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Traditional Medicine Practices of Guji Semi-Pastoralist People to Treat Livestock Ailments in Suro Barguda District, West Guji Zone, Ethiopia

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ABSTRACT

The objectives of this research were to identify and analyze ethnoveterinary medicinal plants and their associated indigenous knowledge, including their preparation and application by traditional healers and the status of their conservation by Guji Semi-Pastoralist People of Suro Barguda District, West Guji Zone, Oromia Regional State, Ethiopia. Forty-six ethnoveterinary medicinal plant species representing 43 genera and 29 families were identified in the district. Approximately 26.1% of the families were represented by more than one species. The highest number of species was recorded for Asteraceae (5 species), followed by Euphorbiaceae (4 species), and most ethnoveterinary medicines were prepared from herbs and shrubs rather than other growth forms. Chopping the remedial parts and homogenizing them with cold water was found to be the major mode of remedy preparation. All documented ethnoveterinary plant species were harvested from the wild, and approximately 4.4% of the ethnoveterinary medicinal plants in the study area were endemic to Ethiopia. This study indicated that the study area encompasses different species of ethnoveterinary medicinal plants that should be given conservation priority, and the local community depends largely on these plants for the treatment of different livestock ailments, although the healers had a very high intention to keep their traditional knowledge secret. The indigenous knowledge of pastoralists about plants and breeding different species of livestock, as well as their environmental management systems (traditional forest, soil, and water conservation systems), should be incorporated into the planning and implementation of developmental interventions.

Keywords: Indigenous Knowledge; Livestock Ailments; Plants.

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SIGNIFICANCE STATEMENT

This study plays a part in disclosing information about which plant species are used in treating different livestock diseases that are rich resources of ingredients that can be used in drug development, either pharmacopoeial, nonpharmacopoeial, or synthetic drugs. It also allows us to know complex, dynamic interactions between human and natural systems and enhances our intellectual merit concerning solving community problems.

INTRODUCTION

Ethnoveterinary research (one of the newest directions in ethnobiology) is not more than a decade old. Ethnoveterinary animal health care has existed alongside human evolutionary history, taking many different forms. It comprises all ethnopractices approaches and traditional knowledge applied by humans to alleviate health constraints afflicting their livestock and hence improve their production and performance. This may take the form of herbalism, spiritualism, ethnoepidemiological knowledge on livestock vectors, pathogens, hosts, and diseases, and traditional 'institutions' and ecosystems in which this knowledge exists (Martin et al. 2001; Mathias 2004). Ethiopia has the highest number of livestock in Africa, and the country is listed among the top 10 countries in the continent known for their livestock wealth (FAO 2019). Livestock is an integral part of agriculture, accounting for approximately 47 percent of the total value of agricultural production and supporting the livelihoods of a large share of the population in Ethiopia (FAO and IGAD 2019). The national herd comprises 59.48 million cattle, 30.7 million sheep, 30.2 million goats, and 59.49 million chickens, as well as camels, equines, and a small number of pigs (FAO and IGAD 2019). Due to technical, economic, and institutional constraints, livestock productivity is generally low. Beyond providing food and other goods and services to the population, the livestock sector is a major contributor to export earnings, mainly through the export of live cattle and small ruminants. It is estimated that Ethiopian livestock contribute approximately 10 percent to total export earnings, of which 69 percent are accounted for by live animal exports (FAO 2019). Despite this large number of livestock and its important economic potential, the sector has still not developed beyond a subsistence type of undertaking, whereas it also remains with low outputs for different reasons, of which animal diseases are among the top factors (Dinesh 2007). Animal health could be managed traditionally through ethnoveterinary medicine practices, which are a mode of identifying, using, and integrating local knowledge, related skills, and customs procedures created by people to preserve the health and welfare of working and productive animals (Jarakabande 2002).

The ethnoveterinary systems are socioecological units and ethnic community-specifics, and therefore, the characteristics, sophistication, and intensity of these practices differ greatly among individuals, societies, and regions. However, these ethnoveterinary systems are facing the threat of rapid erosion because of rapid socioeconomic, environmental, and technological changes (McCorkle 1995). Even though indigenous knowledge systems are rapidly disappearing under the influence of Western culture, 80% of the world's population exclusively relies on traditional medicine (WHO 2002). More than 80% of the human population and 90% of the livestock in Ethiopia depend on traditional medicine (Thomas 2008). The persistence of ethnoveterinary healthcare in Ethiopia is related to the high cost of treatment using modern veterinary drugs and the prohibitive distance of veterinary stations from rural areas (Sori et al. 2004). Elderly community members with this knowledge were dying, and the introduction of modern practices made it difficult for the younger generations to appreciate and use the beliefs and practices of their ancestors (Ngeh et al. 2007), and it has not yet been well documented, promoted, conserved and much effort is needed in research and integration of activities in the country. There is a wide gap in the knowledge about ethnoveterinary data and information from various parts of Ethiopia, although the country has rich and diverse ethnolinguistic groups throughout the country. Ethnoveterinary medicine is community-based indigenous knowledge and methods of caring for, healing, and managing livestock. Ethnoveterinary medicine is a scientific term for traditional animal health management that encompasses the knowledge, skills, methods, practices, and beliefs about animal health care found among community members (McCorkle 1998). This knowledge is based on close observation of animals or the oral transmission of experience from one generation to the next (Mathias and McCorkle 2004). This rich repository of local knowledge about almost all aspects of livestock care is inherent in most of the indigenous communities and pastorals. Ethnoveterinary medicine could be a key veterinary resource and could add useful new drugs to the pharmacopeia, and it can contribute to biodiversity conservation (Tabuti et al. 2003). Ethnoveterinary medicine is more environmentally friendly and often more socioculturally acceptable and very suitable for use with smallholdings by livestock keepers who can prepare the traditional remedies themselves (McCorkle 1998). The extent of knowledge and utilization of ethnoveterinary medicine differ according to the culture and prevailing socioeconomic characteristics (Mahima et al. 2012). Many indigenous veterinary beliefs and practices continue to function in a wide majority of livestock raisers, particularly in developing countries (Kubkomawa et al. 2013). Ethnoveterinary practices have been developed by trial and error and by actual experimentation (Mesfin et al. 2016). Ethnoveterinary medicine comprises traditional surgical techniques, traditional immunization, magico-religious practices, and the use of herbal medicines to treat livestock diseases (Fekadu 2010; Tafesse and Mekonen 2001). It also provides traditional medicines to livestock, which are locally

available and usually cheaper than standard treatments. Livestock holders can prepare and use homemade remedies at a minimum expense. The knowledge of ethnomedicinal plants is on the edge of irreversible loss and declining to deterioration due to the oral passage of herbal heritage from generation to generation rather than in written form, despite their vital role in providing health for the human and livestock population (Fekadu 2010; Tafesse and Mekonen 2001). Environmental degradation, agricultural expansion, cultivation of marginal lands, and urbanization are also posing a significant threat to the future wellbeing of human and animal populations that have relied on these resources to combat various ailments for generations (Giday et al. 2009; Tessema et al. 2003; Yibrah 2015), deserving the urgent need to document and preserve indigenous knowledge. Since ethnoveterinary research is one of the newest directions (not more than a decade old) in the field of ethnobiology, this original research will add certain value to the database of ethnobiology and conservation issues. The study was carried out by using appropriate research questions to gather information about ethnoveterinary medicinal plants and traditional knowledge in treating different livestock ailments following the correct ethnobotanical data collection and data analysis methods in a place where such a type of study was not carried out, Suro Barguda District, west Guji Zone, Oromia Regional State, Ethiopia, based on the following central questions:

- What is the richness of plants used for ethnoveterinary traditional medication and which ailments are treated by them?
- Which plant parts are commonly used to treat livestock diseases, and in what way are they prepared and applied?
- Are there preferred and multipurpose medicinal plants that need conservation priority?
- Are there differences in indigenous knowledge between different biosocial groups (e.g., women vs men, illiterate vs literate, youngsters vs elders)?

MATERIAL AND METHODS

Description of the study area

The present study was conducted in Suro Barguda District, West Guji Zone of Oromia Regional State, southern Ethiopia. Suro Barguda District was established recently (administrative boundaries were redrawn) and is located 497 km south of Addis Ababa, the capital of Ethiopia, and 30 km from Bule Hora town, the capital of the West Guji Zone. The district is generally characterized by rough and rugged topography and lies between latitudes 5°30'0" N and 5°50'0" N and longitudes 37°50'0" E and 38°20'0" E. The elevation ranges from 900 to 2350 m.a.s.l. (meters above sea level), and the total area of the district is 154,958.4 hectares (Suro Barguda District's Land Administration Office Unpublished Annual Report 2018) (Figure 1).

Suro Barguda District is divided into two agroecological zones, namely, the lowlands (from 900 -1500 m a.s.l.) and the middle altitude ranging from 1501-2500 m a.s.l. (Azene 2007). Accordingly, the proportion of the two agroclimatic zones in the district is 41.8% lowlands and 58.2% mid-altitude. The district falls within the southern bimodal rainfall regime of Ethiopia (Befikadu et al. 2019; Mekonnen and Woldeamlak 2013). Since there was no meteorological station in Suro Barguda District, fifteen years of meteorological data (2004 – 2018) registered by the nearby station (Bule Hora District Station) were taken from the National Meteorological Service Agency. Based on the analysis of these data, the district receives high rainfall between March and half of June as well as a relatively good amount from half of September to half of December. The dry season extends from half of December to February and some extent from half of June to half of September. The highest mean annual average rainfall of the study area within fifteen years was 171.3 mm recorded in May, whereas the lowest mean average was 12.4 mm recorded in February. Based on Friis et al. (2011) classifications of Ethiopian vegetation, the study area vegetation lies in the Acacia - *Commiphora* woodland and Bushland, *Combretum terminalia* Woodland, and Dry Evergreen Afro-Montane Forest and Grassland complex.

