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Ethnoveterinary Medicinal Plants and Practices in Aneded District, East Gojjam Zone, Northwestern Ethiopia

Nigussie Amsalu*, Demeke Mihret, Liyew Birhanu

Department of Biology, College of Natural and Computational Science, Debre Markos University, P.O. Box: 269, Debre Markos, Ethiopia

*Corresponding author**:** nigussieam2000@gmail.com; nigussie_amsalu@dmu.edu.et

Abstract

Traditional ethnoveterinary practices using medicinal plants, deeply embedded in indigenous knowledge, have played a crucial role in livestock health management. This study aimed to document the ethnoveterinary knowledge and practices related to medicinal plants in Aneded district, northwestern Ethiopia. Data were collected through semi-structured interviews, group discussions, and field walks. A total of 387 informants were involved, including 26 key informants. Ethnobotanical data were analyzed using informant consensus factor, preference ranking, direct matrix ranking, and fidelity level to assess knowledge consistency and importance. One-way ANOVA was used to identify the significant differences in knowledge among informants. A total of 48 ethnoveterinary plant species under 46 genera and 29 families were collected and documented to treat various livestock ailments. Euphorbiaceae was the most diverse family, accounting for 6 (12.5%) species. Most medicinal plants were collected from wild habitats (52%), followed by home gardens (23%). Herbs were the most popular growth form (43%), with leaves being the primary plant part used (47%). Most remedies (59%) were prepared from fresh plant parts and taken orally. Indigenous knowledge of medicinal plants varied significantly across key informants, education levels, age groups, and marital statuses. Informant consensus analysis indicated that parasitic ailments, including ticks, leeches, coccidiosis, fascioliasis, helminthiasis were the most common health issue (0.95). In preference ranking, Capsicum annum (28 scores) was the most effective for treating leech infestation. Community members cited ***Cucumis ficifolius****,* ***Justicia scimperiana****, and* ***Sesamum angustifolium*** *as remedies for fascioliasis, colix & anthrax, and blackleg, respectively. Agricultural expansion posed a significant threat to medicinal plant biodiversity, particularly affecting species like* ***Echinops kebericho****. Thus, documenting local knowledge and raising community awareness are crucial for conserving medicinal plants and associated indigenous knowledge.*

Keywords: *Aneded, ethnoveterinary practices, indigenous knowledge, livestock ailments, medicinal plants.*

1. Introduction

Indigenous knowledge (IK) of medicinal plants (MPs) has been passed down through generations for centuries (Abebe, 1986; Jamshidi-Kia *et al*., 2018). Historically, the plants have been the cornerstone of healthcare systems in many societies, particularly in Africa, where indigenous communities have long relied on them to treat both human and livestock ailments (Bussmann *et al*., 2011). Even as civilizations advanced and new technologies emerged, our understanding of these plants deepened, highlighting their enduring significance. Beyond their medicinal properties, MPs often hold cultural and economic value, serving as essential sources of food, income, and cultural identity (Ari *et al*., 2015; Randriamiharisoa *et al*., 2015). They continue to play a vital role in the lives of African communities, underscoring their enduring relevance in the modern world.

Ethnoveterinary practices, dating back to the domestication of livestock, remain a cornerstone of animal healthcare in many developing countries (Tadesse *et al*., (2018). As the World Health Organization (WHO, 2010) noted, an estimated 80% of the population in these regions relies primarily on indigenous knowledge and practices for treating livestock ailments. In Ethiopia, plant-based remedies remain the primary, and often the sole, source of treatment for nearly 90% of the livestock population (Abebe, 1986; Birhanu & Abera, 2015). This reliance on traditional medicine is primarily due to the limited availability of modern veterinary care, including clinics and affordable drugs. The high cost of modern medications places them out of reach for most Ethiopian farmers and pastoralists, who are compelled to turn to their ancestral knowledge and locally available plant resources to address their livestock's health needs (Fullas, 2010).

Following Martin (1995) and Cotton (1996), this study sought to answer the following research questions:

1) What medicinal plants are used for livestock ailment treatment in Aneded district?
2) How does local knowledge of ethnoveterinary plants vary across various demographic groups?
3) How are plant parts used, herbal remedies prepared, and administered in the study area?
4) What are the major threats to medicinal plant resources

The lack of accessible and affordable veterinary care has exacerbated both epizootic and Zoonotic diseases, jeopardizing the economic sustainability of livestock production (Giday & Ameni, 2003).

Despite traditional healers and veterinary professionals play a vital role in providing healthcare services (Giday & Ameni, 2003; Wendimu *et al*., 2024), the high costs associated with modern drugs continue to be a major barrier for many Ethiopian farmers (Giday & Ameni, 2003). Moreover, the erosion of indigenous knowledge and the depletion of plant resources jeopardize the survival of traditional veterinary practices, which heavily depend on locally sourced medicinal plants. Given the dearth of understanding and documentation of ethnoveterinary plant practices in Aneded district, Northwestern Ethiopia, this study aimed to document traditional

ethnoveterinary practices and knowledge related to medicinal plant use to treat livestock ailments in the area.

2. Materials and Methods

2.1. Description of the Study Area

A geographical overview: According to Aneded Woreda (district) Agricultural Office (ADAO, 2020), Aneded is nestled within the East Gojjam Zone of the Amhara Region, Ethiopia. Aneded district is strategically located bordering Baso Liben district and the Oromia Region to the south, Debre Markos town and Gozamin district to the west, Gozamin and Awabel districts to the north, and Awabel district to the ea. Spanning 67,585.47 hectares, Aneded district is divided into 22 **Kebeles** (sub-districts). Geographically, it lies between latitudes 9°55'0"N and 10°25'0"N and longitudes 37°45'0"E and 37°55'0"E (Fig. 1). The district's elevation ranges from 1,623 to 2,570 masl. The district's landscape is predominantly flat (65.67%), with plateaus accounting for 34.33% of the area. In terms of land use, natural grazing land covers 9,788.7 ha, cultivated land spans 39,141.49 ha, natural forests occupy 8,770.28 ha, and other land uses account for 9,885 ha

