Medicinal plants used for treatment of domestic animal diseases and their threats in Guraferda District, Bench-Sheko Zone, South West Ethiopia

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Research

Abstract

Background: In the study area, ethnoveterinary medicinal plants are frequently used to treat a variety of domestic animal diseases. However, these plants face significant threats primarily from deforestation driven by agricultural extension, material culture, and the impacts of modernization. This study seeks to identify and document the traditional uses of medicinal plants for treating domestic animals diseases in the Guraferda district, as well as to highlight the key challenges these plants are currently facing.

Methods: To gather ethnobotanical data, researchers conducted interviews with 96 informants, comprising 80 males and 16 females. Quantitative methods were employed, including the informant consensus factor (ICF), fidelity level (FL), plant part value, preference ranking, and direct matrix ranking. Furthermore, the study compared the ethnobotanical knowledge among different informant groups using various statistical analyses, such as Independent t-tests, one-way ANOVA, correlation, and regression, utilizing R software version 4.3.2.

Results: The ethnobotanical study identified a total of 31 medicinal plant species across 31 genera and 20 families in the Guraferda district. Notably, the Asteraceae and Solanaceae families each accounted for 4 species (13%), while the Euphorbiaceae family contributed 3 species (9.7%), indicating their prevalent use in the area. A significant difference ($P < 0.05$) was found in the number of medicinal plants reported by respondents based on various informant characteristics. The Informant Consensus Factor (ICF) was calculated to assess the consistency of the information gathered and the overall agreement regarding the treatment of various animal health disorders. The category of dermal diseases recorded the highest Informant Consensus Factor (ICF) value of 0.90. On the other hand, the musculoskeletal and nervous system category had the lowest ICF value of 0.33. Fidelity level index (FL) indicates the key informants' most preferred plant species used for

treating particular domestic animal diseases. The highest fidelity level was observed for *Ehretia cymosa* Thonn, which reached 100% for treating febrile illness. On the contrary*, Datura stramonium* L. was documented as having low FL (0.26, 26%) for managing mastitis. Medicinal plants are currently threatened by several factors, including deforestation, invasive alien species, overharvesting, material culture, and charcoal production.

Conclusions: The study found that the Gurafarda district still possesses a wealth of knowledge regarding ethnoveterinary medicine. However, residents in the area do not engage in the cultivation of medicinal plants. To secure the future availability of these vital resources, it is crucial to implement conservation measures and sustainable harvesting practices. Additionally, further research is necessary to explore the potential applications of these plants in modern medicine.

Key words: Guraferda, Ethnobotany, Domestic animal, Threats, Medicinal Plants

Background

For many years up to today, traditional healing systems have been using medicinal plants, and various indigenous communities around the world have recognized them as valuable ethnoveterinary and human health medicines (Dzoyem *et al*. 2020). In fact, Dossou-Yovo *et al*. (2021) reported the uses of medicinal plants including herbs and woody species as potential remedies in Southern Benin. Ethnoveterinary medicine encompasses the customs, beliefs, knowledge, skills, methods, and practices related to animal health, playing a crucial role for a primary source of remedies for livestock raising and diseases treatment (Ayeni & Basiri 2018). To satisfy medicinal purposes based on plants, people collect them from various ecosystems. For instance, Dossou-Yovo *et al*. (2021) mentioned home and commercial gardens as well as markets and the wild ecosystems as sources of medicinal plants. Even termitaria were reported as hosting a phytodiversity that local populations exploit for medicinal purposes (Dossou-Yovo *et al.*2021). Ethiopia boasts a remarkable diversity of livestock species, making the country home to some of the largest populations globally. Its cattle stock ranks fifth in the world, surpassing that of significant beef-producing nations like Argentina and Australia (Bachewe *et al*. 2018). In developing countries like Ethiopia, domestic animal breeding remains vital and serves as a significant asset for low-income farmers. People utilized them for food, traction, manure, raw materials, investment opportunities, cash revenue, and contributing to food security, social cohesion, and cultural identity (Temesgen 2022, Bachewe *et al.* 2018)