Demographics and livestock health care system in the distric

Since Suro Barguda District was established recently, a population census was not carried out. However, the district is predominantly (99.9%) occupied by Guji Oromo people who speak the Oromo language (Suro Barguda District's Culture and Tourism Office Unpublished Annual Report of 2018) with a unique dialect, and the majority of the residents live in rural areas and follow a traditional belief called " *Waaqeffannaa* (*Amantii oromoo*), the traditional faith system of the Oromo people, is one version of the monotheistic African Traditional Religion, where the followers of this faith system believe in only one Supreme Being." However, now a day, some of them tend to attend Protestant teaching. Pastoralism with subsistence farming is the most common economic mainstay of the people. In one or another way, their liveli-

hoods depend upon the presence of different plant species and vegetation. Modern veterinary services have played a relatively good role in the control and action taken to prevent livestock diseases in the past three decades in Ethiopia. However, they could not deliver complete coverage in preventive and healing health care practices because of inadequate modern veterinary health professionals, logistic problems, the unpredictable supply of drugs, and the high cost of drugs and equipment. In addition, the majority of livestock breeders in rural areas are far from the site of veterinary clinics/posts, and those who have access to these clinics may not be able to afford to pay for them (Ngeh et al. 2007; Sori et al. 2004). Ethnoveterinary medicine provides traditional remedies, which are available nearby and usually cheaper than standard treatments. Livestock holders can prepare and use homemade remedies at minimum expense. For many livestock holders in Suro Barguda District, where there are relatively few veterinarians and shortages of other facilities, traditional medications were the only choice to treat different livestock ailments.

Site and informant selection

A reconnaissance survey of the study area was conducted from May 06 - 21, 2019, to obtain information about the agroecology of the area, the status of the vegetation, and indigenous knowledge of the local people in using plants for different purposes and to determine the sites from which and how the data should be collected. The study district had 10 semipastoralist *kebeles* (the smallest administrative units), and currently, these kebeles are rearranged and subdivided to be 19 *kebeles* to decentralize the administration processes. Study sites from the ten *kebeles* were selected based on distance from the administrative town (Suro town), and the presence/absence of health facilities for collecting medicinal plant information.

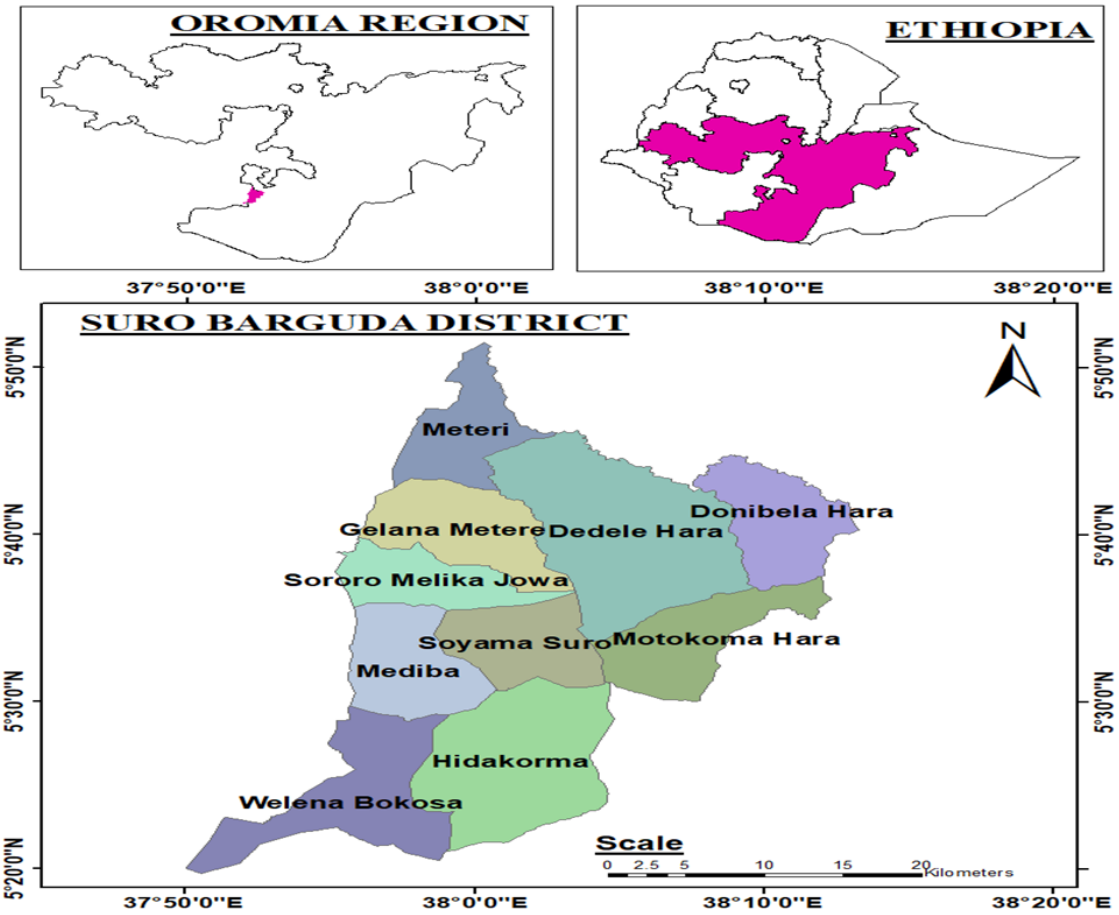

Figure 1. Map of Ethiopia showing Suro Barguda District (study area)

Informant size determination

A simplified formula for the calculation of informant size from a population was suggested by Yamane (1967). According to him, for a 95% confidence level and $p = .05$, the size of the sample should be determined as follows:

$$n = \frac{N}{1 + N(e^2)}$$

The total number of households in the 10 pastoralists' kebeles of the district was 386. Hence, the informant sample size comes to:

$= 386/1 + 386(0.05)2 = 386/1.965 = 196$ informants

Therefore, the required informant (respondent) size was 196. Informants' size for each *kebele* was calculated using the number of households in each *kebele* to the total number of households in the 10 *kebeles*, i. e.

Informants from each kebele = Number of households of the kebele X Total number of informants/Total number of households.

For example, the informant size of *Welena Bokosa kebele* with a total household of 39 was 20, i.e., (39 x 196/386 = 20). The same calculation was used for the other study *kebeles*, and two to four key informants were taken purposefully from each *kebele* based on the size of the households (a total of 24 key informants). The 24 key informants were those informants who had good recognition in treating different diseases (healers/practitioners) and were selected purposively (nonprobability sampling) by consulting local leaders, elders, and development agents at each *kebele*. These key informants shared their knowledge of the method of preparation and mode of application of different medicinal plants that are used to treat livestock ailments. The remaining 172 participants were general informants and were taken randomly to get hold of people who had no official recognition for their traditional healing practices. The general informants were ordinary people who lived in the study area for more than 15 years and used their indigenous medicinal plant knowledge within their families. They were included as respondents to gather additional data and check the transfer of indigenous knowledge among the people. The participants were involved in data collection activities at two different times: from July 01 to August 30, 2019 (for two months), and November 15 to December 30, 2019 (for 45 days). All informants were from Guji Oromo ethnic groups (Oromo people who lived and occupied the study area for a long period) who speak the Oromo language called "*Oromiiffaa*", similar to that of the Oromo ethnic people living in other parts of Ethiopia (Table 1).

Data Collection

Data collection was conducted two times: from July 01 to August 30, 2019, and November 15 to December 30, 2019, and plants reported as ethnoveterinary medicine by the informants were collected. During data collection, the researchers used Motor Bicycle for accessing study *kebeles* and informants' activity and materials such as GPS, Digital Camera, writing materials, plant press with its accessories, cutter, and digger. The data were collected following (Alexiades 1996; Cotton 1996; Cunningham 1993; Martin 1995). Semistructured interviews, guided field walks, discussions, market surveys, and field observations with randomly picked and key informants were applied based on a checklist of questions. The selected informants at the sample site were interviewed using a semistructured interview that was translated into the local language (Oromo language) focusing on ethnoveterinary medicinal plants: their use and management; from where they collect them; which plant was preferable in its use; how they know their habitat and time of availability; whether they obtained any economic benefit from ethnoveterinary medicinal plants or not; whether they had any tendency to cultivate some selected ethnoveterinary medicinal plants or not; about the level of any threat to the ethnoveterinary medicinal plants; what they suggest about the current conservation status of these plants; how widespread the medicinal plant/s in the area was; whether there was disappeared medicinal plant or not; whether there was any restriction or taboo in collecting medicinal plants or not; whether these plants had other purposes or not, etc.

