Research Article

Medicinal Plants Used to Manage Human and Livestock Ailments in Raya Kobo District of Amhara Regional State, Ethiopia

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Plant-based traditional medicine is practiced in Raya Kobo district, Amhara Regional State, Northeastern Ethiopia, to manage different human and livestock ailments. However, the formal ethnobotanical survey that documented such knowledge is lacking. Therefore, the aim of this study was to document the traditional knowledge on the use of medicinal plants to manage human and livestock ailments in the district. The study was conducted from January to July 2017 in five purposefully selected kebeles of the district. Ethnobotanical data were collected mainly using semistructured interviews conducted with 150 informants. In the five kebeles, 30 informants (15 males and 15 females) were selected using the stratified random sampling method from a list of traditional practitioners and knowledgeable individuals. Data were analyzed by employing descriptive and inferential statistical methods. The study documented a total of 91 medicinal plant species (distributed in 51 families) used in managing 38 human and 12 livestock ailments. Out of the total recorded plant species, 74 and 17 were used in managing human and livestock ailments, respectively. Leaves were the most frequently used plant parts in the preparation of remedies, accounting for 53.1% of the total preparations. The three most common methods of remedy preparation were grinding/pounding (23.5%), crushing (19.8%), and boiling (14.5%). Preference ranking conducted by selected informants on eight medicinal plants used in treating human febrile illness locally called “mich” revealed that Ocimum urticifolium is the most preferred medicinal plant—an indication of its high potency against the disease, and therefore needs to be prioritized for future scientific investigation. The result of this study demonstrated the rich traditional knowledge and practices in the district on the use of medicinal plants in treating various human and livestock ailments. Deforestation and drought were reported to be the major factors in the district threatening the medicinal plants and the associated knowledge. Thus, concerted efforts have to be made to conserve this important heritage using every possible means.

1. Background

Estimates show that 80% of the population living in developing countries depends on traditional medicine for its healthcare needs [1]—a practice that largely relies on the use of plants. The high prevalence in the use of traditional medicine is mainly attributed to its low cost, efficacy, and better accessibility. Traditional medicine is also serving as a source of knowledge in the development of many plant-based synthetic drugs—e.g., morphine used as analgesic is synthesized from Papaver somniferum, aspirin used as an analgesic is synthesized from Filipendula ulmaria, and quinine used in treating malaria is synthesized from Cinchona pubescens [2].

In Ethiopia, the knowledge and utilization of traditional medicine, in general, and medicinal plants, in particular, are believed to be wide due to high diversity of higher plants, estimated to reach 6,000 species [3], and rich cultures, belief
systems, and languages. One report indicated that about 80% of the Ethiopian population is still dependent on traditional medicine principally using plants [4]. Abebe and Ayehu [5] reported the application of more than 800 medicinal plant species in the Ethiopian traditional medicinal system. Traditional medicine is the most affordable and easily accessible source of treatment in the primary healthcare system of many communities of the country. But the rich knowledge of traditional medicine that has been developed over thousands of years is being exposed to serious depletion mainly due to deforestation, environmental degradation, overexploitation, agricultural land expansion, acculturation, and limited practice of its documentation.

In Ethiopia, cognizant of the role of traditional medicine and medicinal plants and the existing threats to the associated knowledge and practices, attempts have been made, mainly in the last four decades, to document medicinal plants used by many communities. Some of the notable works include that of Giday et al. [6] (in the northwestern part), Giday and Ameni [7] (in the northern part), Gedif and Hahn [8], and Teklehaymanot et al. [9] (in the central part), Wondimu et al. [10] (in the southeastern part), and Abbink [11] (in the southwestern part). However, such works are not inclusive; thus, concerted efforts should be made in the country to document such valuable knowledge for better utilization and conservation.

A number of ethnobotanical studies have been conducted in different districts of the Amhara State of Ethiopia to which the Raya Kobo district belongs [6, 12–29]. There are 11 rural districts in the North Wollo zone of the Amhara State including Raya Kobo. However, the survey of published works shows that ethnobotanical studies on medicinal plants were conducted in only 2 of the 11 districts in the zone, namely, in Guba Lafto and Delanta. The studies in Guba Lafto [26] and Delanta [24] districts reported 135 and 133 medicinal plant species, respectively. People in the Raya Kobo district, like in other communities in Ethiopia, are expected to have been heavily dependent on herbal medicine to manage human and livestock ailments. However, an ethnobotanical study that aims to document the local use of medicinal plants is lacking. Thus, the aim of this study was to document the local knowledge on the use of medicinal plants in treating human and livestock ailments.

2. Materials and Methods

2.1. Description of the Study Area. The study was carried out in Raya Kobo district of North Wollo zone of the Amhara State of Ethiopia (Figure 1). It is located between 11°54′04″ and 12°02′56″ N latitudes and 39°25′56″ and 39°49′04″ E longitudes. Kobo is the administrative town of the district and is located at 570 km north of Addis Ababa. Raya Kobo is bordered by Raya Alamata district of Tigray State in the north, by Guba Lafto and Gidan districts of Amhara State in the south and west, respectively, and by Golina district of Afar State in the east. The district covers a total area of 183,697.50 hectares of land, of which 59% is kola (lowland), 38% is woyinadega (semihighland), and 3% is dega (highland) with annual temperature ranging from a minimum average of 12.31°C to a maximum average of 33.07°C and annual rainfall ranging from 500 mm to 800 mm [30]. The district is divided into 44 rural and four urban kebeles (subdistricts). Kebele is the smallest administrative unit in Ethiopia.

Raya Kobo district has a total population of 261,897 (females 128,157; males 133,740) [31]. Amharic is the mother tongue language of the great majority of the people of the district [32]. According to a recent local government data, 28% of the district is barren land, 23.7% is agricultural/cultivated land, 24.3% is grazing land, and 15.9% is covered by shrubs and bushes. Agriculture (crop and livestock production) is the livelihood activity of the great majority of people. Crops including sorghum, teff, and pulses are the most commonly cultivated ones. Likewise, it has high populations of sheep (201,753), chickens (183,261), and cattle (158,370). Furthermore, it is home to 47,951 goats, 22,232 donkeys, 13,864 camels, 552 mules, and 48 horses [33].

It was reported that there are seven health centers and 43 health posts in Raya Kobo. Malaria, common cold, tuberculosis, mich (febrile illness), pneumonia, HIV-AIDS, nekera (chronic wound), hepatitis, diarrhea, typhoid fever, and diabetes are the top ten diseases of major public health priorities in the district [34]. Unpublished 2019 government data revealed that blackleg, anthrax, pasteurellosis, sheep and goat pox, lumpy skin disease, mange, tick infestation, and internal parasitic infections are the top eight diseases of veterinary health priorities. But, only 24 veterinary clinics were operating in 2019 [33].