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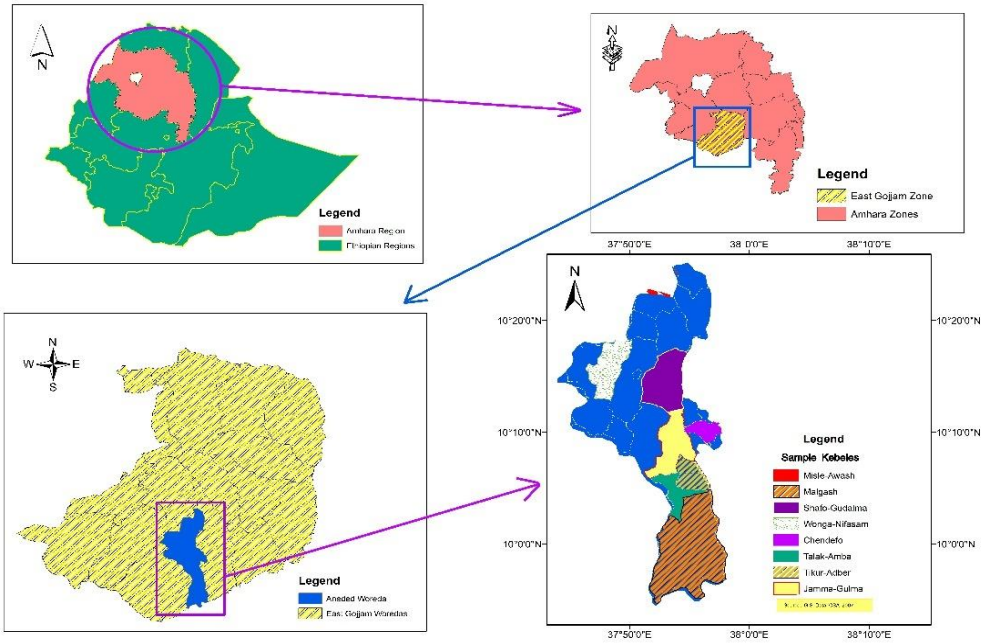

Figure 1. Map of Aneded district in east Gojjam, Amhara region, Ethiopia

Economic activity: In Aneded district, the economic activities of the local communities are cultivation of crops and rearing of livestock. The main crop productions of district are teff, wheat, maize, sorghum, barely, fava bean, field pea, chickpea, nigerseed, sesame and linseed. Of these, the most common crops are teff, wheat and maize. Livestock, including cattle, sheep, goats, and poultry, is equally vital for food security, income, and sustainable livelihoods (ADAO, 2020).

Health condition: Aneded district Animal Health Office (ADAHO) also reported the

prevalence of animal diseases in the district including bacterial, viral, parasitic, and protozoal infections. Common pathogens included black leg, pastureolosis, anthrax, mastitis, fowl typhoid, avian salmonellosis, fascioliasis, paramphitomiasis, strongyliasis, ticks, mites, lice, insect flies, rabies, AHS, foot-and-mouth disease, trypanosomiasis, babesiasis, and coccidiosis (ADAHO, 2021).

Climate, soil, and vegetation of Aneded district: The district experiences a predominantly Woina Dega (mid highlands) climate, accounting for 81.1% of the area. Kola (lowlands) and Dega **(**highlands**)** climates comprise 15.6% and 3.3% of the area, respectively. The annual rainfall in Aneded ranges from 1,500 to 1,800 millimeters, while the average annual temperature falls between 8.9 and 26.2 degrees Celsius (Fig. 2). The area's soils are characterized by their diversity. Brown soil covers 16.5% of the area, while Red soil dominates at 56.6%, and Black soil accounts for the remaining 26.9% (ADAO, 2020). The vegetation type is characterized by species such as *Podocarpus falcatus*, *Olea europaea* subsp. *cuspidata*, *Eucalyptus*, and *Juniperus procera* (Friis *et al*., 2010), as well as *Ficus* spp., *Croton macrostachyus*, *Carissa spinarum*, *Brucea antidysenterica*, *Senna singueana*, *Otostegia integrifolia*, *Anogeissus leiocarpa*, *Millettia ferruginea*, and many others.

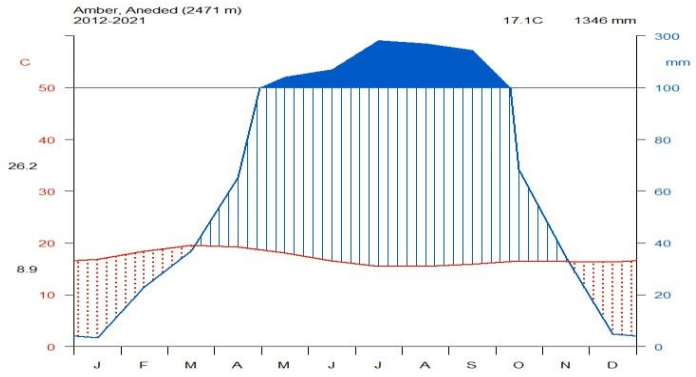

Figure 2. Climadiagram of the study area (Source: National Meteorological Service Agency (NMSA, 2012-2021)

2.2. Site Selection, Sample Size, and Informant Choice

Out of the 22 **Kebeles** in Aneded district, eight were purposefully chosen based on a variety of criteria, including the presence of traditional healers, the history of traditional medicine use, topographical and altitudinal variance, access to healthcare, road connection, and flora diversity. These were Misile Awash, Wenga Nifasam, Shafo Gudalma, Jama Gulma, Chendefo, Talak Amba, Tikur Adber, and Malgash **Kebeles**. The first two were **Dega**, the next three were **Kola**, and the last three were **Woina Dega**. The sample size for quantitative data was determined using Yamane (1967) simplified

formula, as shown through Akpor *et al*. (2016) as follows: $n = \frac{N}{1+N(e)^2}$,

where: n = correct sample size for the research, N = total number of households in all eight **Kebeles**, e = level of precision or margin of error 5% (0.05), 1 = probability of the event occurring (PEO). With a total of 12,128 households in the eight **Kebeles** of the study area, the informant sample size becomes:

N=12128; e=0.05; $n = \frac{N}{1+N(e)^2} = \frac{12128}{1+12128\,(0.05)^2} = \frac{12128}{1+030.32} = 387.$

We selected 387 informants (219 males &168 females) through simple random sampling and 26 key informants (21 males 5 females) through purposive sampling based on local recommendations, and personal observation.

2.3. Methods of Data Collection

There are different data collection methods in ethnobotanical study. From that to conduct this study, the data collection methods were semi-structured interview, field observation, group discussion, and guided field walk. Respondents provided in-depth responses to a series of open-ended questions. These questions were developed in advance and supplemented by emergent themes that arose organically during the conversation (Martin, 1995). Semi-structured interviews were conducted, following the guidance of Martin (1995) and Cotton (1996). To facilitate this approach, an interview guide was developed prior to each interview, outlining key questions and discussion topics to be covered with the informants (Appendix 2).