A semistructured interview questionnaire was an important tool for the collection of both qualitative and quantitative data at the same time. The informants participated in answering the questions by showing the plants that they used as medicine during the guided field walk interview. An explanatory individual and group discussions were made with informants at each locality and site, focusing on the status of the vegetation and acceptance of ethnoveterinary medicinal plants by the community. Information about the respondents, history of medicinal plant users, history of medicinal plants, and other essential information (based on the questionnaire) were taken onsite. During the discussion, the informants were free to explain medicinal plants and their knowledge without being interfered with and restricted. The collected medicinal plant species were brought to the Bule Hora University Herbarium, where they were allowed to dry and deep-freez, and identifications were made by the researchers using taxonomic explanations and descriptions given in the relevant volumes of the Flora of Ethiopia and Eritrea. Further refinement of

Table 1. Number of households and informants included in the ethnobotanical data collection

Name of the kebele (the smallest administrative unit)	Total no of hh	Key informants					Randomly taken informants					Total informants		
		M	Ag	W	Ag	T	M	Ag	W	Ag	T	M	W	T
Dembela Hara 1840 – 1980 m. a. s. l.	47	2	62,73	1	65	3	17	19 - 51	4	22 - 39	21	19	5	24
Didole Hara 1790 – 1965 m. a. s. l.	43	2	59,64	1	52	3	15	23 - 42	4	25 - 56	19	17	5	22
Gelana Meteri 1050 – 1825 m. a. s. l.	36	2	80,54	0	–	2	14	20 - 44	2	25,50	16	16	2	18
Hidha Korma 1990 – 2350 m. a. s. l.	37	2	78,66	0	–	2	15	24 - 57	2	21,71	17	17	2	19
Mediba 1963 – 2185 m. a. s. l.	40	2	48,56	1	63	3	14	22 - 65	3	27 - 47	17	16	4	20
Meteri 900 – 1835 m. a. s. l.	31	2	52,76	0	–	2	13	25 - 70	1	29	14	15	1	16
Motokoma Hara, 1973 -2050 m. a. s. l.	39	2	61,73	0	–	2	16	21 - 43	2	34, 38	18	18	2	20
Sororo Melka Jewe 945 – 1874 m. a. s. l.	34	2	50,77	0	–	2	13	26– 40	2	24, 49	15	15	2	17
Soyama Suro 1982 – 2100 m. a. s. l.	40	2	68,75	1	58	3	15	19 - 41	2	26, 67	17	17	3	20
Welena Bokosa 2100 – 2280 m. a. s. l.	39	2	65,67	0	–	2	16	27 - 69	2	35, 76	18	18	2	20
Total	**386**	20	—	4	–	**24**	148	–	24	–	**172**	168	28	**196**

determinations was made by visual comparison with authenticated herbarium specimens. The plant specimens with labels were finally deposited at the mentioned Herbarium.

Data Analysis

To answer the central questions of this study, ethnobotanical data were analyzed following basic analytical tools (Cotton 1996; Martin 1995). Potentially effective medicinal plants were identified by the informant consensus factor method (Heinrich et al. 1998). The rank-ordering (Preference ranking) of medicinal plants was used to determine their order of cultural importance across a community. The most important in the set was given the highest number decreasing in number as the members of the set decreased in importance. Preference ranking was computed by taking 10 key informants to assess the degree of effectiveness of eight medicinal plants highly cited by the informants used to treat particular disease groups, such as breathing system diseases (Hoffman and Gallaher 2007). The direct matrix ranking is a more multifaceted version of preference ranking. Here, informants order ethnoveterinary medicinal plants by considering several attributes, one at a time, i.e., it draws explicitly upon multiple dimensions. Direct matrix ranking was performed as a group exercise in which participants reached a consensus on the ranking of each item based on their evaluations (Höft et al. 1999). The ranking of threats to five ethnoveterinary medicinal plants that were reported by most of the informants in the study area was conducted using ten key informants as described by (Höft et al. 1999; Martin 1995). This information was used to determine the highest threats to traditional ethnoveterinary medicinal plants in the study area and to help suggest appropriate conservation measures. The informant consensus factor (ICF) was considered for each group of ailments to identify the agreement of the informants on the reported cures for the group of ailments of the plant. The informant consensus factor was computed as follows: several citations in each group (nur) minus the number of species used (nt), divided by the number of citations in each group minus one (Heinrich et al. 1998).

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

Ethnoveterinary medicinal plants that were effective in treating groups of ailments had a higher informant consensus factor.

The fidelity level (FL) computes the significance of a species for a given purpose. Most commonly used medicinal plants, such as *Viscum congolense* and *Cyphostemma serpens*, have a high fidelity level. The fidelity level (FL) among medicinal plants in the study area was computed based on the following formula: FL= Np/N. To calculate the percentage of fidelity level: FL% = (Np/N) × 100 was used (Hoffman and Gallaher 2007; Höft et al. 1999). Np is the number of informants who independently cited the importance of a species to treat a particular disease, and N is the total number of informants who reported the plant to treat any given disease.

The local importance of each species cited in the study area was calculated using the use-value (UV) technique following Phillips and Gentry (1993). Use-value (UV) is a quantitative method that demonstrates the relative importance of the species known locally, which reflects the importance of each species to informants.

RESULTS

Medicinal plant diversity used for ethnoveterinary medication

A total of 46 ethnoveterinary medicinal plant species representing 43 genera and 29 families all of

which were from the wild were identified (Addtional File 1) and analyzed. Approximately 26.1% of the families (twelve families) were represented by more than one species. The highest number of species was recorded for Asteraceae (5 species, 10.9%), followed by Euphorbiaceae (4 species, 8.7%) and Apiaceae, Rubiaceae, Rutaceae, and Solanaceae with three species (6.5%) each. Two species (*Leucas abyssinica* (Benth.) Briq. and *Thunbergia ruspolii* Lindau.) of the ethnoveterinary medicinal plants of Suro Barguda District were found to be endemic to Ethiopia. Concerning the growth forms of plants used for livestock treatment, there were more herbs and shrubs (12 species, 26.1% each), followed by trees (10 species, 21.7%) and lianas (6 species, 13%). All documented ethnoveterinary plant species were harvested from the wild, and overgrazing, deforestation, charcoal making, and firewood collection were claimed to be major factors affecting the ethnoveterinary plant species of the study area. This study clarified that some medicinal plants were more well known in the study area than others. As a result, fifty informants cited such plants repeatedly as a remedy for various diseases of livestock. For example, *Cyphostemma serpens* and *Viscum congolense* were cited by all informants (100%) as sources of remedy for foot and mouth disease and shivering and abnormal breathing, respectively. *Dichrostachys cinerea* and *Syzygium guineense* were also cited by 49 (98%) informants as sources of remedy for hepatitis and shivering and leech infection, respectively (Table 2).

Livestock ailments, their prevalence, and applications of ethnoveterinary remedies

A total of 79 veterinary ailment types were identified in the study area for which informants reported using one or more of the medicinal plant species (Addtional File 1). Of these twenty-six (32.9%) veterinary ailment types belonged to breathing system diseases, sixteen (20.3%) were gastrointestinal diseases, and twelve (15.2%) diseases belonged to blackleg, hepatitis, and FMD (foot and mouth disease) categories. Diarrhea and breathing problems were found to be the most commonly reported (most prevalent) types of livestock ailments in the district.

Even if ethnoveterinary medicinal plants of the district were asserted to be applied for ailments affecting chicken, sheep/goats, cattle, equines, or camels, the majority of the reported medicinal plant species (40, 87%) were found to be applied to treat one or more of the sixty-two different cattle ailments (Additional File 1). Eighteen (39%) equal medicinal plant species were mentioned to be used specifically against twenty-one ailments of goats/sheep and nineteen ailments of equines (Figure 2).

Table 2. Informant consensus on the most frequently used medicinal plants.

The botanical name of the medicinal plants	Disease treated	No. of informants	%
Cissus quadrangularis	Blackleg	48	96
Cyphostemma serpens	Foot and Mouth Disease	50	100
Dichrostachys cinerea	Hepatitis	49	98
Microglossa pyrifolia	Dermal wound	48	96
Prunus africana	Coughing in cattle	47	94
Syzygium guineense	Leech infection	49	98
Tragia cinerea	Diarrhea	48	96
Viscum congolense	Shivering and abnormal breathing	50	100

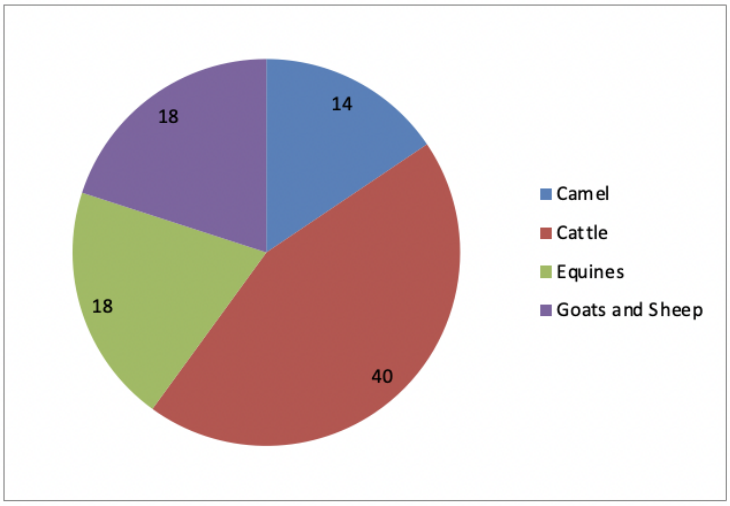

Figure 2. Number of ethnoveterinary plant species used for different livestock types.

Medicinal plant parts used for ethnoveterinary remedy preparation

Regardless of the different plant parts reported to be used for remedy preparation by the community, a greater proportion (41.9%) of the preparations were found to be from leaves alone, followed by bark and roots (12.8%) each (Figure 3). Plants in mixtures of leaves rated to 10.5%, latex 5.8%, and stem 3.5% in the ethnoveterinary medication of the district. Most remedies (98.8%) were prepared from freshly harvested plant parts.