2.2. Selection of Study Kebeles and Informants. Five kebeles, namely, Menjelo, Bewa, Gedeba, Ayub-Amaya, and Mendefera Golesha (Figure 1), were purposively selected for the study following the approach of Martin [35] with the assistance of district authorities, elders, and knowledgeable persons based on the availability of traditional practitioners and knowledgeable individuals. For this purpose, many individuals, aged 40 years and above who claimed to be practitioners of traditional medicine and believed to be knowledgeable, were identified from each of the five kebeles. Then, 30 informants (15 males and 15 females) were selected from each kebele using a stratified random sampling approach [36].

2.3. Collection of Ethnobotanical Data. Ethnobotanical data were collected between January and July 2017 mainly through (a) semistructured interviews conducted with the sampled informants using a list of questions prepared beforehand in Amharic, mother tongue language in the study district, and (b) field observations using the procedures recommended by Martin [35] and Alexiades [37]. Gathered data and information were local names of medicinal plants, plant part(s) utilized, method of preparation, ailments treated or prevented, and routes of administration. Specimens of most of the medicinal plants were collected and identified by botanists at the Ethiopian National Herbarium (ETH) and Aklilu Lemma Institute of Pathobiology.
2.4. Simple Preference Ranking. Preference ranking was performed by seven informants on eight medicinal plants used in treating mich (a human febrile illness) following the guideline established by Martin [35]. Informants for this exercise were randomly selected from those individuals already involved in semistructured interviews. The eight plants had the highest informant consensus among a total of 13 plants reported to be used in treating mich. Of all the ailments reported, mich was found to be treated by the highest number of medicinal plants—an indication of the high health importance of the ailment in the district. The highest value (i.e., 8) was given to medicinal plants considered to be the most effective, and the least value (i.e., 1) was given to the plant considered as the least effective.

2.5. Data Analysis. Descriptive statistical methods were used to produce frequencies and percentages. Coefficient of correlation and analysis of variance (ANOVA) were used to compare mean values of knowledge of medicinal plants among different groups of informants.

3. Results and Discussion

3.1. Diversity of Medicinal Plants. The present study documented a total of 91 species of medicinal plants. Whereas 74 of the species were used to manage human health problems only (Table 1), and 17 of them were used against livestock ailments only (Table 2). Some examples are given in Figure 2. As reflected by the richness of the plants used and the diversity of ailments treated, the results showed the profound roles of medicinal plants in meeting the basic healthcare needs of the communities in the study area. Previous studies carried out in Delanta and Guba Lafto districts of North Wollo zone, to which the study district belongs, reported the use of 135 and 133 species of medicinal plants, respectively, to manage various ailments [24, 26]. Of the reported medicinal plants, 42 (46.2%) were herbs, 29 (31.8%) were shrubs, and 20 (22%) were trees. Previous ethnobotanical studies conducted elsewhere in several districts of Ethiopia also revealed the wide use of herbs as medicinal plants [14, 38–40]. Such wide use of herbs in the study district may be attributed to their ease of harvesting and processing and their relatively better abundance compared to shrubs and trees as it was observed by the investigators and documented in the local government records [33].

The reported medicinal plants belonged to 51 families and 83 genera. Whereas six species belonged to Fabaceae, five species belonged to each of the families of Asteraceae, Euphorbiaceae, and Lamiaceae. Solanaceae was represented by four species, while Boraginaceae, Cucurbitaceae, Ranunculaceae, and Vitaceae were represented by three species each. Each of the remaining 42 families was represented by two or one species. The fact that Fabaceae, Asteraceae, Euphorbiaceae, and Lamiaceae contributed higher number of medicinal plants could probably be attributed to their better species richness in the flora of Ethiopia. Fabaceae, Asteraceae, Euphorbiaceae, and Lamiaceae are among the largest families in the flora of Ethiopia and Eritrea containing 486, 440, 209, and 184 species, respectively [41–44].

3.2. Ailments Managed by Medicinal Plants. The medicinal plants documented by the present study were used for treating 38 human ailments (Table 3) and 12 livestock diseases (Table 4). Of the 74 medicinal plants used for treating human ailments, 17, 13, and 10 were used to treat gastrointestinal complaints, mich, and wound, respectively; while snake bite and devil’s illness were found to be treated by six medicinal plants each. Each of the remaining 33 human ailments was reported to be managed by four or fewer medicinal plants (Table 3). Diarrhea, mich, and wound were among the top ten diseases of major public health
Table 1: Medicinal plants used to treat human ailments.

