L.       | Talbaa          | Linaceae     | H   | Hg | The hair washed by seeds of Linum usitatissimum and used as a soap                                      | Dandruff        | MM096 |
|                              |                 |              |     |    | Seed covered and given by mixing in water                                                              |                 |       |
| Lotus corniculatus L.        | Abbaa qiddii    | Fabaceae     | H   | W  | Powdered root taken with tea                                                                           | Snake ulcer     | MM065 |
| Kalanche laciniata (L.) DC.   | Bosoqqee        | Crassulaceae | H   | W  | Fresh or dried root of Kalanche laciniata, seed of Capsicum frutescens, Allium sativum and leaves of Croton macrostachyus Powdered together and given for affected cattle | Blackleg        | MM158 |
| Malva verticillata L.        | Karfichoo       | Malvaceae    | H   | W  | Leaves cooked and the smoke inhaled to get relief from ‘Mich’                                          | Fibril illness  | MM150 |
| Maesa lanceolata Forssk.     | Abbayyii        | Myrsinaceae  | Sh  | W  | Fresh leaves crushed and rubbed on the body                                                             | External parasite | MM079 |
| Plant Name                      | Common Name | Family   | Habit | Use                          | Condition          | Voucher Number |
|--------------------------------|-------------|----------|-------|------------------------------|--------------------|----------------|
| Nicotiana tabacum L.           | Tamboo      | Solanaceae | H     | Leaves crushed and mixed with water and drunk | Snake bite         | MM004          |
|                                |             |          |       | Leaves crushed and tied on affected part |                    |                |
|                                |             |          |       | Leaves crushed and put in the mouth then the cow will not drink water or feed for certain minutes until the leech come out |                    |                |
| Rumex nepalensis Spreng.       | Timijii     | Polygonaceae | H W  | Few root chewed and swallowed | Gastric            | MM055          |
|                                |             |          |       | Fresh leaves crushed and mixed with Leaves of Acanthus polystachius By mixing with butter creamed on affected part | Spider poison      |                |
|                                |             |          |       | Root powdered and mixed in water then mixed in water and given for the cattle forcefully (waga’uu) | Blackleg           |                |
| Stereospermum kunthianum Cham. | Botoroo     | Bignoniaceae | T     | Fresh/ Dried bark of Stereospermum kunthianum Cham., bark of Croton macrostachys, Root of Cucumis ficifolius, bulb of Allium sativum L. and seed of Capsicum frutescens powdered together and half of a bottle given for three days | ‘Kaashmeer’        | MM176          |
|                                |             |          |       | Dried bark put on fire and the smoke inhaled | Evil eye           |                |
|                                |             |          |       | Powdered and mixed with water and one cup of tea taken for three days | Sache              |                |
|                                |             |          |       | Leaves crushed and rubbed | Spider poison      |                |
| Vernonia amygdalina Del.       | Eebicha     | Asteraceae | Sh    | Leaves crushed and mixed with remnants of local beer (“Tella”) and given for the cow | Delayed placenta   | MM010          |
|                                |             |          |       | Leaves crushed and soak in water and the exudates drunk orally for five days | Malaria            |                |

Key: Hab Habit, H Herb, Sh Shrub, T Tree, Cl Climber and Li Liana, Ha habitat, W Wild, Hg Homegarden, B Both, V. No. Voucher number.
medicinal plants which are expected to be highly toxic. For such medicines the measurement was undertaken by little finger index and very few amounts of the prepared medicine taken by a cup of coffee (Locally known as ‘Sinii’). For example, medicines prepared from Phytolacca dodecandra, Cucumis ficifolius, Carissa spinarum and Securidaca longepedunculata are toxic if overdosed. The second is the dosage used for medicinal plants which can have little effect. The dosage is measured by hand palm and taken by bottle or locally made material from Lagenaria siceraria known as ‘Hullee’. E.g., traditional medicines prepared from Vernonia amygdalina.

In the third case there are medicinal plants that do not have any observable side effect. Medicines prepared from Allium sativum, Citrus limon, and Citrus aurantium can be taken according to personal preference of the patient. Moreover, informants indicated the effectiveness of traditional medicines to get relief from certain diseases including rabies and health problems associated with the liver, spider poisoning and those caused by bat urine.

Methods of preparation of traditional medicine
In the study area, the most common methods of preparation of traditional medicine from plant material was crushing (29%), followed by powdering (28%) and others (Table 5).