The approach of remedy preparation and routes of administration Different modes of ethnoveterinary remedy preparation were reported to be used in the district based on the type and degree of complexity of livestock ailments. Chopping/ pounding the remedial part and homogenizing it with cold water was found to be the major mode of remedy preparation (93.1%) and unprocessed forms covered only 6.9% (Figure 4). These ethnoveterinary remedies were reported to be given through oral, dermal, or nasal routes. The oral application was the most cited route of administration (20 preparations, 66.7%), followed by nasal (six preparations, 20%), and dermal (four preparations, 13.3%) routes.

Plants with a high preference for treating livestock diseases

A preference ranking exercise with 10 key informants for eight medicinal plants that were reported to be used against breathing system diseases (as explained in the methods section) showed that *Viscum congolense* and *Clematis simensis* were the most preferred species to treat the reported diseases (Table 3).

The traditional medicinal uses of 46 different medicinal plant species against several livestock ailments were compiled. Of these species, the highest medicinal use values (UVmed) were recorded for *Lannea rivae* (8.0), *Dichrostachys cinerea* (7.8), and *Ozoroa insignis* (6.6) (Table 4).

Multipurpose medicinal plants used for livestock ailments and their conservation status

The output of the average direct matrix ranking score of ten key informants for five medicinal plant species with six-use diversities indicated that some multipurpose medicinal plant species were currently exploited more for firewood, charcoal, and construction purposes than for their medicinal uses and require conservation priority (Table 5).

All 46 medicinal plant species recorded for livestock ailment treatment in the district were cited for one or more uses other than their medicinal role. The proportion of medicinal plant species over different use categories is summarized in Figure 5.

Effectiveness of ethnoveterinary medicinal plants according to the perception of the practitioners

Six main livestock ailment categories were identified from a total of 79 veterinary diseases reported in the district. Since consensus of use - values or ICF can be computed for different parameters, it was recorded

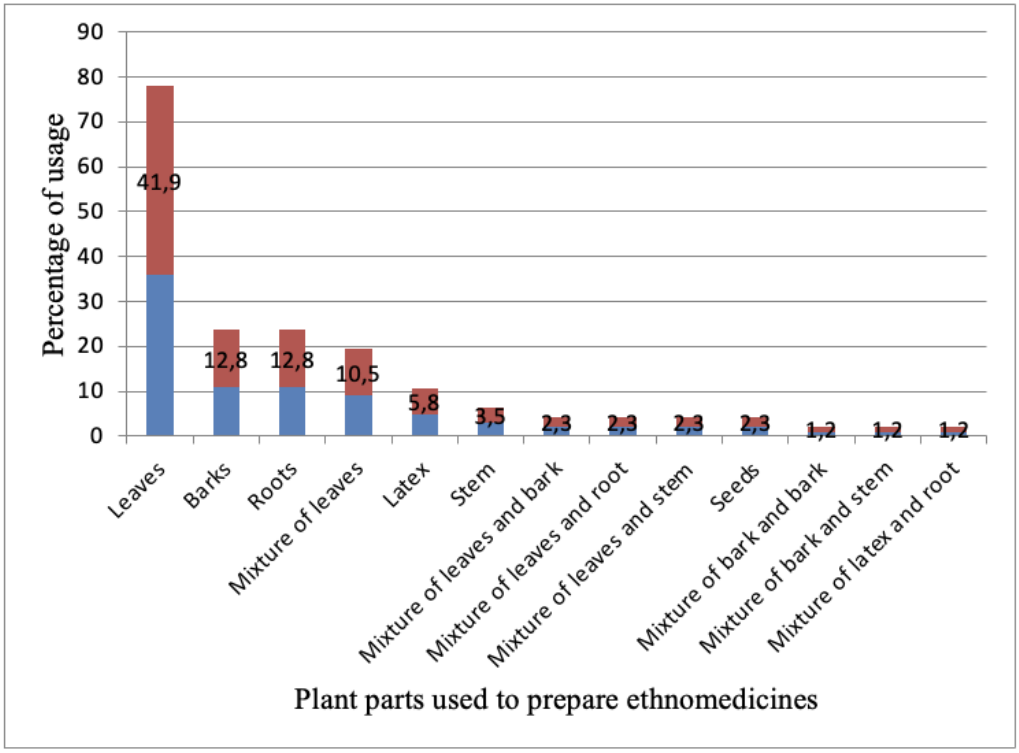

Figure 3. Plant parts used for ethnoveterinary remedy preparation

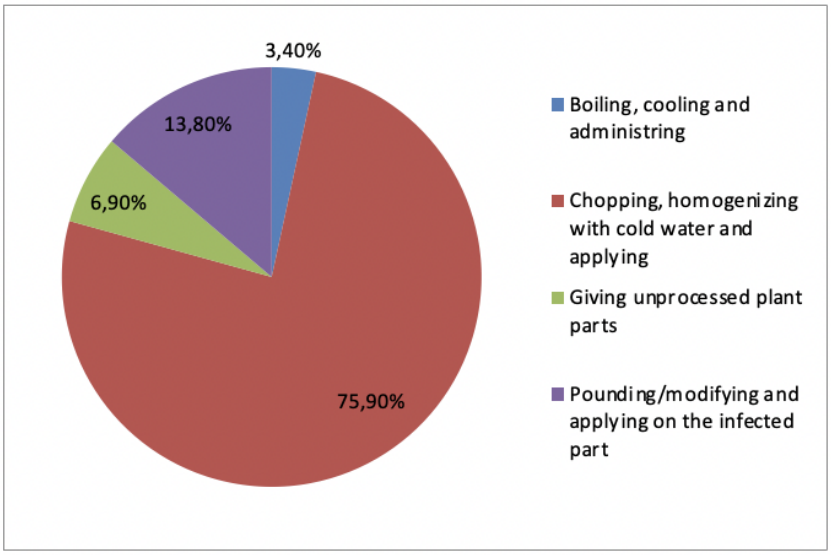

Figure 4. Forms of remedy preparation and administration for treating livestock ailments.

for breathing-system diseases (0.85), dermatological diseases (0.84), blackleg, hepatitis, FMD (0.83), and gastrointestinal disease (0.81) categories (Table 6). Hence, the highest plant use citation (55.1%) was recorded for breathing system diseases.

The comparative healing potential of ethnoveterinary medicinal plants

Cyphostemma serpens revealed the highest fidelity level value (97%) for blackleg, hepatitis, and FMD dis-

Table 3. Results of the preference ranking exercise of eight medicinal plants reported for treating breathing system diseases of livestock.

Plant spp. treating breathing system diseases of livestock	Informants designated A to J										Total score	Rank
	A	B	C	D	E	F	G	H	I	J		
Ammocharis tinneana	4	3	4	5	5	6	7	6	5	5	50	7^{th}
Clematis simensis	8	7	6	8	5	4	6	5	7	6	62	2^{nd}
Heteromorpha arborescens	7	6	8	5	4	6	5	3	6	7	57	5^{th}
Lannea rivae	8	6	5	7	6	4	6	7	5	6	60	3^{rd}
Leucas abyssinica	5	4	4	6	5	3	4	5	6	3	45	8^{th}
Phytolacca dodecandra	6	5	5	6	7	4	5	6	3	6	53	6^{th}
Senecio hadiensis	7	8	6	7	5	8	6	4	4	4	59	4^{th}
Viscum congolense	6	8	7	8	6	5	8	6	7	8	69	1^{st}

N.B. Scores in the table indicate the ranks given to medicinal plants based on their efficacy (the highest number (8) was given for the medicinal plant that informants thought most effective in treating breathing system diseases and the lowest number (3) was given for the least effective plant.

Table 4: Medicinal use values of selected ethnoveterinary plants.

Medicinal plant species	No. informants citing the species	Total citations	No. of ailments treated with	UVmed.
Cyphostemma serpens	84	504	2	6.0
Dichrostachys cinerea	96	749	2	7.8
Lannea rivae	118	944	2	8.0
Ozoroa insignis	102	673	2	6.6
Solanum dennekense	68	374	2	5.5

N.B. UVmed = Medicinal use value.

ease categories, followed by *Viscum congolense* (96%) for breathing-system diseases. In the dermatological therapeutic category, the highest-fidelity level value was recorded for *Prunus africana* (92%). *Ozoroa insignis* (87%) also showed relatively high healing potential under the muscular-nervous-system-disease category (Table 7).

Distribution of indigenous knowledge on medicinal plants among different social groups in the community of the study area

Although more medicinal plants were reported by men (168) than women (28), the difference was not significant ($P > 0.05$) when the average number of medicinal plants mentioned by each group was compared. There was no significant difference seen in the number of medicinal plants listed by informants living around health centers and those living relatively far away from these health centers. However, there was a significant difference ($P < 0.05$) in the number of medicinal plants reported by senior members of the community (> 40 years old) and young- to middle-aged members (< 40 years old); key informants and randomly taken informants, illiterate and literate informants (Table 8). More medicinal plants were reported by elders (> 40 years old), illiterate individuals, and key informants than by young, literate, and randomly taken informants.

Table 5. Average direct matrix ranking score of ten key informants for five medicinal plant species with six-use diversities.