| Scientific name | Local name | Voucher number | Habit  | Ailment treated | Plant part used | Preparation methods | Administration route | No. of informants |
|-----------------|------------|----------------|--------|-----------------|-----------------|---------------------|---------------------|-------------------|
| *Acacia abyssinica* Hochst. ex Benth. (Fabaceae) | Grar | AS-73-2017 | Tree | Allergy | Leaf | Pounding and then squeezing | Dermal | 11 |
| | | | | | | | | |
| | | | Broken bone | Root | Crushing | Dermal on the broken bone | 15 |
| *Acokanthera schimperi* (A.D.C.) Schweinf. (Apocynaceae) | Merez | AS-69-2017 | Tree | Itch | Stem bark | Pounding after mixing it with *A. sativum* and *Ruta chalepensis*, and then adding honey | Dermal | 12 |
| *Allium cepa* L. (Alliaceae) | Key shinkurt | AS-78-2017 | Herb | Stomach complaints | Bulb (leaf) | | Oral | 7 |
| | | | | Cough | Bulb (leaf) | Pounding or chewing | Oral | 8 |
| | | | | Headache | Bulb (leaf) | Pounding and chewing | Oral | 11 |
| | | | | Malaria | Bulb (leaf) | Pounding after mixing it with *Cicer arietinum* | Oral | 5 |
| | | | | Cough | Bulb (leaf) | Pounding or crushing and then mixing it with honey | Oral | 14 |
| | | | | Amoeba | Bulb (leaf) | Grinding and then mixing it with honey | Oral | 6 |
| | | | | Lung cancer/ tuberculosis | Bulb (leaf) | Grinding and then mixing it with honey | Oral | 4 |
| *Aloe* spp.(Aloaceae) | Eret | AS-29-2017 | Herb | Wound | Stem | Cutting to harvest the jelly juice | Dermal | 16 |
| | | | | Malaria | Stem | Cutting to harvest the jelly juice | Oral | 12 |
| | | | | Diarrhea | Root | Cutting to harvest the jelly juice | Oral | 13 |
| *Alternanthera pungens* Kunth (Amaranthaceae) | Yemeret Kitigne/get | AS-58-2017 | Herb | Wound | Leaf | Grinding or pounding | Dermal on the wounded part | 6 |
| *Argemone mexicana* L. (Papaveraceae) | Enkushashle | AS-57-2017 | Herb | Sore | Stem | Cutting to harvest the latex | Dermal on the affected part | 11 |
| *Artemisia absinthium* L. (Asteraceae) | Natra | AS-22-2017 | Herb | Uvula infection | Whole plant | Squeezing and producing juice | Oral | 4 |
| *Azadirachta indica* A. Juss. (Meliaceae) | Nim | AS-41-2017 | Tree | Cough | Leaf | Boiling in water after mixing it with *Eucalyptus globulus* | Inhalation (oral and nasal) | 10 |
| *Balanites aegyptiaca* (L.) Delile (Zygophyllaceae) | Bedena | AS-61-2017 | Tree | *Tinea nigra* | Leaf | Crushing | Dermal on the affected part | 5 |
| | | | | Stomach complaints | Fruit | Chewing | Oral | 7 |
| | | | | Bloody diarrhea | Leaf | Crushing to collect juice | Oral | 8 |
| *Brassica nigra* L. (Brassicaceae) | Senafich | — | Herb | Stomach complaints | Seed | Drying, then grinding after mixing it with *A. sativum* and *Vicia faba* | Oral | 6 |
| Scientific name                        | Local name | Voucher number | Habit          | Ailment treated          | Plant part used | Preparation methods                                      | Administration route | No. of informants |
|---------------------------------------|------------|----------------|----------------|--------------------------|-----------------|--------------------------------------------------------|----------------------|------------------|
| *Biancaea decapetala* (Roth) O. Deg.  | Kentefa    | AS-70-2017     | Shrub          | Evil eye                 | Leaf and root   | Pounding it after mixing it with *Ruta chalepensis*   | Oral                 | 8                |
| *Calotropis procera* (Aiton) W.T. Aiton (Apocynaceae) | Topia      | AS-48-2017     | Shrub          | Wart                     | Leaf            | Cutting to harvest the latex                          | Dermal on the affected part | 9                |
| *Carica papaya* L. (Caricaceae)       | Papaye     | AS-55-2017     | Herb           | Swelling on the skin     | Fruit, seeds    | Splitting                                              | Dermal on the swollen part | 8                |
| *Carissa spinarum* L. (Apocynaceae)   | Agam       | AS-30-2017     | Shrub          | Mental stress            | Root            | Boiling it in water                                   | Boiling it in water after mixing with *Croton macrostachyus* roots | 3                |
|                                         |            |                |                |                          |                 | Pounding after mixing with leaves of *Verbena officinalis* | Inhalation (oral and nasal) | 7                |
| *Caylusea abyssinica* (Fresen.) Fisch. & C.A. Mey. (Resedaceae) | Kibezelzil | AS-64-2017     | Herb           | Mich                     | Leaf            | Boiling it in water                                   | Inhalation (oral and nasal) | 15               |
| *Chenopodium murale* (L.) S. Fuentes, Uotila & Borsch (Amaranthaceae) | Amedmado   | AS-75-2017     | Herb           | Broken bone              | Leaf            | Crushing                                               | Dermal on the broken bone | 5                |
| *Citrus limon* (L.) Osbeck ( Rutaceae) | Habhab     | —              | Herb           | Hypertension             | Fruit           | Squeezing                                              | Oral                 | 4                |
|                                         |            |                |                | Stomach complaints       | Fruit           | Slicing                                                | Oral                 | 9                |
| *Clematis hirsuta* Perr. & Guill. (Ranunculaceae) | Chicho     | AS-67-2017     | Herb           | Cancer                   | Leaf            | Crushing                                               | Dermal on the affected part | 7                |
| *Clematis simensis* Fresen. (Ranunculaceae) | Azo hareg  | AS-36-2017     | Herb           | Cancer                   | Leaf            | Crushing                                               | Dermal on the affected part | 4                |
| *Coffea arabica* L. (Rubiaceae)        | Buna       | AS-46-2017     | Shrub          | Wound                    | Seed            | Roasting and pounding                                  | Dermal on wound       | 12               |
|                                         |            |                |                |                          |                 | Boiling in water after mixing with *Sorghum bicolor*, chewing | Oral                 | 6                |
| *Cordia africana* Lam. (Boraginaceae)  | Wanza      | AS-62-2017     | Tree           | Hepatitis/ jaundice      | Leaf            | Boiling it in water                                   | Inhalation (oral and nasal) | 8                |
|                                         |            |                |                | Mich                     | Leaf            | Boiling it in water                                   | Oral                 | 10               |
| *Croton macrostachyus* Hochst. ex Delile (Euphorbiaceae) | Mekenisa   | AS-19-2017     | Tree           | *Tinea nigra*            | Leaf            | Grinding or pounding                                   | Dermal on wound       | 4                |
|                                         |            |                |                | Mich                     | Leaf            | Boiling it in water                                   | Inhalation (oral and nasal) | 7                |
| *Cucumis dipsaceus* C.G. Ehrenb. ex Spach (Cucurbitaceae) | Yemdir embuay | AS-13-2017    | Herb           | Wound                    | Fruit           | Crushing                                               | Dermal on wound       | 10               |
| Scientific name                  | Local name | Voucher number | Habit | Ailment treated | Plant part used | Preparation methods | Administration route | No. of informants |
|---------------------------------|------------|----------------|-------|-----------------|-----------------|---------------------|----------------------|------------------|
| *Cynoglossum lanceolatum* Forssk. (Boraginaceae) | Yegid Zemedie | AS-17-2017 | Herb | Mich | Leaf | Squeezing | Dermal | 4 |
| *Datura stramonium* L. (Solanaceae) | Banjie | AS-24-2017 | Herb | Hemorrhoids | Leaf | Squeezing | Dermal | 6 |
| *Dyschoriste radicans* Nees (Acanthaceae) | Telba Titi | AS-21-2017 | Herb | Anthrax | Whole plant | Crushing | Dermal on the swollen part | 3 |
| *Eucalyptus globulus* Labill. (Myrtaceae) | Nech bahirzaf | AS-72-2017 | Tree | Common cold | Leaf | Boiling in water after mixing it with *Withania somnifera* | Inhalation (oral and nasal) | 14 |
| *Euclea divinorum* Hiern. (Ebenaceae) | Dedoho | AS-26-2017 | Shrub | Mental stress | Root | Boiling in water | Oral | 3 |
| *Euphorbia sp.* (Euphorbiaceae) | Qulqualda | AS-38-2017 | Shrub | Thorn inside the skin | Leaf | Cutting to harvest the latex | Dermal on the affected skin | 10 |
| *Euphorbia tirucalli* L. (Euphorbiaceae) | Kinchibt | AS-53-2017 | Shrub | Hemorrhoids | Stem | Cutting to harvest the latex | Dermal on the affected part | 3 |
| *Ficus palmata* Forsskål (Moraceae) | Beles | AS-16-2017 | Shrub | Wound | Leaf | Cutting the leaves and harvesting the latex | Dermal | 9 |
| *Gizotia abyssinica* (L.f.) Cass. (Asteraceae) | — | — | Herb | Gastritis | Seed | Pounding | Oral | 12 |
| *Hagenia abyssinica* Willd. (Rosaceae) | Kosso | — | Tree | Stomach distention | Root | Grinding and stirring the powder in tella (locally produced drink) | Oral | 16 |
| *Heliotropium cinerascens* A. DC. (Boraginaceae) | Nechilo | AS-39-2017 | Shrub | Mich | Leaf | Boiling it in water | Inhalation (oral and nasal) | 15 |
| *Hydnora johannis* Becc. (Hydnoraceae) | Demerech | AS-77-2017 | Herb | Wound | Root | Crushing | Dermal on the affected part | 7 |
| *Jasminum grandiflorum* L. (Oleaceae) | Tembelet | AS-14-2017 | Shrub | Snake bite | Leaf | Crushing and squeezing to collect juice | Oral | 6 |
| Scientific name | Local name | Voucher number | Habit | Ailment treated | Plant part used | Preparation methods | Administration route | No. of informants |
|-----------------|------------|----------------|-------|----------------|-----------------|---------------------|---------------------|------------------|
| *Juniperus procera* Hochst. ex Endl. (Cupressaceae) | Yehabeshatsid — | — Herb | Anthrax | Leaf | Drying and then pounding | Dermal | 3 |
| *Justicia schimperiana* (Hochst. ex Nees) T. Anders (Acanthaceae) | Simiza AS-34-2017 Shrub | Mental stress | Root | Boiling it in water | Dermal | 3 |
| *Lawsonia inermis* L. (Lythraceae) | Hina AS-54-2017 Shrub | Rheumatic disease | Root | Pounding it after mixing it with *Citrus limon* and adding water | Oral | 3 |
| *Lepidium sativum* L. (Brassicaceae) | Feto — | Herb | Stomach complaints | Seed | Chewing, Squeezing, Pounding | Oral | 15 |
| *Lawsonia inermis* L. (Lythraceae) | Hina AS-54-2017 Shrub | Rheumatic disease | Leaf | Crushing | Oral | 10 |
| *Malva parviflora* L. (Malvaceae) | Zebenya AS-12-2017 Herb | Diarrhea | Leaf | Squeezing | Oral | 14 |
| *Mangifera indica* L. (Anacardiaceae) | Aftegene AS-03-2017 Shrub | Mich | Leaf | Roasting | Oral | 12 |
| *Ocimum urticifolium* Roth (Lamiaceae) | Dema Kassie AS-42-2017 Shrub | Mich | Leaf | Pounding after mixing it with *Nigella sativa* and *A. sativum* | Oral | 8 |
| *Moringa stenopetala* (Baker f) Cufod. (Moringaceae) | Sheferaw AS-43-2017 Tree | Hypertension | Leaf | Drying and Pounding, and filtering it after adding water | Oral | 6 |
| *Musa paradisiaca* L. (Musaceae) | Muz — | Shrub | Rough skin | Fruit | Peeling to remove the skin | Dermal | 10 |
| *Myrsine africana* L. (Primulaceae) | Kechem AS-23-2017 Shrub | Tapeworm | Fruit | Crushing | Oral | 4 |
| *Nigella sativa* L. (Ranunculaceae) | Tikur Azmud — | Herb | Stomach complaints | Seed | Pounding after mixing it with *A. sativum*, *Ruta chalepensis*, and *A. cepa* and then adding lemon juice | Oral | 12 |
| *Ocimum urticifolium* Roth (Lamiaceae) | Dema Kassie AS-42-2017 Shrub | Mich | Leaf | Boiling in water after mixing it with *Withania somnifera* | Oral | 15 |
| *Olea europaea* L. subsp. *cuspidata* (Wall. & G. Don) Cif. (Oleaceae) | Weyra AS-49-2017 Tree | Uvula infection | Leaf | Pounding and then chewing | Oral | 9 |
| *Oxalis radicosa* A. Rich. (Oxalidaceae) | Shimburut AS-07-2017 Herb | Snake bite | Root | Crushing | Oral | 8 |
| Scientific name                          | Local name | Voucher number | Habit  | Ailment treated | Plant part used | Preparation methods | Administration route | No. of informants |
|-----------------------------------------|------------|----------------|--------|----------------|------------------|---------------------|---------------------|-------------------|
| *Phytolacca dodecandra* L’Hér. (Phytolaccaceae) | Mehan endod | AS-25-2017     | Shrub  | Snake bite     | Root             | Chewing            | Oral                | 4                 |
| *Plectranthus spp.* (Lamiaceae)           | Tezeteza    | AS-20-2017     | Herb   | Bleeding       | Leaf             | Crushing            | Nasal (smelling)   | 8                 |
| *Rhamnus prinoides* L’Hér. (Rhamnaceae)   | Gesho       | AS-33-2017     | Shrub  | Tonsillitis    | Leaf             | Squeezing or chewing | Oral               | 14                |
|                                           |             |                |        | Uvula infection| Leaf             | Squeezing to produce juice | Oral               | 7                 |
|                                           |             |                |        |                |                  | Pounding after mixing it with | Oral               | 7                 |
|                                           |             |                |        |                |                  | *Withania somnifera* and squeezing | Oral               | 7                 |
| *Ricinus communis* L. (Euphorbiaceae)     | Gulo        | AS-47-2017     | Shrub  | Devil’s illness| Leaf             | Oral                | 10                  |
| *Rumex abyssinicus* Jacq. (Polygonaceae)   | Moqmoqo     | —              | Shrub  | Common cold    | Root             | Burning             | Fumigation (oral and nasal) | 15                |
| *Rumex nervosus* Vahl (Polygonaceae)       | Embacho     | AS-31-2017     | Shrub  | Mental stress  | Root             | Boiling it in water | Dermal              | 7                 |
| *Ruta chalepensis* L. (Rutaceae)          | Tena Adam   | AS-32-2017     | Herb   | Asthma         | Leaf             | Adding it into a boiled tea/coffee | Oral               | 12                |
|                                           |             |                |        |                |                  | Pounding or crushing | Oral               | 3                 |
|                                           |             |                |        |                |                  | Crushing | Oral               | 12                |
|                                           |             |                |        |                |                  | Unprocessed | Oral               | 11                |
|                                           |             |                |        |                |                  | Boiling it in water after mixing it with | Oral               | 15                |
|                                           |             |                |        |                |                  | *Psychotria* sp. | Inhalation (oral and nasal) | 15                |
| *Schinus molle* L. (Anacardiaceae)        | Qundo berberie | AS-60-2017 | Tree   | Mich           | Leaf             | Grinding           | Oral                | 7                 |
| *Sida schimperiana* Hochst. ex A. Rich. (Malvaceae) | Chifrig      | AS-05-2017     | Shrub  | Toothache      | Leaf             | Oral                | 8                  |
| *Silene macrosolen* A. Rich. (Caryophyllaceae) | Wegert      | —              | Shrub  | Devil’s illness| Root             | Putting it on fire to produce smoke | Fumigation (oral and nasal) | 8                 |
| *Solanum marginatum* L.f. (Solanaceae)     | Embuay      | AS-02-2017     | Shrub  | Stomach illness| Root             | Pounding by mixing it with root of *Tragia* sp. | Oral               | 6                 |
| *Terminalia brownii* Fresen. (Combretaceae) | Inkoy       | AS-65-2017     | Shrub  | Uvula infection| Leaf             | Squeezing           | Oral               | 9                 |
| *Tragia spp.* (Euphorbiaceae)              | Awl alit    | AS-11-2017     | Herb   | Wound          | Leaf             | Crushing            | Oral               | 9                 |
| *Trigonella foenum-graecum* L. (Fabaceae)  | Abish       | —              | Herb   | Evil eye       | Root             | Grinding or pounding | Dermal             | 6                 |
|                                           |             |                |        |                |                  | Crushing and adding it on fire | Dermal             | 6                 |
|                                           |             |                |        |                |                  | Gridding or pounding | Dermal             | 10                |
| *Verbascum sinaiticum* Benth. (Scrophulariaceae) | Yejib Chama | AS-06-2017     | Herb   | Mental stress  | Root             | Squeezing and boiling it in water | Dermal             | 5                 |
|                                           |             |                |        |                |                  | Uterus retention | Nasal               | 7                 |