Importance of medicinal plants in the study area
Paired comparison ranking of 7 medicinal plants that were reported as effective for treating blackleg, was conducted after selecting 9 informants. The informants were asked to compare the given medicinal plants based on their efficacy. The results showed that Cucumis ficifolius scored the highest mark and ranked first indicating that it was the most effective in treating blackleg and followed by Lepidium sativum (Table 6).

Direct matrix ranking of multipurpose medicinal plants
Among the medicinal plants reported by the informants, there were those that were used for other purposes and thus grouped as multipurpose species. Key informants first identified eight medicinal plant species that were used by the community for additional purpose including fire wood, charcoal making, construction purposes, food, fencing and forage. Application of direct matrix ranking to these species showed that Cordia africana was the

| Family            | Number of genera | Percentage | Number of species | Percentage |
|-------------------|------------------|------------|-------------------|------------|
| Fabaceae          | 11               | 10.0       | 15                | 12.0       |
| Solanaceae        | 4                | 3.7        | 8                 | 6.3        |
| Asteraceae        | 5                | 4.6        | 7                 | 5.6        |
| Lamiaceae         | 5                | 4.6        | 6                 | 4.7        |
| Poaceae           | 6                | 5.5        | 6                 | 4.7        |
| Cucurbitaceae     | 5                | 4.6        | 5                 | 4.0        |
| Rutaceae          | 4                | 3.7        | 5                 | 4.0        |
| Euphorbiaceae     | 5                | 4.6        | 4                 | 3.0        |
| Rubiaceae         | 3                | 2.7        | 4                 | 3.0        |
| Boraginaceae      | 3                | 2.7        | 3                 | 2.3        |
| Malvaceae         | 3                | 2.7        | 3                 | 2.3        |
| Rosaceae          | 2                | 2.0        | 3                 | 2.3        |
| Other 44 families | 52               | 48.0       | 57                | 45.0       |
| Total             | 108              | 100        | 126               | 100        |
best, followed by *Eucalyptus globulus* and *Croton macrostachyus* (Table 7).

**Informant consensus factor (ICF)**

The result showed that, diseases that were frequent in the study area have higher Informant Consensus Factor. Medicinal plants that are effective in treating certain disease and well known by community members also have higher ICF. Malaria and headache had the highest ICF value (0.85) whereas, Rabies had the lowest ICF value (0.25) (Table 8).

**Threats to medicinal plants and conservation practices in the study area**

In Wayu Tuka District various factors that were considered as main threats for medicinal plants were recorded by discussion with the informants. Accordingly, the major factors reported were deforestation for the purpose of agricultural expansion (75%), overgrazing (10%), collection of plant material for construction (10%) and fire wood (5%).

People of the study area know the benefits of conserving medicinal plants. However, the effort of conserving medicinal plants is very limited (minimal). That is an evident for being only 26% of medicinal plants were collected from homegarden. Local healers who frequently make use of medicinal plants for a living do not conserve medicinal plants very well, and they preferred to collect them from wild stands when patients visit them. It was explained by informants that local healers do this in order not to let the other community members know the identity of the medicinal plants they are using. Informants further explained that if healers planted the species in their homegardens, they suspect that somebody else might see them while they are preparing the medicine from the plants and start to prepare them and reduce the income which could have gone to the healer. Further observations showed some medicinal plants frequently growing in homegardens, including *Ocimum urticifolium* and *Ruta chalepensis*, the medicinal plant knowledge of which is in the public domain.

Beliefs have reported to have some contributions to conservation of medicinal plants. It was reported that medicinal plants collected during ‘Chegino’ (that means Monday, Wednesday and Friday) are not used, and limitation of days for collecting medicinal plants reduces the effect of over-harvesting.