A group discussion was conducted two times (in each **Kebele**) with 7-10 of the most knowledgeable individuals who were selected by respective **Kebele** elders and administrators about the use of MPs, livestock diseases, threats, and conservation mechanisms of traditional MPs.

Guided field walk is a combination of observation and interview methods to visit locations where medicinal plants are growing (Martin, 1995). In this method, the researcher was guided with some interviewee to the most knowledgeable one who was selected by respective **kebele** elders and administrators through areas where interested plants were considered to be existed.

2.4. Voucher Specimen Collection and Identification

In this study, specimens of MPs were collected from wild and cultivated areas during field observation and guided field walk. The Voucher Specimen of these collected plants then, pressed, dried, mounted, and labeled to be identified. Identifications were made using published volumes of the flora of Ethiopia and Eritrea, and voucher specimens were deposited at the Debre Markos University Herbarium (DMU).

Ethical Clearance

Ethical clearance was obtained from the DMU and Aneded District Administration Office, respecting local cultural, religious, and linguistic sensitivities. Informed consent was secured from participants, ensuring understanding of study objectives, respect for dignity and privacy, and confidential handling of sensitive information.

2.5. Methods of Data Analysis

Descriptive statistics (percentages and frequencies) were used to analyze data on MPs, their uses, conservation, and associated local knowledge. Information on plant species, medicinal uses, preparation methods, administration routes, treated ailments, dosages, plant parts, growth forms, and sources was analyzed. One-way ANOVA was used to compare medicinal plant use across sociodemographic groups ($\alpha = 0.05$).

To assess the perceived effectiveness of MPs in treating livestock diseases, a preference ranking exercise was conducted. Following the methodology of Martin (1995), informants were asked to rank a selected group of plants based on their personal experience, community consensus, or other relevant criteria. Participants rate items 1-5, with 5 being the best, and the item with the highest total score is ranked best overall. Direct matrix ranking was also a method for assessing the multi-purpose use of a species and its relative importance within a particular ecosystem (Martin, 1995). Key informants were asked to assign use values to various medicinal plant species. Averaging and summing scores for each species created a ranked list based on utility and dominance.

Informant consensus factor (ICF) assesses plant species importance based on informant agreement. The ICF was calculated to measure agreement among informants on reported cures using the following formula:

$\text{ICF} = \frac{\text{Nur}-\text{Nt}}{\text{Nur}-1}$, where, Nur is the number of individual plant use reports for particular ailments, and Nt is the total number of species used by all informants for these ailments (Martin, 1995).

Fidelity level (FL) quantifies the importance of a given species for a particular purpose in a given cultural group. The FL is important to identify the importance of a plant species used for treating a particular ailment (Alexiades, 1996) given by: $\text{FL} = \frac{\text{Ip}}{\text{Iu}} \times 100$, where, **Ip** represents the number of informants who mentioned a species for a specific ailment, while **Iu** denotes the total number of informants who reported the species for any ailment.

3. Results and Discussion

3.1. Demographic Characteristics of Informants

Informants provided demographic data including informant category, gender, age, education level, and marital status. The majority of participants were aged from 36-80, with 88% being married. Additionally, 78% of participants lacked formal education, while 22% had some literacy. Key informants demonstrated significantly greater knowledge of MPs ($p < 0.05$). Paradoxically, while education often correlates with increased knowledge, illiterate participants in this study demonstrated a significantly higher level of awareness of MPs compared to their literate counterparts ($p < 0.05$). In addition, couples reported significantly more plants on average than single individuals ($p < 0.05$). However, there was no statistically significant difference in the number of MPs reported by male and female informants ($p > 0.05$) (Table 1).

Table 1. Statistical test of informant-reported knowledge of ethnoveterinary MPs.

Parameters	Informant groups	N	Percent (%)	P
Informant category	General informants	361	93	0.001*
	Key informants	26	7	
Gender	Males	219	57	0.041*
	Females	168	43	
Age range	24-35	138	36	0.001*
	36-80	249	64	
Education level	Uneducated	303	78	0.001*
	Literate	84	22	
Marital status	Married	339	88	0.000*
	Single	48	12	

*Significance difference ($P < 0.005$); N= No. of informants

The study underscored the complex interplay between social structures, and plant knowledge. Key informants exhibited significantly deeper MPs knowledge, likely due to specialized skills or extensive experience. This finding is supported by Lulekal *et al*. (2014) and Wendimu *et al*. (2024), who have demonstrated that key informants identified significantly more MPs than ordinary informants ($p < 0.05$), highlighting their greater knowledge. Interestingly, gender did not significantly influence knowledge, with both men and women contributing equally to the community's botanical understanding. Respondents with less formal education displayed a deeper understanding of plants. This likely stems from greater reliance on traditional knowledge, closer ties to nature, and cultural emphasis on plant-based remedies. While formal education broadens awareness, traditional knowledge remains vital, particularly for illiterate individuals. A small subset of literate informants suggests potential for integrating formal and informal learning. The demographic analysis further indicates a majority of mature adults, reflecting the community's experienced knowledge holders. Given their prolonged direct interaction with plants, elderly individuals often possess deep knowledge of MPs and their uses. The higher the marriage rate among participants, the higher knowledge of ethnoveterinary practices and its MPs. This demonstrates the significant role of family structures in traditional MPs knowledge transmission, and with couples often owning more medicinal plants knowledge due to shared responsibilities.

3.2. Ethnoveterinary Medicinal Plant Diversity in the Study Area

A total of 48 plant species, representing 46 genera and 29 families, were identified as traditional herbal remedies for 24 livestock ailments in the study area (Appendix 1). Euphorbiaceae and Solanaceae were the most diverse families, with Euphorbiaceae encompassing four genera (9%) and six species (12.5%), and Solanaceae comprising five genera (11%) and five species (10.42%). This dominance could be attributed to their widespread distribution and extensive utilization within Ethiopia and/or the specific flora area under study. In line with the present study, Alemneh (2021)

has identified Asteraceae and Euphorbiaceae families as dominant, while Birhanu & Abera (2015) have recognized Solanaceae as the dominant family. In other studies, Asteraceae and Euphorbiaceae have been found to be the most prevalent plant families, with Asteraceae being the most dominant (Lulekal *et al*., 2014; Wendimu *et al*., 2024). The extensive use of herbal medicines suggests that the local community has a strong tradition of using plants for veterinary purposes. Consistent with previous research (Sunder *et al*., 2014; Lulekal *et al*., 2014; Ashagre *et al*., 2016; Adane, 2018), this study highlighting the deep-rooted reliance on MPs for traditional livestock healthcare practices within the Aneded district.