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| Scientific name                          | Local name | Voucher number | Habit  | Ailment treated | Plant part used | Preparation methods | Administration route | No. of informants |
|-----------------------------------------|------------|----------------|--------|----------------|------------------|---------------------|---------------------|-------------------|
| *Sida schimperiana* Hochst. ex A. Rich. (Malvaceae) | Chifrig      | AS-05-2017     | Shrub  | Toothache      | Leaf             | Oral                | 7                  |
| *Silene macrosolen* A. Rich. (Caryophyllaceae) | Wegert      | —              | Shrub  | Devil’s illness| Root             | Oral                | 8                  |
| *Solanum marginatum* L.f. (Solanaceae)     | Embuay      | AS-02-2017     | Shrub  | Stomach illness| Root             | Oral                | 6                  |
| *Terminalia brownii* Fresen. (Combretaceae) | Inkoy       | AS-65-2017     | Shrub  | Uvula infection| Leaf             | Oral                | 9                  |
| *Tragia spp.* (Euphorbiaceae)              | Awl alit    | AS-11-2017     | Herb   | Wound          | Leaf             | Oral                | 9                  |
| *Trigonella foenum-graecum* L. (Fabaceae)  | Abish       | —              | Herb   | Evil eye       | Root             | Oral                | 6                  |
| *Verbascum sinaiticum* Benth. (Scrophulariaceae) | Yejib Chama | AS-06-2017     | Herb   | Mental stress  | Root             | Oral                | 5                  |