**Discussion**

**Medicinal plants used to treat human and livestock ailments in the study area**

A considerable number (126) of medicinal plants have been documented in this study. The number of reported medicinal plants and their uses by the local people of

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**Table 6 Paired comparison of medicinal plants used to treat blackleg in the study area**

| Medicinal plants used          | Respondents (R1-R9) |
|-------------------------------|---------------------|
|                               | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | Total Rank |
| **Clematis simensis**         | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0  | 1  | 7  | 6th         |
| **Cucumis ficifolius**        | 5  | 5  | 5  | 4  | 6  | 4  | 6  | 4  | 5  | 44 | 1st         |
| **Cyphostemma cyphopetalum**  | 0  | 1  | 1  | 0  | 0  | 2  | 0  | 1  | 0  | 5  | 7th         |
| **Kalanchoe laciniata**       | 3  | 4  | 2  | 2  | 4  | 3  | 2  | 5  | 2  | 27 | 5th         |
| **Lepidium sativum**          | 3  | 4  | 5  | 5  | 3  | 4  | 5  | 4  | 5  | 38 | 2nd         |
| **Rumex nepalensis**          | 3  | 3  | 4  | 4  | 4  | 4  | 5  | 4  | 5  | 35 | 3rd         |
| **Thalictrum rhynchocarpum**  | 6  | 3  | 3  | 5  | 3  | 4  | 3  | 2  | 4  | 33 | 4th         |

**Table 7 Direct matrix ranking of eight multipurpose medicinal plants (Average score of 8 key informants)**

| Plant species              | Medicine | Fire wood | Charcoal | Construction | Food | Fence | Forage | Total | Rank |
|---------------------------|----------|-----------|----------|--------------|------|-------|--------|-------|------|
| *Acacia abyssinica*       | 2        | 4         | 5        | 4            | 0    | 2     | 0      | 17    | 4th  |
| *Cordia africana*         | 3        | 4         | 5        | 5            | 3    | 2     | 0      | 22    | 1st  |
| *Croton macrostachyus*    | 5        | 4         | 3        | 4            | 0    | 2     | 0      | 18    | 3rd  |
| *Eucalyptus globulus*     | 4        | 5         | 3        | 5            | 0    | 2     | 0      | 19    | 2nd  |
| *Justicia schimperiana*   | 5        | 2         | 0        | 1            | 0    | 4     | 3      | 15    | 6th  |
| *Prunus africana*         | 2        | 3         | 4        | 4            | 0    | 3     | 0      | 16    | 5th  |
| *Rhamnus prinoides*       | 4        | 1         | 1        | 0            | 0    | 3     | 3      | 12    | 7th  |
| *Ricinus communis*        | 3        | 1         | 0        | 0            | 2    | 3     | 1      | 10    | 8th  |
the District indicates the depth of the local indigenous knowledge on the medicinal plants and their applications. Out of the collected medicinal plants, 78 species were reported for use in the treatment of human diseases, whereas 23 species were used to treat livestock ailments and 25 species were used to treat both human and livestock ailments. Similar findings were reported by other studies [24-27] in other parts of Ethiopia where local people use more medicinal plants to treat human diseases than livestock ailments.

Various studies [27-29] conducted in Ethiopia as well as in other countries of the world reported that the majority of medicinal plants are being harvested from non-cultivated areas. This observation is a good indication of the fact that the local people have not yet started cultivating the majority of the plant species they are using as medicines. Some medicinal plants recorded in Wayu Tuka District were also used as remedies in other parts of Ethiopia. Accordingly, 51 medicinal plants were documented in [28]; 47 species in [30]; 41 species in [24]; 36 species in [25]; 33 species in [31]; 30 species in [26] and 15 species in [32,33]. The fact that some of the reported plants are having similar uses elsewhere can be considered as indication of their pharmacological effectiveness [31].

Among the families, Fabaceae was represented by 15 species (12%) followed by Solanaceae which had 8 species. The finding of the family Fabaceae as the contributor of higher number of plant species used for medicinal purposes than other families is in line with similar studies elsewhere in Ethiopia [30,31,34-36], whereas other researchers reported that Asteraceae is the leading family with highest number of medicinal plants [24,25,32]. Both findings are reasonable since the two families are both represented by higher number of species in the Ethiopian Flora.

The most widely used plant remedies by people of Wayu Tuka District were obtained from herbs which constituted the highest category of 55 species (43.6%). This finding is in line with other results [24,26,30,33,37]. Moreover, Giday et al. [33] reported that Zay people derive their medicine from herbs partly because of the fact that forests have been degraded and it takes much time and effort to harvest plant material from medicinal trees. It is true that herbs can grow everywhere (roadside, homegarden, farmland and in wild habitats) and common in the study area compared with other species such as trees, shrubs and climbers. However, other findings [25,27,34-36,38] indicated that shrubs were the most frequently used plant categories.