3.3. Sources of Medicinal Plants

The majority of MPs in the study area were sourced from wild habitats, with home gardens being a secondary source. Accordingly, wild habitats provided most of MPs (52%), whereas home gardens contributed 23% to the overall diversity (Fig.3). This pattern is consistent with previous research conducted elsewhere (Lulekal *et al*., 2008, 2014; Ashagre *et al*., 2016; Adane, 2018), indicating a strong reliance on natural ecosystems for medicinal plant resources.

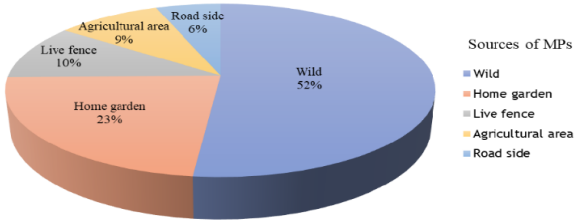

Figure 3. Source of medicinal plants in the study area

3.4. Growth Forms of Medicinal Plant Species

A total of 48 ethnoveterinary MPs were identified, of which herbs and shrubs were accounted for the largest category (19 species each, 39.6%) followed by trees (7 species, 14.6%) (Fig. 4; Appendix 1).

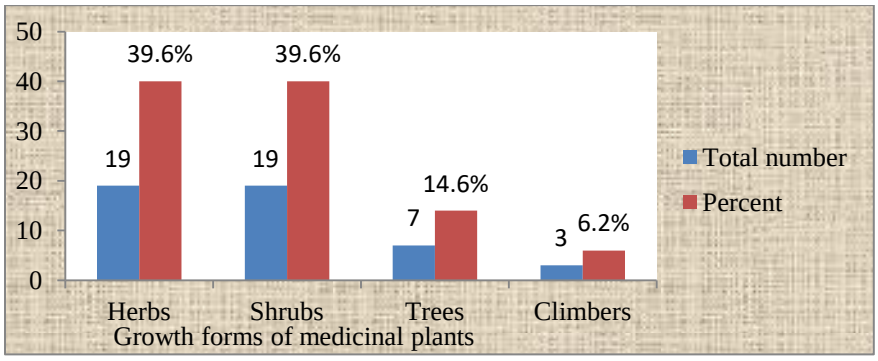

Figure 4. Growth forms of medicinal plants

Herbal remedies have historically been a primary source of treatment for livestock ailments. This prevalence likely reflects the abundance of herbs and shrubs compared to other plant growth forms in the study area. Studies have consistently shown that herbs

are the most abundant and widely used plant species in Ethiopian traditional medicine (Lulekal *et al*. 2013; Adane, 2018; Amsalu *et al*., 2018; Alemneh, 2021). Likewise, shrubs have been found to be the most frequently utilized growth forms in herbal therapy (Lulekal *et al*., 2008; Giday & Teklehaymanot, 2013). Their prevalence is likely due to their remarkable adaptations to dry conditions. Deep roots and waxy leaves enable shrubs to conserve water efficiently, making them vital resources in areas with limited rainfall.

3.5. Plant Parts Used and Conditions of Remedy Preparation of Herbal Medicines

Various parts of medicinal plant species were used to treat livestock ailments. The most commonly utilized and reported parts of MPs were leaves (46%), followed by roots (24%) (Fig. 5).

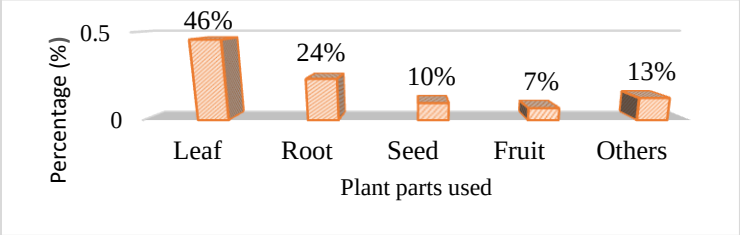

Figure 5. Plant parts used in remedy preparations for treating livestock ailments

Leaves are the primary source of veterinary remedies, as confirmed by previous studies (Giday & Teklehaymanot; Amsalu *et al*., 2018; Alemneh, 2021; Wendimu *et al*., 2024). This enduring reliance on plant-based remedies, particularly leaves, highlights their perceived medicinal value. The presence of secondary metabolites in leaves further supports their potential therapeutic properties, making them a primary ingredient in many veterinary preparations (Lulekal *et al*., 2014; Amsalu *et al*., 2018). Moreover, the majority of plant remedies (56%) were prepared using fresh plant materials, followed by dried (42%) and a combination of both (2%). This preference for fresh parts aligns with previous research (Lulekal *et al*., 2013; Birhanu & Abera, 2015; Wendimu *et al*., 2024), which suggests that local communities believe fresh preparations are more potent than dried ones. The increased use of fresh ingredients in remedy production may indicate that most essential plant components are available locally throughout the year.

3.6. Methods of Remedy Preparation and Route of Administration

Based on the preparation of plant remedies, the local people of the Aneded district employed different methods to prepare traditional medicines for the treatment of livestock ailments. The most important and commonly used preparation methods were crushing or grinding (65%), followed by a smaller proportion (7%) through direct chewing or consumption of the medicinal materials (Fig. 6). The preference for crushing and grinding suggests that the active ingredients in these remedies are often insoluble and require physical breakdown to be released and absorbed. Other ways of preparations included pounding, juicing, infusion (macerations), boiling (decoction), and many others. Similar studies in Ethiopia (Adane, 2018;

Amsalu *et al*., 2018; Kassa, 2020) have predominantly reported crushing as the primary method of remedy preparation. However, Ashagre *et al*. (2016) have found that pounding was the most common technique.