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Table 1: Continued.
Table 1: Continued.

| Scientific name                                      | Local name     | Voucher number | Habit  | Ailment treated                          | Plant part used | Preparation methods                          | Administration route | No. of informants |
|------------------------------------------------------|----------------|----------------|--------|------------------------------------------|-----------------|---------------------------------------------|----------------------|-------------------|
| *Vicia faba* L. (Fabaceae)                           | Bakela — Herb  | —              | Herb   | Swelling on skin                         | Seed            | Grinding or pounding                        | Dermal               | 15                |
| *Vitis vinifera* Linn. (Vitaceae)                    | Wein — Tree    | AS-35-2017     | Shrub  | Eye diseases (dirt)                      | Seed            | Pounding and then squeezing                 | Ocular               | 5                 |
| *Withania somnifera* (L.) Dunal (Solanaceae)         | Gizewa         |                | Shrub  | Mich                                     | Root            | Drying and pounding                        | Oral                 | 12                |
| *Zehneria scabra* (L.f.) Sond. (Cucurbitaceae)       | Hareg resa —   | AS-45-2017     | Herb   | Evil disease                              | Leaf            | Boiling it in water                         | Oral and nasal       | 12                |
| *Zingiber officinal* (Zingiberaceae)                 | Zingible — Herb|                | Herb   | Tonsillitis                              | Rhizome (stem)  | Chewing                                    | Oral                 | 6                 |
| *Ziziphus spina-christi* (Rhamnaceae)                | Qunqura         | AS-52-2017     | Tree   | Devil’s illness                          | Leaf            | Pounding and then squeezing                 | Oral                 | 7                 |
|                                                      |                |                |        | Dandruff                                 | Leaf            | Boiling after adding water and then squeezing | Dermal on the affected part | 13                |

Table 2: Medicinal plants used to treat livestock ailments.