Medicinal plant species	Use categories						Total	Rank
	Ch	Co	Fr & TI	Fw	Md	We		
Combretum collinum	5	2	2	5	3	0	17	3^{rd}
Dichrostachys cinerea	5	4	1	3	3	0	16	4^{th}
Lannea rivae	2	2	1	3	3	2	13	5^{th}
Prunus africana	4	5	4	5	5	0	23	1^{st}
Syzygium guineense var. *guineense*	3	5	3	5	3	3	22	2^{nd}
Total	19	18	11	21	17	5	91	
Rank	2^{nd}	3^{rd}	5^{th}	1^{st}	4^{th}	6^{th}		

where, Ch = charcoal, Co = construction, Fr & Tl = furniture and tools, Fw = firewood, Md = medicinal and We = wild edible

Table 6. ICF values of traditional medicinal plants used to treat livestock ailments.

Disease category	No. of specie	% of all specie	Use citation	% of use citations	ICF
Breathing system diseases	17	37	108	55.1	0.85
Gastro - intestinal diseases	17	37	86	43.9	0.81
Blackleg, hepatitis, and FMD	11	23.9	60	30.6	0.83
Dermatological diseases	9	19.6	50	25.5	0.84
Muscular-nervous-system diseases	18	39.1	52	26.5	0.67
Toothache, leech infection, and cold	8	17.4	19	9.7	0.61

DISCUSSION

What is the richness of plants used for ethnoveterinary traditional medication?

The reported ethnoveterinary medicinal plants of Suro Barguda District showed that the study area is relatively rich in ethnoveterinary medicinal plant diversity and indigenous knowledge related to each traditionally used species (Addtional File 1). The highest number of ethnoveterinary medicinal plant species was contributed by Asteraceae (5 species), followed by Euphorbiaceae (4 species). As indicated in (Edwards et al. 1995; Hedberg et al. 2004), this could be due to the wide presence of the family Asteraceae, which is the second dominant family in the flora of Ethiopia and Eritrea. The existence and employment of such a large number of medicinal plants indicate that the majority of the people continue to employ indigenous medicinal practices.

All documented ethnoveterinary plant species (100%) were harvested from the wild. Such wild harvesting implies that medicinal plants are exposed to depletion due to environmental degradation, agricultural expansion, and cultivation of marginal lands, which pose a significant threat not only to the plants but also to the future wellbeing of human and animal populations relying on these resources to combat various ailments for generations. This finding was relatively in agreement with the reports of Mirutse et al. (2003), in which 95.7% of the medicinal plants were collected from the wild. Overgrazing, deforestation, charcoal making, and firewood collection were

claimed to be major factors affecting the ethnoveterinary plant species of the study area (Table 3).

Comparatively, a higher diversity of ethnoveterinary medicinal plant species was recorded than in other cultural communities of Ethiopia and abroad, such as Akash et al. 2014; Mesfin et al. 2016; Mirutse et al. 2003; Yibrah 2015, reported 41, 40, 33, and 29 medicinal plant species used by the Zay people who live on islands as well as shore areas of Lake Ziway in the Ethiopian Rift Valley; the Bensa people, southern Ethiopia; the Wolaita and Dawuro peoples, Ethiopia; and tribal society of Sulaiman Range, Pakistan, respectively.

Which plants/plant parts are commonly used to prepare remedies in treating the different types of livestock diseases? And how are these remedies prepared and administered?

Viscum congolense, *Clematis simensis*, and *Lannea rivae* were the most preferred ethnoveterinary medicinal plants to treat breathing system diseases, which were the most prevalent animal health problems reported in the study area (Addtional File 1). Herbal preparations from *Viscum* spp. have been reported for their traditional uses in two main thera-

Table 7. Fidelity level values of medicinal plants commonly reported on certain livestock ailment categories.

Medicinal plant	Healing category	Np	N	FL value (%)
Cyphostemma serpens	Blackleg, hepatitis, and FMD	22	23	96.00
Viscum congolense	Breathing system diseases	32	33	97.00
Prunus africana	Dermatological diseases	24	26	92.00
Ozoroa insignis	Muscular-nervous system diseases	26	30	87.00
Tragia cinerea	Gastrointestinal diseases	20	24	83.00
Syzygium guineense	Toothache, leech infection, and cold	12	16	75.00

N.B. FL= fidelity level, Np = number of informants who independently cited the importance of a species for treating a particular disease, and N = total number of informants who reported the plant for any given disease.

Table 8. Statistical tests of significance on the average number of medicinal plants among different informant groups.

Considerations	Informant groups	N	Average ± SD	t -value**	p –value
Gender	Men participants	168	6.62 ± 2.65	1.97	p 0.97
	Women participants	28	6.05 ± 2.18		
Age	Youngsters (< 40 years old)	110	5.16 ± 2.07	-12.87	P 0.001*
	Elders (> 40 years old)	86	7.96 ± 2.19		
Literacy	Illiterate participants	146	7.22 ± 2.31	12.92	P 0.001*
	Literate participants	50	4.28 ± 1.82		
Proximity to the health center	Near to the health center	11	6.00 ± 2.37	-0.94	P 0.36
	Far away from the health center	185	6.5 ± 2.57		
Informant category	Key informants	24	10.76 ± 1.09	25.75	P 0.001*
	Randomly taken informants	172	5.85 ± 2.04		

*Significant difference ($p<0.05$); ** t(0.05) (two-tailed), degree of freedom (df) = 223 N= number of respondents

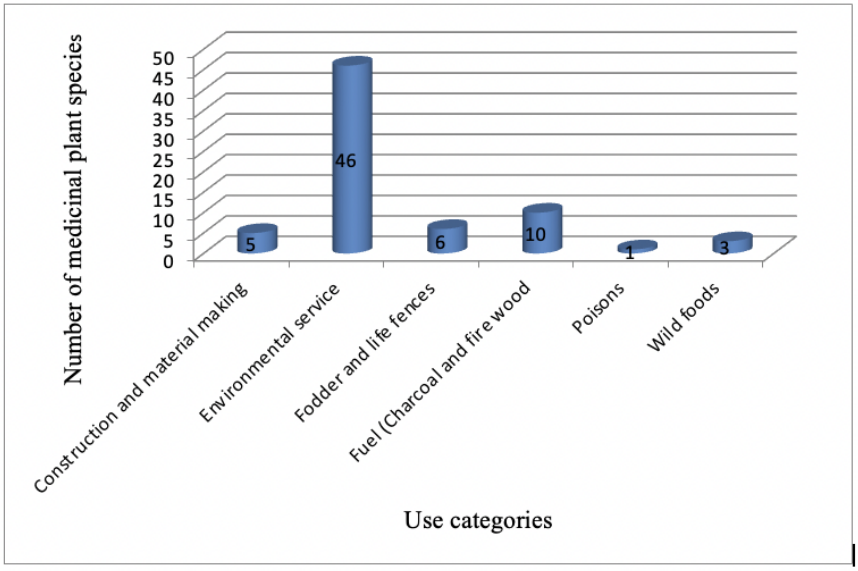

Figure 5. Use categories of livestock medicinal plants.

peutic areas for cardiovascular disorders and oncology, even if the species of the host tree, the harvest time, and the process of preparing the extracts determine the concentrations of the ingredients (Committee on Herbal Medicinal Products [CHMP] 2012). Out of the 46 different medicinal plant species used for livestock ailment treatment, the highest medicinal use values (UVmed) were recorded for Lannea rivae followed by *Dichrostachys cinerea*, which is considered the top species used by the local people for medicinal purposes in the study area, and knowing and undertaking such useful plant species could be used to consider them for priorities of management and conservation, as suggested by Kvist et al. (2001). The use of additives for reducing bitterness and bad flavor or increasing the efficacy of herbal formulations was reported by Ermias et al. (2014). The highest usage of the additive was reported for "*Magado*" salt (locally produced salt) in this study area.

The majority of ethnoveterinary medications (42 preparations) were reported to comprise medicinal parts of a single medicinal plant. This finding was in line with the reports of Mirutse et al. (2003), which stated that most of the remedies are prepared from a single species. The remaining medications were prepared using formulations from two or more species. Healers used multiple plants in the mixture to increase the strength and efficacy of the drug (Ermias et al. 2014). Among all plants reported, the highest proportion of species was claimed to treat breathing problems (13 species out of 46), followed by diarrhea (11 species out of 46). Multiple ethnoveterinary uses were recorded for *Croton macrostachyus* and *Teclea salicifolia* (each used against six ailment types), while *Calpurnia aurea* was used to treat five livestock diseases (Addtional File 1). *C. macrostachyus* is regarded as a multipurpose tree by subsistence farmers in Ethiopia, Kenya, and Tanzania, and the species has the potential to play an important role in primary healthcare (Tagesu 2019). The bark, fruits, leaves, roots, and seeds of *C. macrostachyus* are reported to possess diverse medicinal properties and are used as herbal medicine for at least 61 human and 20 animal diseases and ailments (Tagesu 2019). In the study area, there is a high degree of medicinal use consensus for treating swelling and deep openings, wounds, premature abortion, shivering, and abnormal breathing in different livestock species.

Similar to some other previous findings (Mirutse et al. 2003; Dawit and Ahadu 1993; Debela et al. 2006; Fisseha et al. 2009; Getu et al. 2015; Mersha et al. 2016), leaves were the most widely used plant parts in the study area for ethnoveterinary medicine preparations, followed by bark and roots (Figure 3). This wide utilization could be attributed to the high pharmaceutical value and concentration of bioactive ingredients in these plant parts. Concerning sustainable use and conservation, root and whole-plant harvesting are more destructive to medicinal plants (e.g., herbs, shrubs, and trees) than collecting their leaves and flowers or buds. On the other hand, other findings, for instance, (Lulekal et al. 2008; Turner 2000), reported different results that showed that roots were the most frequently utilized plant parts in their respective research areas. The possible reason could be that people living in different ecological zones could

use different plants and plant parts in their traditional treatment systems.