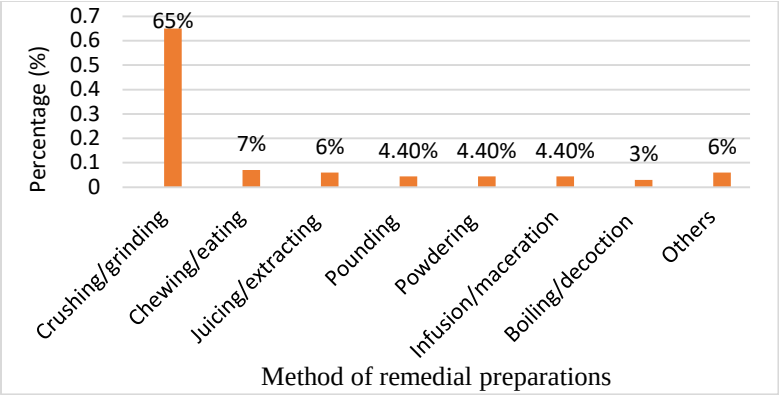

Figure 6. Methods of remedy preparation to treat livestock ailments

The routes of administration of plant remedies in the study area were oral, dermal, nasal and ocular. Oral administration (71%) was the most common route, followed by dermal application (16%) for treating livestock ailments (Fig. 7). This is due to the fact that oral routes allow for rapid absorption and increased therapeutic efficacy. This route of applications aligns with previous studies (Giday & Teklehaymanot, 2013; Ashagre *et al*., 2016; Adane, 2018; Wendimu *et al*., 2024).

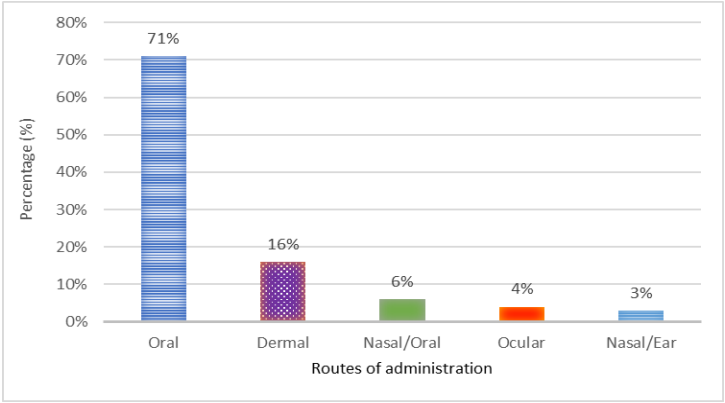

Figure 7. Routes of administration of plant remedies for livestock ailments

3.7. Dosages, Solvents, and Additives in Ethnoveterinary Plants

In the study area, plant remedies for livestock were administered using various non-standardized measures, such as teaspoons, water glasses, cups, and ladles. This lack of standardization hinders accurate and consistent dosing. Similarly, Abebe (1986), and Giday & Ameni (2003) highlighted the absence of precise and standardized practices as a significant limitation of traditional healthcare systems globally. Local practitioners often used water as a primary solvent and added substances like salt, injera, and milk to enhance the taste and perceived efficacy of plant-based remedies. However, knowledge about potential antidotes and side effects of these treatments on livestock was limited.

This practice aligns with similar cultural traditions reported in Lulekal *et al*. (2008). While solvents, particularly water, were commonly used (75%), the addition of other substances (additives) was less frequent (25%).

3.8. Preference Ranking of Medicinal Plants

In the study area, six medicinal plant species were used to treat leech infestation. Leech infestation was most common ailment. Among six plants, *Capsicum annum* (28) was effective and the best MPs for treating leech infestation followed by *Nicotiana tobacum* (27), and *Silene macrosolen* (23). The least preferred plant species was *Calpurnia aurea* (15) (Table 2).

Table 2. Preference ranking of six medicinal plants used for treating leech infestation.

List of species	Key informants coded A to G							Total score	Rank
	A	B	C	D	E	F	G		
Capsicum annum	5	4	5	4	4	3	3	28	1st
Nicotiana tobacum	4	5	3	3	4	5	3	27	2nd
Silene macrosolen	3	4	3	2	3	5	3	23	3rd
Solanum marginatum	4	2	3	3	2	2	2	18	4th
Dracaena steudneri	3	2	2	3	2	3	2	17	5th
Citrus limon	2	3	3	2	2	2	2	16	6th
Calpurnia aurea	2	3	2	2	2	2	2	15	7th

Key informants (A-G); Informants rated plants 1-5, with 5 being most effective for leech

In livestock ailments, *C. annum* scored the highest preferred value for treating leech infestation, followed by *N. tobacum*. The former species proved most effective against leech infestation. Following Martin (1995), informants rated the plant they deemed most effective for the given ailment highest.

3.9. Informant Consensus and ICF for Livestock Medicinal Plants

Informant consensus and informant consensus factor (ICF) were used to gauge the consistency and reliability of information provided by multiple informants. Informant consensus analysis revealed that certain medicinal plant species were more frequently used than others within the study area. For example, *Capsicum annum* was particularly popular, cited by the highest number of informants for treating various livestock ailments. Overall, *C. annum*, *Justicia schimperiana*, and *Cucumis ficifolius* emerged as the most widely used and valued MPs, ranking first, second, and third, respectively.

Livestock ailments can be classified based on various factors, including their causative agent, mode of transmission, and the affected animal species. Following this, traditional healers in the study area harnessed the power of plants to treat 28 various livestock ailments, classified into eight categories. Parasitic diseases were the most common health issue, with external infestations (ticks and leeches) and internal

infections (coccidiosis, fascioliasis, and helminthiasis) occurring at a rate of 0.95. Digestive disorders, such as bloating, retained placenta, urine retention, diarrhea, and colic, followed closely at a rate of 0.91 (Table 3).

Table 3. Informant consensus factor for livestock ailments in study area.

Ailment categories	Nt	Nur	ICF
Parasitic ailments: coccidiosis, tick, leech infestation, fascioliasis and helminthiasis	10	185	0.95
Digestive disorder & non-infectious: bloating, retained placenta, urine retention, diarrhea, and abdominal colic	14	140	0.91
Anthrax and blackleg	7	60	0.90
Trypanosomiasis (protozoal)	3	19	0.89
Emaciation (nutritional), loss of appetite	5	28	0.85
Rabies, lumpy skin, pink eye (conjunctivitis) and contagious ecthyma (Orf)	8	20	0.63
Demon (evil spirit)	7	25	0.75
Others: fever, cough, swelling, epidemic, clumsiness, nasal affliction, neck infection, and eye pain	9	40	0.79

Key: ICF = informant consensus factor; Nur = the no. of use citations; Nt = the no. of spp.