| Scientific name                                      | Local name     | Voucher number | Habit  | Ailment treated                          | Plant part used | Preparation method                          | Administration route  | No. of informants |
|------------------------------------------------------|----------------|----------------|--------|------------------------------------------|-----------------|---------------------------------------------|-----------------------|-------------------|
| *Acacia* spp. (Fabaceae)                             | Doret AS-28-2017 | Shrub          | Wound  | Eye infection                            | Leaf            | Crushing                                    | Dermal                | 7                 |
| *Bidens prestitaria* (Sch. Bip.) Desc. ex A. Rich. | Chigogot       | AS-18-2017     | Herb   | Insect bite                              | Leaf            | Pounding to produce juice                   | Dermal                | 6                 |
| *Calpurnia aurea* (Aiton) Benth. (Fabaceae)          | Digitas        | AS-04-2017     | Herb   | Mange                                    | Leaf            | Crushing                                    | Dermal                | 10                |
| *Chenopodium ambrosioides L.* (Chenopodiaceae)       | Sinign         | AS-09-2017     | Herb   | Chicken flea                             | Root            | Putting it on fire                          | Fumigating the house | 4                 |
| *Cissus quadrangularis* L. (Vitaceae)                | Kimtita         | AS-44-2017     | Herb   | Mange                                    | Whole plant     | Crushing                                    | Dermal                | 11                |
| *Cyphostemma adenoacaule* (Steud. ex A. Rich. Desc. ex Wild & R.B. Drumm. (Vitaceae) | Abawoldu       | AS-10-2017     | Herb   | Leech infestation                        | Root            | Crushing                                    | Oral                  | 13                |
| *Dodonaea angustifolia* L.f. (Sapindaceae)           | Kitkita         | AS-50-2017     | Shrub  | Bone dislocation                         | Leaf            | Crushing and pounding                       | Dermal                | 4                 |
| *Echinops kebericho* Mesfin (Asteraceae)             | Kebercho — Herb | AS-30-2017     | Herb   | Anthrax                                  | Root            | Grinding to yield juice                     | Oral                  | 10                |
| *Echinops spp.* (Asteraceae)                         | Kushelie        | AS-27-2017     | Shrub  | Bone dislocation                         | Root            | Unprocessed                                 | Dermal (tie it on the dislocated bone) | 14                |
| *Ficus vasta* Forsk. (Moraceae)                      | Warka AS-74-2017 | Tree           | Thrips | Stem bark                                | Pounding and boiling in water | Oral | 7 |
| *Kalanchoe marmorata* Bak. (Crassulaceae)            | Endahul         | AS-01-2017     | Herb   | Cancer                                   | Root            | Crushing                                    | Dermal                | 4                 |
| Scientific name                                           | Local name | Voucher number | Habit | Ailment treated | Plant part used | Preparation method                                      | Administration route | No. of informants |
|-----------------------------------------------------------|------------|----------------|-------|----------------|----------------|--------------------------------------------------------|----------------------|-------------------|
| *Lycopersicon esculentum* Mill. (Solanaceae)              | Timatim    | —              | Herb  | Leech infestation | Leaf           | Pounding after adding water                            | Oral and nasal       | 14                |
| *Maytenus senegalensis* (Lam.) Exell (Celastraceae)       | Qoqoba     | AS-71-2017     | Shrub | Insect bite     | Leaf           | Crushing it to yield juice                            | Dermal               | 10                |
| *Nicotiana tabacum* L. (Solanaceae)                       | Timbaho    | AS-15-2017     | Shrub | Leech infestation | Leaf           | Pounding after adding water                            | Oral and nasal       | 8                 |
| *Otostegia integrifolia* Benth. (Lamiaceae)               | Tunjut     | AS-68-2017     | Shrub | Wound           | Leaf           | Crushing                                              | Dermal on the wound  | 10                |
| *Portulaca oleracea* L. (Portulacaceae)                   | Antaria    | AS-63-2017     | Herb  | Bone dislocation | Root           | Boiling it in water                                   | Dermal on the dislocated bone | 10                |
| *Ximenia americana* L. (Olacaceae)                        | Ikma       | AS-66-2017     | Shrub | Emaciation      | Stem bark      | Boiling it in water                                   | Oral                 | 6                 |

**Figure 2: Continued.**
Figure 2: Some medicinal plants of Raya Kobo. (a) Antaria (*Portulaca oleracea*); (b) kinchibt (*Euphorbia tirucalli*); (c) qulqualda (*Euphorbia spp.*); (d) embuay (*Cucumis dipsaceus*); (e) yegid zemedie (*Cynoglossum lanceolatum*); and (f) simiza (*Justicia schimperiana*).

| SN | Ailment treated                     | No. of medicinal plants used |
|----|-------------------------------------|------------------------------|
| 1  | Gastrointestinal complaints         | 17                           |
| 2  | Mich (febrile illness)              | 13                           |
| 3  | Wound                              | 10                           |
| 4  | Snake bite                          | 6                            |
| 5  | Devil’s illness                     | 6                            |
| 6  | Mental stress                       | 5                            |
| 7  | Dislocated/broken bone              | 5                            |
| 8  | Cough                               | 5                            |
| 9  | Evil eye                            | 5                            |
| 10 | Common cold                         | 4                            |
| 11 | Uvula infection                     | 4                            |
| 12 | Tinea nigra                         | 3                            |
| 13 | Jaundice                            | 3                            |
| 14 | Cancer                              | 3                            |
| 15 | Hemorrhoids                         | 2                            |
| 16 | Swelling on the skin                | 2                            |
| 17 | Malaria                             | 2                            |
| 18 | Tonsillitis                         | 2                            |
| 19 | Wart                                | 2                            |
| 20 | Asthma                              | 2                            |
| 21 | Allergy                             | 1                            |
| 22 | Thorn inside the skin               | 1                            |
| 23 | Toothache                           | 1                            |
| 24 | Hypertension                        | 1                            |
| 25 | Anthrax                             | 1                            |
| 26 | Hepatitis                           | 1                            |
| 27 | Headache                            | 1                            |
| 28 | Itch                                | 1                            |
| 29 | Bleeding                            | 1                            |
| 30 | Dandruff                            | 1                            |
| 31 | Erectile dysfunction                | 1                            |
| 32 | Joint ache                          | 1                            |
| 33 | Black spider bite                   | 1                            |
| 34 | Eye disease                         | 1                            |
| 35 | Lung disease                        | 1                            |
| 36 | Rough skin                          | 1                            |
| 37 | Stroke                              | 1                            |
| 38 | Uterus retention                    | 1                            |
importance in the study district [34]. Mich is a local term used by traditional medicine practitioners for human ail-
ment mainly characterized by fever, headache, and sore lips but not well-understood and recognized by modern healthcare practitioners. The fact that relatively high number of medicinal plants is used for treating mich in the district could be an indication of the high health importance of the ailment and the lack of effective treatment against it in modern medicine.

Of the 17 medicinal plants used for treating livestock diseases, three medicinal plants were used to treat dislocated/broken bones and three more to treat leech infestation. Likewise, mange, insect bites, and wound are treated by two medicinal plants each; while the remaining seven ailments are treated by one medicinal plant each (Table 4). According to an unpublished 2019 local government data, mange and anthrax were reported as the top two of the eight diseases of veterinary importance in the district [34].

### 3.3. Plant Parts Used and Methods of Remedy Preparation and Administration

Leaves were the most commonly used plant parts in the preparation of remedies in Raya Kobo accounting for 53.1% of the total preparations, followed by roots (21.8%) and fruits and seeds (12.9%) (Figure 3). Ethnobotanical studies carried out elsewhere in Ethiopia [20, 38, 40, 45] also reported that leaves are the most widely used parts in the preparation of plant remedies. The wide use of leaves in the preparations of plant remedies may be attributed to the fact that leaves are much easier to process quickly as compared to other plant parts. Collection of leaves does not pose a great danger to the survival of individual plants as compared to the collection of underground parts, stems, and whole plants. Removal of up to 50% of leaves of plants does not significantly affect their growth [36]. Contrary to ours, studies conducted in other places of Ethiopia [46, 47] observed roots as the most widely used plant parts in preparing traditional remedies. Harvesting roots, if not performed carefully, may cause detrimental effects on the plants that could ultimately bring about their disappearance or extinction from their natural habitats [6, 48].

The preparation methods of plant remedies in the study district were diverse. The most commonly used methods were grinding/pounding (23.7%), crushing (19.8%), boiling (14.5%), chewing (10.7%), squeezing (8.4%), and cutting and bleeding (6.9%) (Table 5). Similar studies conducted in the country by Girmay and Teshome [49], Amenu [40], and Hunde et al. [47] reported crushing, grinding, or pounding as the most common methods of preparation of plant remedies. But Luleka et al. [46] reported boiling as the most frequently used method of remedy preparation in Mana Angetu district of Oromia State of Ethiopia. Choice of preparation methods may be influenced by the types and diversity of medicinal plants as well as the cultural background of the communities practicing traditional medicine.