The majority (97.8%) of remedies were prepared from freshly harvested plant parts. The predominant use of fresh materials for herbal preparation probably reflects an attempt to capture potent, volatile substances that determine the therapeutic efficacy of herbal preparations (Addis et al. 2009). As reported by informants, from their long experience, high efficacy was attained from freshly collected plant parts since they contain many bioactive ingredients in the form of secondary metabolites. This finding was in line with the reports of (Dawit and Ahadu 1993; Debela et al. 2006; Fisseha et al. 2009; Anteneh et al. 2012; Getaneh et al. 2014; Seyoum and Zerihun 2014; Solomon et al. 2015), which clarified that most of the remedy preparation was from freshly collected medicinal plants, whereas 2.2% was prepared from dried forms.

Most veterinary ailments belong to the breathing system disease category followed by gastrointestinal diseases. Breathing problems and diarrhea are known to be the most commonly described forms of veterinary ailments in the district. This result corroborates the report of Fisseha et al. (2009), who reported that the majority of veterinary ailments claimed by the community belong to breathing system disease categories. Healers treat veterinary ailments based on observation of the animals or evidence obtained by asking the livestock owners about the major symptoms shown by the diseased animals, and medicines were commonly given only after the diseased animal was visually examined by a traditional healer for any symptoms on its suspected body part.

Diverse modes of ethnoveterinary remedy preparation were mentioned for use in the district based on the type and degree of complexity of livestock ailments. Chopping/pounding the remedial part and making its solution with cold water was found to be the major method of local remedy preparation (Figure 4). This finding was in agreement with the reports of many studies, such as those (Anteneh et al., 2012; Getaneh et al. 2014; Noriko et al. 2012), which clarified that crushing/pounding and concocting were the common methods of remedy preparation. Oral administration of traditional medicines was reported as the main route in the treatment method of most diseases (Figure 4). This finding was also in line with the reports of (Anteneh et al. 2012; Getu et al. 2015; Mersha et al. 2016; Ngeh et al. 2007; Noriko et al. 2012; Seyoum and Zerihun 2014), which informed us that most of the traditional remedies were administered orally.

Oral administration of remedies was reported to be more effective than any topical application due to their immediate impact on the livestock's internal system (Ermias et al. 2014). Rubbing or pasting herbal preparations were also commonly reported treatment methods for handling dermatological diseases. The physical appearance of the diseased animal and visually confirmed degree of complexity of the illness were used to determine the doses of traditional medicines in treating livestock ailments. Some traditional practitioners reported the use of the coffee cup, water glasses, and bottles to determine the dosage for some traditional medicines, while others reported using the size of their fingertips or full of a small dish of unprocessed parts to treat ailments. However, no standardized doses of herbal preparations were reported by traditional healers for any of the preparations used to treat livestock ailments in Suro Barguda District, even if they used such various units of measurement. Similar findings have been reported in other studies in Ethiopia and abroad, such as (Almeida et al. 2010; Anteneh et al. 2012; Ayantunde et al. 2008; Begossi et al. 2002; Yibrah 2015), the result of which showed that there is a lack of precision in the dose in traditional medical applications.

Since informant consensus is used to identify the most cited plant species for its particular importance, the highest plant use citation was recorded in the present study for breathing system diseases with the highest ICF value (Table 5). *Viscum congolense* was highly effective in treating breathing system diseases, whereas *Cyphostemma serpens* was identified as having the highest healing potential in treating blackleg, hepatitis, and FMD (foot and mouth disease) with FL tests (Table 6). Informant consensus factor values (ICF values) are commonly used to identify the harmony of the informants on a reported cure for the group of ailments (breathing system diseases in the present study)) of the plant, while the fidelity level (FL) computes the significance of a species (*Viscum congolense*) to treat a given disease (breathing system diseases). Hence, their analysis values were confirmed as the information obtained was tangible.

What seems the distribution of indigenous knowledge on medicinal plants among different social groups in the community of the study area?

Although more medicinal plants were reported by men than women, the difference was not significant ($P > 0.05$) when the average number of medicinal plants mentioned by each group was compared. This could be because both men and women were knowledgeable about the use of traditional plant remedies regardless of the relative dominance of medicinal plant traditions by men, which could be related to the transfer of traditional knowledge along the male line in the study area (Table 8). Similar results were reported by

(Ayantunde et al. 2008; Seyoum and Zerihun 2014). There was no significant difference observed in the number of medicinal plants listed by informants living around health centers and those living relatively far away from these health centers. However, there was a significant difference ($P = 0.00$) in the number of medicinal plants reported by senior members of the community (> 40 years old) and young- to middle-aged members (< 40 years old). More medicinal plants were reported by elders than by youngsters, and this could be attributed to the high degree of opportunity for more cultural contact and experience with plants and associated therapeutic uses by the elderly individuals. Similar reports were made by (Abera et al. 2021; Ketema et al. 2013; Mirutse et al. 2009; Nakashima and Rou´e 2002; Slikkerveer 1990; Solomon et al. 2015; Tilahun 2009), who clarified that elders (> 40 years old) showed a higher diversity of plant citations than youngsters. Similarly, significant differences were also seen in the number of medicinal plants reported by key informants and randomly taken informants, illiterate informants, and literate informants. More medicinal plants were reported by illiterates and key informants than literates and randomly taken informants (Table 8). This could again be related to the impact of lifelong experience and serious secrecy in using medicinal plants in the former, and modernization in the latter. Similar results were reported by (Pfeiffer and Butz 2005; Phillips and Gentry 1993), who clarified that there are key individuals in the population with a very detailed knowledge of medicinal plants.

Can significant types of livestock diseases be treated by a traditional medication system?

A large number and types of livestock diseases (79 disease types) for which diseased livestock were visited by traditional healers indicated the preference of local people in the study area to use traditional medicines (Figure 2). The reported reasons for this to happen were the efficacy and availability of these medicines, cultural trends, and life standards (being poor), factors that force the community to visit traditional healthcare practitioners more than modern healthcare centers with unreasonable prices. Similar findings were reported by (Bach et al. 2016; CN Fokunang et al. 2011), who mentioned that respondents reported that a higher preference for traditional medicine than their counterparts is due to the long distance to the commune veterinary health station and service dissatisfaction. Even though livestock traditional medicinal plants of the district were asserted to be applied for ailments affecting chicken, sheep/goats, cattle, equines, or camels, the majority of the reported medicinal plant species were found to be applied to treat one or more of the sixty-two different cattle ailments (Addtional File 1). Eighteen (39%) medicinal plant species were mentioned to be used specifically against twenty-one ailments of goats/sheep and nineteen ailments of equines.

Reflections on conservation practices in the study area

Dwellers of Suro Barguda District and their livestock population depend mainly on the natural resources of the area for their existence. Deforestation for timber production or construction, overgrazing, charcoal production, and fuelwood collection were claimed to be the anthropogenic causes of resource depletion by the residents, as indicated by the average direct matrix ranking analysis in the results section. This finding was in line with the reports of (Cunningham 1993; Noriko et al. 2012). As was observed during the field survey of the study area, highly affected dry evergreen montane forest and the remaining woodland area were severely degraded due to overgrazing with immense livestock population and illegal charcoal production and fuelwood collection. Not only were medicinal plant species affected, but the vegetation as a whole was also in a critical condition. Some medicinal plants, such as *Warburgia ugandensis*, disappear from the study area due to their high and improper usage (peeling the bark, which leads to the death of the plant). Some conservation practices were implemented in a very specific area of the district, but this did not guarantee the well-being of plant diversity and their contribution to the perpetuation of life in the area (no pronounced conservation effort).

Inhabitants of the study area simply went to the forest, woodland, or grazing areas to collect medicinal plants as their needs arose and did not worry about the long-term survival of these plants. Most of these informants gave the reason that the medicinal plants were easily accessible in their surroundings and hence there was no need for a personal effort to conserve these plants. Because of this, some medicinal plants (such as *Warburgia ugandensis*, for which only one individual plant was obtained in the surveyed sites of the 10 kebeles and the informants confirmed its scarcity) disappear from the study area due to their improper usage, as mentioned above. Except for its secrecy, no taboo was reported that restricts the collection and application of these medicinal plants. Because of this, medicinal plants in the study area were highly threatened by anthropogenic and natural factors. The natural factors affecting medicinal plant species were an irregular and very short rainy season, and prolonged and recurrent drought. Hence, sustainable land management, which involves both the con-

servation and improvement of the present vegetation cover, such as through enrichment planting, enhancing soil fertility, and rehabilitating degraded lands, is required to reduce the pressure on and destructive use of natural resources. This could be achieved by solving the problems associated with open access to forest resources through sustainable forest management involving the local communities neighboring this vegetation as comanagers and cobeneficiaries of the generated revenues.

CONCLUSION

This study revealed that the study area has many medicinal plants used to treat a wide range of livestock ailments. Of which medicinal plants from the families Asteraceae and Euphorbiaceae were better diversified than other family members. Traditional practitioners showed a preference for some medicinal plants in treating specific livestock diseases. It was reported that many remedies are prepared from freshly collected leaves and their common way of preparation is by pounding and crushing to make their solution and administer it orally. Significant indigenous knowledge variation was observed concerning age, education level, and being key or randomly taken informants in preparing remedies and treating livestock ailments. This knowledge is transferred from generation to generation orally. This study is significant as it helps the conservation of medicinal plants and their associated indigenous knowledge and constitutes a written document for the next generation.