Moreover, the ICF analysis indicated anthrax, blackleg, and trypanosomiasis were the most frequently reported livestock ailment categories. Similarly, in the Omo-Gibe and Rift Valley basins of Ethiopia, blackleg, bloat, and endoparasites were the diseases with the highest informant consensus (Wendimu *et al*., 2024). As indicated in the preceding table, a total of 10 and 14 MPs were utilized in the treatment of the first and second ailment categories, respectively. The findings of this study align with Giday & Ameni (2003), who have noted the reliance of farmers and pastoralists on local knowledge for livestock health. A higher ICF indicates strong community agreement on the significance of MPs, whereas lower ICF values suggest potential knowledge gaps. High ICF values, as noted by Heinrich *et al*. (1998), indicate strong informant agreement on taxa selection, while low values suggest disagreement.

3.10. Healing Potential of Medicinal Plants

The fidelity level (FL) of various ethnoveterinary MPs was determined to assess their significance in the local communities. *Cucumis ficifolius* emerged as the most valuable plant, with a FL of 97% for healing Fascioliasis. Other notable plants included *Justicia schimperiana* (94%) against abdominal colic, and *Sesamum angustifolium* (88%) against blackleg (Table 4).

Table 4. Fidelity level of six top cited plants in treating livestock ailments.

Scientific name	Ailments treated	Ip	Iu	FL	FL%
Cucumis ficifolius	Fascioliasis	38	39	0.97	97
Justicia scimperiana	Colic & anthrax	34	36	0.94	94
Sesamum angustifolium	Blackleg	35	40	0.88	88
Lepidium sativum	Emaciation	27	37	0.73	73
Capsicum annum	Bloating	28	40	0.70	70
Withania somnifera	Trypanosomiasis	18	30	0.60	60

FL = Fidelity Levell Ip = No. of respondents mentioning importance,
Iu = Total no. of respondents reporting species

C. ficifolius and *J. schimperiana* demonstrated the highest FL, suggesting superior healing properties, consistent with the findings of Asfaw *et al*. (2022). This concurrence supports their potential medicinal applications. Moreover, our findings align with previous Ethiopian studies that assessed FL for various MPs (Giday & Teklehaymanot, 2013; Lulekal *et al*., 2014; Ashagre *et al.*, 2016; Adane, 2018; Amsalu *et al*., 2018; Kassa, 2020; Wendimu *et al*., 2024). FL reflects the relative effectiveness of MPs uses within a species against specific ailments (Heinrich *et al*., 1998). High FL indicates strong cultural consensus, while low FL suggests greater variability in reported uses (Andrade-Cetto & Heinrich, 2011).

3.11. Threats to and Threatened Medicinal Plants in the Study Area

Forests are crucial resources for rural communities, but unsustainable practices threaten their health. To understand local perceptions of these threats, seven key informants were interviewed to identify and rank the most significant risks to medicinal plant diversity. Based on their responses, agricultural expansion (34 scores) was the most pressing concern, followed by overgrazing (32 scores), and construction activities (30 scores) (Table 5). The most threatened medicinal plant species, as perceived by the informants, included *Echinops kebericho, Silene macrosolen, Securidaca longepedunculata, Withania somnifera*, and *Millettia ferruginea*.

Table 5. Average direct matrix ranking of threats to ethnoveterinary medicinal plants.

Threats	Key informants coded A to G							Total score	%	Rank
	A	B	C	D	E	F	G			
Agricultural expansion	5	4	5	5	5	5	4	35	17	1st
Overgrazing	5	5	4	4	5	5	4	32	15.5	2nd
Construction	5	5	3	4	4	5	4	30	14.5	3rd
Firewood collection	4	5	5	4	4	4	2	28	13.5	4th
Charcoal making	5	3	3	4	3	3	3	24	11.6	5th
Furniture making	4	4	2	3	3	3	3	22	10.6	6th
Farm tool making	3	2	2	3	3	3	4	20	9.6	7th
Drought	3	4	1	2	3	1	2	16	7.7	8th
Total								207	100%	

Key informants, designated A through G; 1: least destructive, 5: most destructive

The district's primary economic activity, agriculture, poses the greatest threat to MPs due to rapid population growth and subsequent expansion. This trend is consistent with other national ethnobotanical studies (Adane, 2018; Amsalu *et al*., 2018). The result also revealed *E. kebericho* was identified as the most threatened medicinal plant, with the highest preference value in the ranking analysis. Over-harvesting of roots, a common practice in traditional medicine, poses a significant threat to its long-term survival, as documented in previous studies (Lulekal *et al.,* 2013). Adane (2018) identified *E. kebericho* as the most endangered medicinal plant in Ankesha district, followed by *Aloe trigonantha* and *Kalanchoe petitiana*. Local communities and traditional healers employed traditional methods to conserve medicinal plants. Traditional conservation methods included drying, preserving, and storing plant parts in containers. To protect crops, locals employed guards and fencing. These conservation methods proved ineffective for long-term storage. Adane (2018) found that healers also use basic storage methods.

4. Conclusions and Recommendations

This study highlights the continued significance of traditional herbal medicine in livestock healthcare within the Aneded district. Local communities in the study area possess a wealth of ethnoveterinary knowledge and practice, utilizing diverse medicinal plants to treat various livestock ailments, including coccidiosis, tick, leech infestation, fascioliasis, helminthiasis, bloating, urine retention, diarrhea, abdominal colic, anthrax, blackleg, and trypanosomiasis. However, access to this knowledge varies significantly among different groups, influenced by factors like literacy, gender, general and key informants, and age groups. Euphorbiaceae and Solanaceae were the primary plant families forming the therapeutic landscape. This dual reliance on natural habitats and home gardens for plant materials illustrated a sustainable approach to resource management. *Cucumis ficifolius* and *Justicia scimperiana* emerged as a particularly versatile herb, widely employed for a range

of health conditions. The results underscore the substantial contribution of traditional herbal medicine to the healthcare of livestock in the study area, providing valuable insights for future research and potential applications in sustainable animal health management. To ensure the future of this knowledge, future research should focus on the pharmaceutical potential and sustainable use of these plants. Furthermore, raising community awareness about documenting MPs and traditional knowledge is essential.

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Competing interests

The authors declare that they have no competing interests.

Authors' contributions

All authors contributed equally to the manuscript's conception, design, data acquisition, analysis, interpretation, and drafting, and have read and approved the final version.