Analysis of the routes of administration revealed that the majority of the plant remedies were given orally (53.7%), followed by those applied dermally (or topically) (28.9%) (Figure 4). Similar observations were reported by many

### Table 4: Livestock diseases and the corresponding number of medicinal plants used for their treatments.

| SN | Ailment treated                  | No. of medicinal plants used |
|----|---------------------------------|------------------------------|
| 1  | Dislocated/broken bone          | 3                            |
| 2  | Leech infestation               | 3                            |
| 3  | Mange                           | 2                            |
| 4  | Insects bites                   | 2                            |
| 5  | Wound                           | 2                            |
| 6  | Anthrax                         | 1                            |
| 7  | Cancer                          | 1                            |
| 8  | Eye infection                   | 1                            |
| 9  | Thrips                          | 1                            |
| 10 | Flea infestation                | 1                            |
| 11 | Ear disease                     | 1                            |
| 12 | Emaciation                      | 1                            |

### Table 5: Remedy preparation methods in Raya Kobo district.

| SN | Remedy preparation method       | Number of preparations | Percentage |
|----|---------------------------------|------------------------|------------|
| 1  | Grinding/pounding               | 31                     | 23.7       |
| 2  | Crushing                        | 26                     | 19.8       |
| 3  | Boiling                         | 19                     | 14.5       |
| 4  | Chewing                         | 14                     | 10.7       |
| 5  | Squeezing                       | 11                     | 8.4        |
| 6  | Cutting and bleeding            | 9                      | 6.9        |
| 7  | Pounding and squeezing          | 4                      | 3.1        |
| 8  | Burning                         | 3                      | 2.3        |
| 9  | Squeezing and boiling           | 2                      | 1.5        |
| 10 | Roasting and pounding           | 2                      | 1.5        |
| 11 | Pounding and chewing            | 2                      | 1.5        |
| 12 | Splitting and slicing           | 2                      | 1.5        |
| 13 | Crushing and squeezing          | 1                      | 0.8        |
| 14 | Roasting                        | 1                      | 0.8        |
| 15 | Crushing and burning            | 1                      | 0.8        |
| 16 | Pounding and boiling            | 1                      | 0.8        |
| 17 | Peeling                         | 1                      | 0.8        |
| 18 | Unprocessed                     | 1                      | 0.8        |
|    | Total                           | 131                    | 100        |
studies carried out in other parts of Ethiopia [14, 38, 46, 49–53]. Ashagre [54] reported that both oral and dermal routes permit the quick physiological reaction of remedies to the causative agents of diseases to increase curative power. In the present study, informants affirmed that they advise their patients to be cautious during and after application of remedies depending on the types of ailments treated. For instance, in some cases, patients were restricted from drinking milk and local alcoholic drinks (e.g., tella and tej), eating meat and eggs, and having sexual intercourse as such practices are believed to interfere with the curative powers of the remedies.

3.4. Habitats and Abundance of and Threats to Medicinal Plants. Analysis of interview data revealed that majority (52.2%) of the plants used in the traditional medicinal practices of the people in the study district were harvested only from the wild, while some are harvested from home gardens and cultivated fields (Table 6). Adefa and Getaneh [38], Adefa and Abraha [14], and Amenu [40] reported similar findings in their studies conducted in the Ethiopian districts of Chencha, Tehuledere, and Chelya, respectively. Tanto et al. [55] also reported that most Ethiopian medicinal plants are harvested from the wild. According to Mander et al. [56], 56,000 tons of medicinal plants are utilized in Ethiopia annually, of which 87% is obtained from the wild. Field observations made by the present investigators revealed that there was very little effort in Raya Kobo to conserve medicinal plants. Only few medicinal plants including Carica papaya, Ocimum ursicifolium, and Rhamnus prinoides used in treating gastric problems, mich, and infection of uvula, respectively, were purposely grown in some home gardens or cultivated fields. These indicate that the medicinal flora in the study district is under big threat due to extensive environmental degradation. According to Leta [57], deforestation and overgrazing are serious problems in Raya Kobo and other north Ethiopian places.

Of the total informants interviewed, majority (51.3%) of them attested that most of the medicinal plants were either difficult or very difficult to find, while 48.7% of them claimed that most of the medicinal plants were easy to find in the immediate environment. According to them, deforestation (49.3%), draught (22%), and overgrazing (14%) are the main factors for the depletion of medicinal plants in their places (Table 7). Most of the informants reported that they kept their knowledge of medicinal plants as secret with limited willingness to share with the younger generation. The limited interest of practitioners of traditional medicine in passing over their knowledge on medicinal plants to the younger generation is considered as another threat to the continuation of the practice in the study area. Other studies conducted elsewhere in the country also reported secrecy as a problem responsible for the loss of traditional medicinal knowledge and practices and the associated medicinal plants [20, 46, 48, 58].

Informants claimed that environmental protection/rehabilitation (60%), cultivation of medicinal plants in home gardens (14%), reforestation (10%), and demarcation of grazing lands (9.3%) are the main measures that can help in the conservation of medicinal plants in the district (Table 8). They also revealed that there were few medicinal plants that were intentionally managed in home gardens and crop fields but primarily for other purposes such as food, fodder, spice, live fence, and shade. The investigators observed that there were efforts by some traditional medical practitioners to grow/cultivate medicinal plants, which were also used as sources of food and spices, in their home gardens and crop fields. According to Asfaw [59], of the medicinal plants managed in home gardens, only 6% is cultivated for medicinal uses only. The present investigators observed that annual reforestation programs in the study district mainly focused on exotic and few indigenous plants with very limited attention to plants of medicinal values.

3.5. Sources of Traditional Medicinal Knowledge. Informants of this study who have participated in the interviews claimed that they acquired knowledge of medicinal plants from different sources including family members (61.3%), friends/acquaintances (14%), and traditional healers (Table 9). A study carried out in Gimbi district, western Wollega zone of Ethiopia, reported that great majority of informants (91%) cited parents as their sources...
of knowledge of traditional medicinal plants [60]. Other researchers have also reported similar findings elsewhere in Ethiopia [40, 61–65]. These observations imply that initiatives that promote the sharing of such knowledge have to be encouraged.

3.6. Acceptance of Medicinal Plant Remedies. This study revealed that treatment with medicinal plants was highly accepted in Raya Kobo because of the belief that medicinal plants were efficacious in managing different ailments. Most informants (72.7%) reported that medicinal plants are more effective as compared to modern drugs. Some informants (14.7%) claimed that there were ailments that could only be treated using medicinal plants and not with modern medications (Table 10). It is a well-known fact that traditional medicine is still recognized in different parts of the world as the preferred means to manage different ailments. Estimates show that about 80% of the Ethiopian population is still dependent on traditional medicine, which essentially involves the use of medicinal plants [4].