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DATA AVAILABILITY

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

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

CONTRIBUTION STATEMENT

Dr. Mersha Ashagre Eshete collected and analyzed the data, and wrote the manuscript. Dr. Ermias Lulekal Molla critically reviewed and improved the first draft of the manuscript. The two authors have read and approved the final version of the manuscript.

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ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This ethnobotanical study of medicinal plants used to treat human ailments was approved by the concerned bodies of Bule Hora University. During our field investigations, all stakeholders in this study, including users of traditional medicines, the local community of Suro Barguda District, and all authors willingly agreed to participate in the study, use the data related to their knowledge and publish the results. Consent for publication has been obtained from the Scientific Research Committee of the Bule Hora University, College of Natural and Computational Sciences, authors, and all stakeholders who participated in this study.

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Additional Files

Add File 1. Summary of medicinal plants used to treat livestock ailments in Suro Barguda District. Key: Hb=Habit, T=Tree, Sh=Shrub, Cl=Climber, H=Herb, Se = Sedge, Su = succulent, Ep = Epiphyte Ut=Used to treat, Ls=Livestock, Ra= Route of application, O=Oral, Dm=Dermal, Na=Nasal, Op=Optical, Er=Ear, Cp=Condition of preparation, F=Fresh, D=Dried, F/D=Fresh/Dried, Pu=Parts used, L=Leaf, R=Root, St=Stem, Ba=Bark, Fl=Flower, Fr=Fruit, S=Seed, Bu=Bulb, Rh= Rhizome, La=Latex, Ds=Distribution, C=Common, R=Rare, An asterisk/*= Endemic.

No.	Scientific name	Family	Local name (Oromo language)	Hb	Pu	Ut	Cp	Ra	Disease treated	Preparation & Application	Ds	Co. No
1	Acokanthera schimperi (A.DC) Schweinf	Apocyanaceae	Qaraarru	T	L	Ls	F,Dr	Dm	Itching (Qanxoo/Ciitto), External parasites	Crushing the leaves and applying to the affected part. Fumigating the chicken and their overnight place with dried leaves.	C	MA63
2	Aloe calidophila Reynolds	Asphodelaceae	Hargissa	Su	L, La	Ls	F	Dm,O	Skin cancer and wound,Hepatitis (Biirtee)	Cutting and chopping the leaf or peeling the leaf and applying it to the affected part. Applying the latex to the infected part.Crushing the leaves with magado salt and boiling them with water and giving half a liter to animals.	R	MA280
3	Ammocharis tinneana (Kotschy & Peyr.) Milne- Redh. & Schweick	Amaryllidaceae	Butte Werabesa	Se	R	Ls	F	O	Being breathless in cattle (Tuma)	Chopping the root, making s/n, and giving 1 coffee cup/day for 2 days.	R	MA281
4	Balanites aegyptiaca (L.) Del.	Balanitaceae	Badanaa	T	R	Ls	F	O	Breast cancer in cattle (Mucha Lonii)	Crushing the root, making s/n, and giving ½ a liter 2 times a day for 1 week for livestock.	C	MA23
5	Barleria steudneri C.B.Clarke	Acanthaceae	Qilxiiphee	H	L	Ls	F	O	Internal parasite of the Camel	Feeding it (the whole upper part) to the Camel	R	MA303
6	Calpurnia aurea (Alti) Benth.	Fabaceae	Ceekatta	Sh	L	Ls	FF	O,Er	Black leg (Abagorba,Anthrax (Abaseng),Hepatitis (Biirtee),External parasites of chicken (Andaqoo),Ear ache (Dhukkubgurra)	Chopping the leaves, making s/n, and giving 1 liter for adult cattle and ½ liter for calf 2 times/day for 3 days.Chopping the leaves with magado salt, making s/n, and giving 1 liter for adult cattle and one coffee cup for humans at once.Chopping the leaves, making s/n, and spreading on their body and their overnight site.Crushing the leaves, making s/n, filtering, and dropping 2 drops into the infected ear 2 times a day for 3 days.	C	MA59 b
7	Cissus quadrangularis L.	Vitaceae	GAALLE ARBAA	Cl	Ba	Ls	F	Dm	Black leg (Abagorba)	Chopping it, and inserting it into the dissected skin of the cattle.	R	MA196
8	Clematis simensis Fresen.	Ranunculaceae	Fiitti	Cl	L	Ls	F	O	Shiveringandabnormalbreathing(Cuma'a)	Crushing the leaves, making a solution, and giving one water glass of it to the sick animal.	C	MA103
9	Combretum collinum Fresen.	Combretaceae	Dhandhassa	T	L	Ls	F	O	Diarrhea ofcalves(Busootu)	Pounding the leaves, making s/n if possible adding Megado salt & giving small amt through the nostrils & one coffee cup orally once and for all.		MA38
10	Croton macrostachyus Hochst. ex Delile	Euphorbiaceae	Mokonniisa	T	Ba,Ba,L,Ls La,R		F	O	Tooth ache,Swellingand formingdeepopening (Luuxaa),Wound and tetanus, Abortion in cattle, Hepatitis,Shivering and abnormal breathing (Cuma'a)	Holding/chewing the internal part of the bark with the infected tooth. Crushing the internal bark, making thick s/n, and adding to the infected part.Crushing the internal part of the bark with its leaves, making s/n, boiling, and giving 2 water glasses 2 times a day for 3 days.Dropping the latex on the wound or infected part.Crushing the leaves, making s/n, and giving 2 coffee cups of the s/n for tetanus.Crushing the leaves and internal part of the bark, making s/n, and giving 3 coffee cups once. Or-Crushing the leaves with the leaves of Premna schimperi, making s/n, and giving ½ liter 2 times a day for 1 week.Chopping the root, making s/n, and giving 1 coffee cup once.Crushing root bark, making s/n, boiling, and giving 1 water glass 2 times a day for 3 days.Chopping the leaves with the leaves of Calpurnia aurea, making s/n, and giving ½ a liter for livestock.	C	MA137