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Appendix 1. List of medicinal plants used to treat livestock ailments in the study area

Scientific & family name	Amharic name	Gf	Ailments treated	PU	CP	Methods of preparations & route of administration	Vo. no. (DMX)
1. *Allium sativum* L. (Alliaceae)	Nech Shinkurt	H	Nasal affliction (**Kurro**)	Bu	D	Grind the dry bulbs and mix water then drink nasally/orally a glass (donkey/horse)	DM01
			Diarrhea	Bu	F	Crush bulbs and mix water given orally by a glass then drink	
2. *Albizia amara* (Roxb.) Boiv. (Fabaceae)	Sheferie	T	Bloat (**Nifat**)	L	F	Crush leaves and mix with water and drink a glass orally	DM38
3. *Brassica carinata* A.Br. (Brassicaceae)	Gomenzer	H	Anthrax	Se	D	Grind seeds and mix with water and drink a cup	DM46
4. *Calotropis procera* (Ait.) Ait. f. (Asclepiadaceae)	Qilanbo	Sh	Rabies	R	D	Powdered root bark mixed with cow's milk given to rabid dog itself	
5. *Calpurnia aurea* (Ait.) Benth. (Fabaceae)	Ligita	Sh	Tick parasitism	L	F	Extract the fluid and apply it dermally.	DM27
			Leech infestation	L	F	Grind, mix with water, and give to the animal.	
			Helminthiasis	L	F	Pound, mix with water & give to animal	
6. *Capsicum annum* L. (Solanaceae)	Berberie	H	Leech infestation	Fr	D	Grind, mix with water then drink a glass	DM09
			Bloat	Fr	D	Grind, mix with water, add salt, and give a glass to the cattle	
7. *Capparis tomentosa* Lam. (Capparidaceae)	Gummero	Sh	Demon	R	D	Grind roots and smoke then fumigate whole body	DM37
8. *Citrus limom* (L.) Burm.f. (Rutaceae)	Lomi	Sh	Leech infestation	Fr	F	Pour the juice and drink by a glass	DM45
9. *Clausena anisata* (Willd.)	Limich	Sh	Trypanosomiasis	R/	F	Applying root and leaf solution to	DM44

Benth. (Rutaceae)			(**Gendi**)	L		pack animals through ear/nasal	
10. *Clematis simensis* Fresen. (Ranunculaceae)	Azo areg	Cl	Neck infection	L	F	Crush fresh leaves and paint on neck	DM36
11. *Clutia abyssinica* Jaub. & Spach. (Euphorbiaceae)	Fiyele feji	Sh	Trypanosomiasis	R/ L	F	Water solution of the root and leaf as drops for horses and mules with foamy saliva through ear/nasal	DM14
12. *Coriandrum sativum* L. (Apiaceae)	*Dimblal*	H	Bloat	Se	D	Grind dry seeds and mix with crushed *A. sativum* & *Z officinale* and water then drink a glass	DM15
13. *Croton macrostachyus* Del. (Euphorbiaceae)	Bissana	T	Lumpy skin ailments	Fr	D	Roast fruits and grind & boil then drink a glass	DM35
14. *Cucumis ficifolius* A. Rich. (Cucurbitaceae)	Yemidr Imboy	H	Cough	R	F	Crush leaves and eat with injera	DM13
			Emaciation (**Kumegna**)	R	F	Soak roots by bottle gourd (*Lagenaria siceraria*) in water and wait many times and filter then drink a liter	
			Fascioliasis (liver fluke)	Ba	D	Chew and swallow	
15. *Cynodon dactylon* (L.) Pers. (Poaceae)	Serdo	H	Clumsiness (**Abeya**)	L	D	Eat the dry leaves	DM12
16. *Datura stramonium* L. (Solanaceae)	Astenagir	H	Contagious ecthyma (Orf) (**Kuffign**)	L	F	Coat the sheep's mouth with crushed part	DM11
17. *Dracaena steudneri* Engl. (Dracaenaceae)	Merko	T	Demon	L	F	Crush and mix with water and drink	DM10
			Epidemic (**Teher**)	L	F	Crush the leaves and drink a glass	
			Leech infestation	L	F	Crush leaves and drink a glass	
			Coccidiosis (**Fengil**)	L	F	Crush and drink tea spoon	
			Anthrax	L	F	Crush leaves and drink a glass	

18. *Echinops kebericho* Mesfin (Asteraceae)	Kebercho	H	Demon	R	D	Grind the dry roots and smoke then fumigate whole body	DM16
19. *Euphorbium candelabrum* Kotschy (Euphorbiaceae)	Qulqual	T	Rabies	La	F	Fetch latex and add milk and drink a cup	DM48
20. *Euphorbia abyssinica* Gmel (Euphorbiaceae)	Qulqual	T	Swelling	La	F	Grind and paste the crushed part	DM08
21. *Grewia ferruginea* Hochst. ex A. Rich. (Tiliaceae)	Lenquata	Sh	Retained placenta	L	F	Cut the fresh leaves and given orally then eat	DM29
22. *Foeniculum vulgare* Mill. (Apiaceae)	Ensilal	H	Urine retention	L	F	Two handfuls were mixed with water, boiled, filtered, and given to livestock	DM31
23. *Leonotis ocymifolia* (Burm. f.) Iwarsson (Lamiaceae)	Yefferes Zeng	H	Anthrax (**Abasenga**)	L	F	Crush fresh leaves and drink a glass	DM43
			Demon	R	D	Grinding and smoking /fumigation	DM07
24. *Justicia schimperia* Hochst. ex Nees) T. Anders. (Acanthaceae)	Simitha	Sh	Abdominal colic	L	F	Crush leaves, add salt, give cattle drink	DM30
			Anthrax	L	F	Crush and steep in water, and give one glass	
			Epidemic	L	F	Crush & steep in water, & give a glass	
25. *Lepidium sativum* L. (Brassicaceae)	Feto	H	Fever in horse	Se	D	Drink a glass of ground seed water.	DM32
			Emaciation	Se	D	A glass of pounded seed water is given	
			Bloat	Se	D	Grind dry seeds, add water, and drink a refreshing beverage.	
26. *Nicotiana tobacum* L. (Solanaceae)	Timbaho	H	Leech infestation	L	F	Crush the fresh leaves and drink orally or nasally a cup	DM02
27. *Ocimum lamiifolium* Hochst. ex Benth.	Damakesiy	Sh	Fever	L	F	Crush fresh leaves and drink a glass	DM17
			Loss of appetite	L	F	Grind, mix with water, and give to	DM05