People of the study area, prepare remedies for human or livestock ailments, either from single plant or plant parts or by mixing them. Most of medicinal plants reported from the study area were claimed to be prepared from a single plant or plant part. Similar findings were also reported for use of multiple plants or plant parts for a single health problem [35,39,40] and use of single species was rare. This finding deviated from that reported by another researcher [30] who reported that 78% of the preparations of traditional medicine by people of Chelya Wereda were drawn from mixtures of different plants or plant parts and another work [36] also reported that local healers of Sokoru mostly used more than one plant species to prepare remedy for an ailment. In the present study, it was observed that healers mostly used multiple plants or plant parts in order to increase the strength and efficacy of the drug as they reported during the interview. For example, rabies was treated by mixing the bark of Clausena anisata, leaves of Sida rhombifolia, root of Cucumis ficifolius, and root bark of Brueca antidysentrica. They used different additives like soil, ash, honey, salt, sugar, local beer, milk and butter in order to increase the flavor, taste and general acceptability of certain orally administered remedies. This means that since traditional medicines could have sour or bitter

| Category                                      | No. of spp. | Total % of spp. | No. of use citation | % of use citation | ICF |
|-----------------------------------------------|-------------|-----------------|---------------------|-------------------|-----|
| Malaria and headache                          | 7           | 5.5             | 42                  | 13.0              | 0.85|
| Fibril illness, swelling and evil eye          | 9           | 7.0             | 40                  | 12.4              | 0.79|
| Intestinal parasite, diarrhea, amoeba and stomach ache | 17         | 13.5            | 60                  | 19.0              | 0.72|
| Ear, eye and tooth ache (Organ)               | 7           | 5.5             | 23                  | 7.5               | 0.71|
| Cattle ailments (Blackleg, Anthrax, Leech and External parasite) | 14         | 11.0            | 30                  | 10.0              | 0.55|
| Common cold and cough                         | 8           | 6.0             | 16                  | 5.0               | 0.53|
| Snake bite, spider poison and bat poison      | 16          | 12.6            | 28                  | 9.0               | 0.44|
| Skin diseases, skin cut and wound             | 25          | 20.0            | 41                  | 13.0              | 0.40|
| Lung, kidney and liver diseases (Organ)       | 8           | 6.0             | 12                  | 4.0               | 0.36|
| Gonorrhea and menstruation                   | 3           | 2.0             | 4                   | 2.0               | 0.33|
| Rabies                                        | 7           | 5.5             | 9                   | 3.0               | 0.25|
tastes in most cases the additives reduce such tastes and may even improve the efficacy of the medicine.

The finding of leaves to be the most widely harvested plant parts is inline with other results [24,30-32]. However, other findings [25,26,35] indicated that roots were mostly utilized plant part. It was reported that collection of root, bark and whole plants might kill plants in harvest [41]. The same document also reported that root, which accounts for 58.3% is the most extensively used plant part in Ethiopia. Utilization of leaves may not cause detrimental effect on the plants compared with plant species in which root is utilized. However, this has to be seen on a case by case basis.

Mode of preparation, condition and route of application
Crushing was the most widely used method of preparation of remedy in the area. This finding agrees with the findings of Getaneh [24], Yineger and Yehuwalaw [36] and Virga [42]. However, the finding of Mesfin et al. [25] and Amenu [30] shows that powdering and pounding are the dominant method of preparation in Wonago and Chelya Woreda respectively.

The majority of the medicines (74%) were prepared from fresh plant materials in the study area. Different studies from other parts of Ethiopia also reported similar results [24-26,28,31,32,42,43]. Preference of application of fresh plant parts is related to the efficiency of the medicines in curing diseases compared with the dried parts. This is because of the fact that most important chemical may be changed upon drying [44]. On the other hand, utilization of fresh plant parts may threaten the plants through frequent collection including in dry seasons since local people made minimal efforts in storing dried plant material for later use.

About 64% of the medicines in the area were administered orally and 27.3% used as dermal applications. In similar studies, other researchers reported oral administration of medicine as the leading route of application, in particular the results from Chelya Wereda [30] and Fentalle area [35], which accounted for 60.3% and 54.7% respectively. Similarity among those results showed that internal diseases are more prevalent in Ethiopia.

Effectiveness and dosage of medicines
Medicinal plants are reported to be effective in certain diseases. The results from Sokoru District [36] indicated that local people visit traditional healers even in preference to modern medications. In the present study, local people indicated their preferences for traditional medicines over modern drugs to get relief from certain diseases including rabies and health problems associated with the liver, spider poisoning and those caused by bat urine.