No.	Scientific name	Family	Local name (Oromo language)	Hb	Pu	Ut	Cp	Ra	Disease treated	Preparation & Application	Ds	Co. No
11	Cyphostemma serpens (A. Rich.) Desc.	Vitaceae	Coophii (Yezihon Hareg)	Cl	St, Ba, L	Ls	FF	Dm	Blackleg (Abaa Goorbaa), FMD (Foot and Mouth Disease)	Chopping the stem with its bark, dissecting the skin of the cattle, and inserting it.Heating the bark and put on (place) the infected part.	C	MA250
12	Datura inoxia Mill.	Solanaceae	Xuxiyyee	H	L	Ls	F	O	Diarrhea in calves(Busootu), Tissue cancer (Luxaa Ykn Xandhacha)	Crushing the leaves with the leaves of Clematis simensis, making s/n, and giving 1 coffee cup for 1 day.Chopping the leaves, making thick s/n, inserting through the opening of the wound and covering the mouth of the opening with the residue.	C	MA14
13	Datura stramoniumL.	Solanaceae	QobbooArddaa	H	L	Ls	F	O	Rabies(DhukkubSaree)	Pounding the leaves, making s/n, & giving 1-2 coffee cup foradult livestock and half of it for calves.	C	MA307
14	Dichrostachys cinerea (L.) Wight & Arn.	Fabaceae	Jirmee	Sh	R, Se	Ls	F,Dr	O	Diarrhea in Calves (Biissotu),Hepatitis (Biirtee),	Chopping the roots, making solution and giving 1 coffee cup at once.Feeding the diseased animal with its seeds.	C	MA85
15	Dodonaea angustifolia L.f.	Sapindaceae	Dhitachaa	Sh	L, St	Ls	F	O	External parasites of livestock (Taffi Horii)	Chopping young leaves, making s/n, and giving ½ - 1 water glass to the animal.	C	MA30
16	Euphorbia ampliphylIa Pax	Euphorbiaceae	Hadaamaa	T	La	Ls	F	Dm, O	Wound (Naqarssa),Tooth ache,Reproduction organ infection in livestock	Taking the latex, combining it with the crushed Carissa spinarum root and applying on the wound.Taking small amount of the latex, adding water and giving 1 water glass 2 times a day for the animal. Applying the latex on the infected tooth.Applying the latex on the infected part.	C	MA48
17	Foeniculum vulgareMiller	Apiaceae	Kalkala Ykn Insilaala	H	R	Ls	F	O	To remove plasticmaterials fromlivestock stomach(DhukkubGarra)	Pounding the roots,making s/n, & giving one liter for livestock.	R	MA311
18	Guizotia scabra(Vis.) Chiov.	Asteraceae	Hadaa Butti	H	L	Ls	F	O	Black leg(Abagorba)	Chopping the leaves, making s/n, & giving one water glass.	C	MA313
19	Gymnanthemum amygdalinum (Delile) Sch.Bip.	Asteraceae	Eebiicha	Sh	R, L	Ls	F	O	Blotting and urine retention (Bokkoksa Fi Dhiibiinsa Fiincaanii)	Chopping the leaves, making s/n, and giving a liter for livestock at once.	C	MA156
20	Heteromorpha arborescens (Spreng.) Cham. & Schltdl.	Apiaceae	Ali-Hanqaa	Sh	L	Ls	F	O	Shiveringandabnormalbreathing(Cumha)	Crushing its leaves with the leaves of Ozoroa insignis, Crotonmacrostachyus,Calpurnia aurea and Senecio hadiensis, making s/n, & giving one liter orally at once.	R	MA218
21	Hordeum vulgare L.	Poaceae	Garbuu	H	Se	Ls	Dr	O	Broken bones &worn outtissues (LafeeCabaa Fi Nafaa Dadhabaa)	Giving some amount of grains daily for sick equine.	R	MA314
22	Laggera crassifolia (Sch.Bip. ex A. Rich) Oliv & Hiern	Asteraceae	Tamboo Looonii	H	R	Ls	F	O	Tooth ache of livestock (Qooraa Loon)	Crushing the root, making s/n, giving ½ liter once per day for 3 days.	C	MA141
23	Lannea rivae (Chiov.) Sacl.	Anacardiaceae	Handaraku	T	Ba	Ls	F	O	Shivering and abnormal breathing in livestock(Cuma'a),Breathing problem in cattle	Grinding the bark with megado salt and 1 liter solution is given per day for adult cattle for 3 days.Crushing the bark, making s/n, and giving 1 liter per day for 3 days.	R	MA148
24	Leucas abyssinica* (Benth.) Briq.	Lamiaceae	————	H	L	Ls	F	Na	Coughing &sneezing ofcalves(Bussotu)	Pounding the leaves,making s/n, &applying half of aCoffee cup through the nose.	R	MA23
25	Leucas discolorSebald	Lamiaceae	Xuxiyee	Sh	L	Ls	F	Na	Breathing problem incalves	Pounding the leaves, making s/n, & applying half of a coffee cup through the nose.	C	MA316
26	Maesa lanceolata Forssk	Myrsinaceae	Abbayyii	Sh	L	Ls	F	O	Leech infection (Ulaula)	Chopping the leaves, making s/n, boiling and giving ⅓ liter 2 times a day for 3 days.	C	MA272
27	Microglossa pyrifolia (Lam.) O.Kuntze	Asteraceae	QORSSAA TARAABII	Cl	L	Ls	F	Dm	Dermalwound ofequines(Booccoqa)	Pounding the leaves, making thick s/n, & applying on thewound daily until it heal.	C	MA35
28	Ozoroa insignis Del.	Anacardiaceae	Garrii	Sh	Ba	Ls	F	O	Diseases of equines (Dhukkub Tarabii), Bloody diarrhea (Garaa Kaasaa)	Chopping internal part of the bark with the bark of Pappea capensis, making s/n, boiling it and giving ¼ - ½ liter to the equine.Crushing inner bark, making s/n, and giving 1 water glass 2 times a day for 2 days.		MA222
29	Pavetta abyssinica Fresen.	Rubiaceae	Komoqorssa	Sh	R	Ls	F	O, Dm	Tooth ache& woundedcancer/skin cancer(DhukkubIllkani FiCacassa)	Chewing the root for tooth ache.Pounding the root & put on the infected part.	R	MA18
30	Pavetta oliveriana Hiern	Rubiaceae	Komoqorssa	Sh	L	Ls	F	O, Dm	Urineretention(DhidiinsFincaanii)	Chopping the leaves, making s/n, & drinking one coffee cup at once or smelling the chopped leaves.	C	MA18
31	Phytolaccadodecandra L'He'rit	Phytolaccaceae	Haraanja	Cl	L	Ls	F	O	Coughingdisease in equines.(Gamojii Taraabii)	Chopping the leaves, making s/n, & giving one water glass twice per week.	R	MA346

No.	Scientific name	Family	Local name (Oromo language)	Hb	Pu	Ut	Cp	Ra	Disease treated	Preparation & Application	Ds	Co. No
32	Prunus africana(Hook. f.) Kalkm.	Rosaceae	Sukkee	T	L	Ls	F	O	Diarrhea,wound andcoughing incattle(Sumuxe)	Pounding the leaveswith the leaves ofClematis hirsuta,Calpurnia aurea,Ehretia obtusifolia,Crotonmacrostachyus andTeclea simplicifolia,making s/n, andgiving one waterglass orally at once.	R	MA178
33	Ricinus communis L.	Euphorbiaceae	Qoobboo	H	L	Ls	F	O	Urine retention,Rabies(DhukkubSaree)	Crushing the leaves, making s/n, and giving 1 liter to the diseased livestock.Pounding its leaveswith the leaves ofCrotonmacrostachyus,making s/n, andgiving one water glass for the livestock at once.	C	MA322
34	Senecio hadiensis Forssk	Asteraceae	Walgabissa	Cl	L	Ls	F	O	Shiveringand unableto breathnormally in cattle(Cuma'a)	Chopping the leaves with the leaves of Heteromorphaarborenscens, Crotonmacrostachyus,Calpurnia aurea andLagenariaabyssinica, makings/n, and giving oneliter orally at once.	R	MA326
35	Solanum dennekense Dammer	Solanaceae	Hiidii	Sh	L, R	Ls	F	O	Swellingand formingdeepopening (Luuxaa)	Chopping the leaves and root together, making s/n, introducing through the opening and closing the opening with the residue.Crushing the root, making solution and giving 1 water glass at once.	C	MA78
36	Steganotaenia araliacea Hochst.	Apiaceae	Luqaaluqqe	T	L	Ls	F	O	Different diseases of equines including eye disease	Chopping its leaves together with the leaves of Gardenia ternifolia and magado salt, 2 cup of its s/n, is given to the diseased equine.	R	MA237 b
37	Syzygium guineense (Wild.) DC. var. guineense	Myrtaceae	Baddessa	T	Ba	Ls	F	Na	Leechinfection(Ulaulaa)	Chopping internalpart of stem bark,making s/n, andgiving half of acoffee cup throughthe nostrils.	R	MA128
38	Teclea borenensis M.Gilbert	Rutaceae	Hadheessa	Sh	R, L	Ls	F	O	Bloody diarrheain livestock (Woraan), Beingbreathless in animals	Crushing the root and leaves together with magado salt, making s/n, and giving 1/3 of a liter for the animal once a day. Crushing the leaves, making s/n, and giving 1 liter at once.	C	MA275
39	Teclea salicifolia Engl.	Rutaceae	Hadheessa	Sh	L St	Ls	F	O	Diarrhea (Albaattii),Wound (Cacca),Trypanosomiasis (Gandii), Hepatitis (Birtee),Stomach acheTooth ache of livestock (Dhukubii Iilkaan)	Crushing the leaves giving 1 coffee cup of its solution for the patient. Heating the leaves on fire, adding butter and putting on the wound.Chopping the leaves, giving 1 liter of its solution to the diseased livestock to treat trypanosomiasis.Crushing the leaves, making s/n, and giving half a liter to the diseased animal.Chopping the leaves and holding it with the infected tooth.	R	MA77
40	Thunbergia ruspolii* Lindau	Acanthaceae	———————	Cl	L	Ls	F	Na	Diarrhea in calves(Busootu)	Chopping the leaves, making s/n, and applying one coffee cup through the nostrils two times a day.	R	MA328
41	Tragia cinerea (Pax)Gilbert & Radcl. Smith	Euphorbiaceae	Lallessaa	Cl	L	Ls	F	O, Na	Diarrhea incattle(Busootu)	Pounding the leaves, making s/n, and giving one liter orally and some droplets through the nostrils.	C	MA14
42	Vangueria apiculata K. Schum	Rubiaceae	Bururii	Sh	R, L	Ls	F	O,Na	Liver disease,Urineretention(DhidiinsFinsaamii)	Chopping the root bumps, making s/n, and giving half a liter for livestock. Chopping the leaves, making s/n, & drinking one coffee cup at once or smelling the chopped leaves.	R	MA87
43	Viscum congolense DC. Wild.	Viscaceae	Balddoo	Ep	L, St	Ls	F	O,	Shivering and abnormal breathing in cattle (Cuma'a), Cold and liver diseases of cattle (Dhukkub Qorra Fi Tiruu Looni),	Chopping these parts, making s/n, and giving 1 water glass solution 2 times a day for adult cattle.Chopping the leaves, making s/n, and giving one water glass to the cattle.	R	MA71
44	Viscum tuberculatum A. Rich.	Viscaceae	Dhertoo	Ep	St, L	Ls	F	O	Poisons, snake venom,Shiveringandabnormalbreathing(Cuma'a)	Chopping the whole part with magadoh salt, making s/n, and giving 1 water glass 2 times a day for 1 day for the cattle. Or Chopping its leaves with the leaves of Fagaropsis angolensis, making s/n, and giving one coffee cup 2 times a day for 3 days.	C	MA330
45	Zanthoxylum chalybeum Engl.	Rutaceae	Gaddaa	Sh	Ba,R, Se, L, St,	Ls	FDr	O,	Back side pain (Dhukubii Duba), Diarrhea in goats (Albaattii Re'ee),	Chopping the leaves, making s/n, and giving $\frac{1}{2}$ liter per day for 3 days.	R	MA16

No.	Scientific name	Family	Local name (Oromo language)	Hb	Pu	Ut	Cp	Ra	Disease treated	Preparation & Application	Ds	Co. No
46	Ziziphus abyssinica Hochst ex A. Rich.	Rhamnaceae	Huqunqura	T	Ba	Ls	F	Na,O	Weight loss and being powerless inlivestock(Xuxii).	Crushing internal part of the bark, making s/n, and dropping 2 drops through the nostrils. Chopping the bark, making s/n, boiling, adding milk or butter and giving 1 water glass 2 times a day for 3 days.	C	MA217b