(Lamiaceae)						orally	
28. *Otostegia integrifolia* Benth. (Lamiaceae)	Tunjit	Sh	Demon	L/ St	D	Smoke stems or leaves & then fumigate body	DM04
29. *Plantago lanceolata* L. (Plantaginaceae)	Gorteb	H	Pink eye (**wirirt**)	L	F	Crush leaves and paint the eye	DM06
30. *Phytolacca dodecandra* L. ´Herit. (Phytolaccaceae)	Endod	Sh	Abdominal colic	L	F	Crush and drink a glass of liquid is given to livestock	DM03
31. *Premna schimperi* Engl. (Verbenaceae)	Checho	Sh	Pink eye (Kerayto conjunctiva) sheep	L	F	Chew the fresh leaves by teeth and vomit on eye	DM33
32. *Rubus steudnerii* Schweinf. (Rosaceae)	Enjor	Sh	Blackleg	R	F/ D	Grind, mix with water, and allow the animal to drink.	DM26
			Bloat	L	F	Grind, mix with water & give to animal	
			Diarrhea	R	F	Grind, mix & drink allow the animal to drink.	
33. *Rhamnus prinoides* L'Herit. (Rhamnaceae)	Gesho	Sh	Rabies	L	D	Grind the leaves, add water, and enjoy a refreshing drin	DM18
34. *Ruta chalepensis* L. (Rutaceae)	Tiladam	Sh	Diarrhea	L	F	Crush fresh leaves and drink by a glass	DM28
35. *Schinus molle* L. (Anacardiaceae)	Kundo Berberie	T	Abdominal pain	Se	D	Grind dry seeds & mix water then drink a cup	DM19
36.*Securidaca longepedunculata* Fresen. (Polygalaceae)	Etse Menahi	Sh	Demon	R	D	Grind dry roots and smoke then fumigate the whole body	DM42
37. *Sesamum angustifolium* (Oliver) Engl. (Pedaliaceae)	Selit	H	Blackleg	Se	D	Grind dry seeds & mix water then give a cup of liquid to the cattle.	DM38
38. *Solanecio gigas* (Vatke.)	Boz	Sh	Demon	R	D	Grind roots and smoke then fumigate	

C. Jeffrey (Asteraceae)						the whole body of the animal	
39. *Solanum marginatum* L.f. (Solanaceae)	Imboy	Sh	Leech infestation	Fr	F	Pour the juice and mix with water and filter then drink a cup	DM34
40. *Silene macrosolen* A. Rich. (Caryophyllaceae)	Wegerit	H	Leech infestation	L	F	Crush and put nasally or orally a cup	DM39
41. *Stephania abyssinica* (Dillon & A. Rich.) Walp. (Menispermaceae)	Ayitareg	H	Anthrax	R	F	A cup of root juice given to cattle	DM21
42. *Tragia brevipes* Pax. (Euphorbiaceae)	Ablalit	H	Eye pain	L	D	Grind dry leaves and spread on eye	DM20
43. *Tragia pungens (*Forssk.) Muell. Arg. (Euphorbiaceae)	Alebilabit	Cl	Rabies	R	D	Rabid dogs are treated with root powder mixed with injera.	DM40
44. *Verbascum sinaiticum* Benth. (Scrophulariaceae)	Ketetina	H	Cough	R	F	Crush leaves and eat with injera	DM22
			Emaciation	R	F/ D	Crush roots or grind roots and prepare injera then eat	
45.*Vernonia amygdalina* Del. (Asteraceae)	Girawa	T	Abdominal colic	L	F	Crush the leaves & give a glass of liquid	DM24
46. *Withania somnifera* (L.) Dunal (Solanaceae)	Gizewa	Sh	Trypanosomiasis	R	D	Grind & smoke then fumigate whole body	DM41
47. *Zehneria scabra* (Linn. f.) Sond. (Cucurbitaceae)	Etsesabieq	Cl	Emaciation	R	F	Chew and swallow	DM23
			Fever	L	F	Crush, squeeze, and offer a glass of liquid to the animal.	
48. *Zingiber officinale* Roscoe (Zingiberaceae)	Zingible	H	Abdominal colic	Rh	F	Crush fresh rhizomes, mix water & drink a glass	DM25

Key: Gf-growth forms (H-herb, T-tree, Sh-shrub, Cl-climber), PU-parts used (Bu-bulb, Se-seed, L-leaf, R-root, Ba-bark, Fr-fruit, La-lax, Rh-rhizome), CP-condition of preparation (F-fresh, D-dry, F/D-fresh/dry), (Na-nasal, Or-oral, Dm-dermal, Oc-ocular; Ea-ear), Vo. No-Voucher number and DM-Demeke Mihret

Appendix 2. Semi-structured Interview (Data Collection Tool) Employed in the Study Area

I) General information related to informants

Identification

Label	**Value**
Name	(Respondent's Name)
Types of informants	General Vs key informants
Sex	Male/female
Age	(Age in years)
Marital status	Single/married/divorced/widowed/other
Educational status	(Level of education)
Ethnic group	(Ethnic group)
Religion	(Religion)

II) Address: Region-----Zone-------District------Kebele----Locality-----

1) What are the most common livestock diseases in your area?
2) Concern of the informants to the medicinal plants
3) What are the ethnoveterinary medicinal plants used to treat livestock diseases in your locality?
4) Are there any threats to the medicinal plant? (List them)
5) What are conservation strategies of ethnoveterinary medicinal plants in your area?
6) From whom did you acquire the knowledge?
7) To whom do you want to share your knowledge?
8) Acceptance of traditional medicine by the community you live in? A) If not accepted why? B) If it is accepted why?
9) Do you collaborate with other traditional healers? If you do not collaborate, why?
10) Do you document your ethnoveterinary traditional medicinal practice?

11. Please provide a detailed list of medicinal plants used in your locality, including the following information for each plant:

Plant Information	**Details**
Scientific name	(Scientific name)
Family name	(Family Name)
Local name	(Local name/Amharic)
Habit	Herb, shrub, tree, climber
Habitat/sources of MPs	Forests, home gardens, live fences, cultivated areas, road sides etc.
Diseases Treated	List of diseases
CPU (Condition of Parts Used)	Fresh, dried, both in fresh and dry form
MPA (Method of Preparation and Application)	Boiling, concoction, chewing, infusion, crushing, squeezing, etc.
PU (Parts Used)	Leaves, roots, barks, Seeds, Flowers, etc.
RA (Route of Application)	Oral, topical/dermal, Inhalation
Dosage	Amount and Frequency