Lack of consistency regarding amount of medicines to be used was observed among informants during the interview. It was reported that lack of precise dosage is one drawback of traditional medicinal plants [39,45,46].

Threats to medicinal plants and conservation practices in the study area
Medicinal plants are at increasing risk from destruction of their habitats (agricultural activities, fire wood collection, collecting plants for construction, overgrazing by domestic animals, urbanization) and over-harvesting of known medicinal species. As already indicated, most medicinal plants in the study area relied on collection of leaves and this practice helps to reduce the rate of threats on plant species compared with utilization of roots. However, there were medicinal plants in the study area in which roots were collected for treatment of ailments. As a result, over collection poses a threat to medicinal plants in the cases of harvesting the roots. This was observed in the cases of Cucumis ficifolius, Rumex nepalensis and Securidaca longepedunculata. These medicinal plant species were used to treat blackleg, evil eye and liver diseases and informants reported that it is difficult to collect them easily and they are getting lost due to over utilization for medicinal purposes.

Informants highly cited that deforestation became the most threatening factor on medicinal plants as reported by other researchers [25,33]. In this respect, plant species with multiple uses were said to be highly affected as also witnessed during the research. For instance, local people of the area preferred Cordia africana for construction; timber production, charcoal and medicine and it is on the verge of being eliminated from the area.

The conservation of medical plants in the study area was minimal rather beliefs have some contributions to conservation of medicinal plants as also reported by another study [27,30]. Keeping the knowledge on medicinal plants secretly can also have some contribution for their conservation. Thus, if medicinal plants are known by all people the impact could increase [25].

Conclusion
The present study records 126 reported medicinal plants and their uses and majority of traditional medicinal plants were harvested mostly from wild. In the study area herbs constituted the highest proportion of medicinal plants to be utilized. Majority of medicinal plant species were harvested for their leaves and utilization of leaves may not cause detrimental effect on the plants compared with plant species in which root is utilized. Although high numbers of medicinal plants have been reported to be used for the treatment of human and livestock health problems, they are being threatened by different human activities while conservation efforts are minimal in the area. Deforestation for agricultural purpose was the major threat reported to medicinal plants.
of the study area. To save medicinal plants from further loss, the District Agricultural Office needs to team up with the local people, including by providing to the community planting materials of the most threatened and preferred medicinal and multipurpose species so that they can grow them in their homegardens. Moreover, the documented medicinal plants can serve as a basis for future investigation of modern drug.

Competing interest
The authors declare that they have no competing interests.

Authors’ contributions
We have made substantive intellectual contribution to this study in data collection, identification of plants, preparation and editing of the manuscript and proof reading. MM conducted the field work, identified the plants, analyzed the data and wrote the draft of manuscript. ZA identified the plants, provided comments and suggestions on the manuscript. AB and BW edited, provided comments and suggestions on the manuscript. All authors read and approved the final manuscript.

Acknowledgments
We acknowledge the help of Dr. Liwan S. and his assistants, MM & KE, who identified and described the plants and herbs in the study area. They were very helpful in suggesting plant species to us to study. We are most grateful to ZA, MM, KE and BW, who provided valuable contributions to the study at various stages by editing the manuscript, providing comments and suggestions on the manuscript. We have made substantive intellectual contribution to this study in data collection, identification of plants, preparation and editing of the manuscript and proof reading. MM conducted the field work, identified the plants, analyzed the data and wrote the draft of manuscript. ZA identified the plants, provided comments and suggestions on the manuscript. AB and BW edited, provided comments and suggestions on the manuscript. All authors read and approved the final manuscript.

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Acknowledgments
We are very much grateful to Wayu Tuka District administration for their cooperation in allowing us to carry out the study. Especially, Mr. Yadessa Abdi is heartfully acknowledged for his help in convincing the local people to participate in the study. Moreover, informants are fully acknowledged for their participation by providing relevant responses to the questions. Thus, without them the study would not have been realized. We also gratefully acknowledge the financial support provided by Addis Ababa University.

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Received: 11 February 2013 Accepted: 22 September 2013
Published: 25 September 2013

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Cite this article as: Megersa et al.: An ethnobotanical study of medicinal plants in Wayu Tuka District, East Welega Zone of Oromia Regional State, West Ethiopia. Journal of Ethnobiology and Ethnomedicine 2013 9:68.