3.7. Preference Ranking of Medicinal Plants Used for Treating Mich. Analysis of preference ranking conducted on eight medicinal plants used for treating mich (febrile illness) in the study district revealed that Ocimum urticifolium is the most preferred plant, followed by Withania somnifera and Zehneria scabra (Table 11). Mich is an ailment in the district against which the highest number of medicinal plants was reported by the informants. Many other studies have showed that Ocimum urticifolium is widely used in Ethiopia for treating mich and other febrile illnesses [10, 48, 66–71]. A related species, Ocimum lamiifolium, is also widely employed in different parts of the country to treat mich and similar ailments [6, 10, 13, 72, 73]. The common use of Ocimum urticifolium and related species may imply the potency of species of the genus Ocimum in treating mich and febrile illnesses. Furthermore, studies conducted on medicinal properties of extracts of different Ocimum species showed their antipyretic properties [74–77]. Withania somnifera [10, 16, 26, 48, 78] and Zehneria scabra [8, 16, 24, 26, 79, 80] are also widely reported to be effective in treating febrile-like illnesses.

3.8. Comparison of Knowledge of Medicinal Plants among Different Groups. Comparison of knowledge of medicinal plants of the respondents across ages—in terms of number of remedies they reported—showed a strong correlation ($n = 150; r = 0.709; p < 0.01$) (Table 12); as age increased, knowledge of medicinal plants increased. Moreover, comparisons among age groups in regard to their knowledge of medicinal plants using one-way ANOVA showed a statistically significant difference ($F = 74.22; p \leq 0.05$) implying that older informants have accumulated more knowledge and experience in the study district. This finding is in agreement with results of other ethnobotanical investigations carried out elsewhere in the country [14, 62, 65, 72]. The low interest of the younger generation towards traditional medicine and medicinal plants may be influenced by the expansion of modern education and acculturation. On the other hand, results of studies by Yineger and Yewhalaw [45] and Adefa and Getaneh [38] have demonstrated the absence of correlation between the number of medicinal plant reported and the age of informants.

### Table 7: Reasons for depletion of medicinal plants in Raya Kobo district as reported by informants.

| SN | Reasons for depletion of medicinal plants | Number of informants | Percentage |
|----|----------------------------------------|----------------------|------------|
| 1  | Deforestation                          | 74                   | 49.3       |
| 2  | Drought                                | 33                   | 22.0       |
| 3  | Over-grazing                           | 21                   | 14.0       |
| 4  | Over-exploitation                      | 8                    | 5.3        |
| 5  | Firewood collection                    | 8                    | 5.3        |
| 6  | Environmental degradation              | 3                    | 2.0        |
| 7  | Other factors                          | 3                    | 2.0        |
|    | Total                                  | 150                  | 100.0      |

### Table 8: Ways of conserving medicinal plants in Raya Kobo district.

| SN | Conservation activity                  | Percentage |
|----|---------------------------------------|------------|
| 1  | Environmental protection/rehabilitation| 60.0       |
| 2  | Cultivation in home gardens           | 14.0       |
| 3  | Reforestation                         | 10.0       |
| 4  | Isolation of grazing lands            | 9.3        |
| 5  | Cultivation on agricultural plots     | 5.3        |
| 6  | Construction of check dams            | 1.3        |
|    | Total                                  | 100.0      |

### Table 9: Sources of traditional knowledge on medicinal plants in Raya Kobo district.

| SN | Sources of knowledge                  | Frequency | Percentage |
|----|---------------------------------------|-----------|------------|
| 1  | Family members                        | 92        | 61.3       |
| 2  | Friends/acquaintances                 | 21        | 14.0       |
| 3  | Traditional healers                  | 17        | 11.3       |
| 4  | Books                                 | 7         | 4.7        |
| 5  | Observation                           | 6         | 4.0        |
| 6  | Relatives                             | 5         | 3.3        |
| 7  | Modern health practitioners           | 1         | 0.7        |
| 8  | Others                                | 1         | 0.7        |
|    | Total                                 | 150       | 100.0      |
However, there was no significance difference in the knowledge of medicinal plants expressed in terms of mean number of prescriptions of medicinal plants reported between men and women ($d = 149; F = 0.073; p > 0.05$). Men informants ($n = 75$) reported 617 prescriptions (mean = 8.2), while women informants ($n = 75$) reported 620 prescriptions (mean = 8.3). Similar finding was reported by Alemayehu et al. [20] in a study conducted in Minjar-Shenkor district of the Amhara State of Ethiopia. Interview results of the present study also indicated that traditional knowledge was transferred within the family without special preference to either sex.

3.9. Status of Knowledge of Medicinal Plants in Raya Kobo.

Of the 150 informants participated in the present study, 83 (55.3%) rated themselves as having low level of knowledge of medicinal plants, while 59 (39.3%) rated themselves as having medium level of knowledge. Only eight (5.4%) informants considered themselves as having high level of knowledge of medicinal plants (Table 13). Of the 56 illiterate informants participated in the study, 5 (9%) of them reported that they have high level of knowledge of medicinal plants.
and only 3 (5%) of the 62 informants with informal education claimed to have high level of knowledge. However, none of the 32 informants with formal education claimed to have high level of knowledge of medicinal plants. This may be taken as an indication that the number of people with high level of knowledge of medicinal plants in the district is dwindling due to the influence of formal education, acculturation, and expansion of modern healthcare services.

4. Conclusion

The result of this study showed the existence of rich traditional knowledge in Raya Kobo district on the use of medicinal plants for treating many human and livestock ailments. Since herbal preparations are cheaper and are believed to be more effective, the majority of people in the district still give priority to visit traditional healers to seek treatments for themselves and for their families and livestock. Many of the plants used for traditional remedies are collected from the wild. The observation that majority of the remedies are prepared from leaves imply that ethnomedical and ethnoveterinary practices in the study area do not cause the depletion of plant biodiversity. Mich, the most common ailment in the study district, is treated or managed by the highest number of medicinal plants. The preference ranking conducted on eight medicinal plants used for treating this ailment showed that Ocimum utricifolium is the most preferred plant. These observations are important indications of the high potency of the plant against the disease to call for prioritized scientific investigation. Generally speaking, extensive documentation of ethnomedical and ethnoveterinary knowledge has to be pursued in the study district and neighboring regions before it is too late.

Data Availability

The data used to support this study are available from the corresponding author upon request.

Ethical Approval

The proposal was reviewed and approved by the Ethical Review Board (IRB) of Department of Biology, College of Natural and Computational Sciences, Mekelle University.

Consent

Oral informed consent was also obtained from people who participated in the study.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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