The utilization of ethnoveterinary medicine offers a more cost-effective and sustainable option compared to synthetic medicine (Aziz *et al*. 2018,Silva *et al*. 2020). Over the course of time,farmers have relied on ethnoveterinary medicines, which draw upon centuries of traditional beliefs and ptactices, to treat various diseases in domestic animals (Teixidor-Toneu *et al*. 2020). Ethnoveterinary medicine is commonly applied in the treatment of various livestock diseases within different cultural groups in Ethiopia (Gemechu 2021, Gensa 2023). With its diversity of languages, cultures, and beliefs, the country serves as a valuable repository of knowledge and traditional practices concerning the utilization of medicinal plants (Adibaru & Chane 2021). The majority of livestock farmers (90%) relying on plant-based medicines to treat their animals diseases in the country (Alemneh 2021,Wendimu *et al*. 2023). Ethiopia is home to a diverse range of higher plants, approximately 6,000 to 7,000 species, with around 12% of these species being endemic to the country (Assefa *et al*. 2018). Kassa *et al*. (2020) have emphasized the remarkable plant diversity present in the forested areas of southwestern Ethiopia. Among the 7000 plant species discovered in Ethiopia, approximately 63% are found in southwest Ethiopia which has been designated for the conservation of medicinal plants (Awas 2007). These plants play a vital role as the main source of traditional medicine, addressing various health concerns, as highlighted by Awas (2007) and Ganesan *et al. (*2015). The field of ethnoveterinary practice is significantly impacted by the processes of acculturation and the depletion of plant habitats. These effects are a direct result of environmental degradation, deforestation, and the overexploitation of medicinal plants themselves (Kahsay *et al*. 2020,Eshete & Molla 2022,Asfaw *et al*. 2022). Furthermore, the transmission of ethnoveterinary knowledge and practices has predominantly occurred through oral traditions rather than written documentation, being passed down from one generation to another(Lulekal *et al*. 2014,Eshetu *et al*. 2015,Neja 2022). Consequently, without the conservation of valuable medicinal plants and the proper documentation and analysis of associated indigenous knowledge, the ethnoveterinary practices are at risk of being lost. Regrettably, there have been minimal efforts thus far to document and analyze ethnoveterinary medicinal plants and practices in southwest Ethiopia (Mose *et al*. 2020) and other regions of Ethiopia (Kahsay *et al*. 2020,Feyisa *et al*. 2021,Wendimu *et al*. 2023).

Given the cultural diversity and rich vegetation of the study area, along with other factors that contribute to its reliance on traditional medicine, it is hypothesized that there exists a significant body of knowledge regarding valuable medicinal plants among the people of Guraferda district that merits further investigation. Additionally, it is observed that traditional

knowledge of these plants tends to diminish with age, resulting in decreased awareness among younger generations. Habitat loss due to agriculture and deforestation is recognized as a major threat to the availability of these plants. Despite these challenges, no prior ethnoveterinary studies on medicinal plants have been conducted in this area. Consequently, the present study aims to: (i) document the medicinal plants and the associated indigenous knowledge utilized by local communities; (ii) identify and analyze the primary threats facing these medicinal plants while evaluating current conservation strategies; (iii) explore the cultural significance of medicinal plants within local communities; and (iv) develop policy recommendations based on the research findings to assist local governments and conservation organizations in formulating strategies for the sustainable management of medicinal plant resources in Guraferda district.

Materials and Methods

Location and description of the Study Area

The research was conducted in the Gurafarda district, which is part of the Bench-Sheko Zone in Southwest Ethiopia. The district is located roughly 644 kilometers southwest of Addis Ababa and is 42 kilometers from Mizan aman. The geographical coordinates of the research area are approximately 6°51'24.6"N latitude and 35°20'02.1"E longitude, with an elevation ranging from 500 to 2,500 meters above sea level, as established through GPS data and visualized using ArcGIS software (Figure 1). The district is bordered by Sheko district to the north, Meienit Shasha to the south, South Bench to the west, Surma to the southwest, and the Gambella Region to the northwest. It covers an estimated area of 2,565.42 square kilometers (256,542 hectares) and consists of 32 kebeles, which are the smallest administrative units in Ethiopia, along with an administrative town named Biftu (Guraferda health office document, 2023). As of 2017, the population of Guraferda district was approximately 43,137, comprising 23,473 males and 19,664 females. Of this population, 9,030 individuals live in urban settings, while 34,107 are in rural areas (CSA 2017).

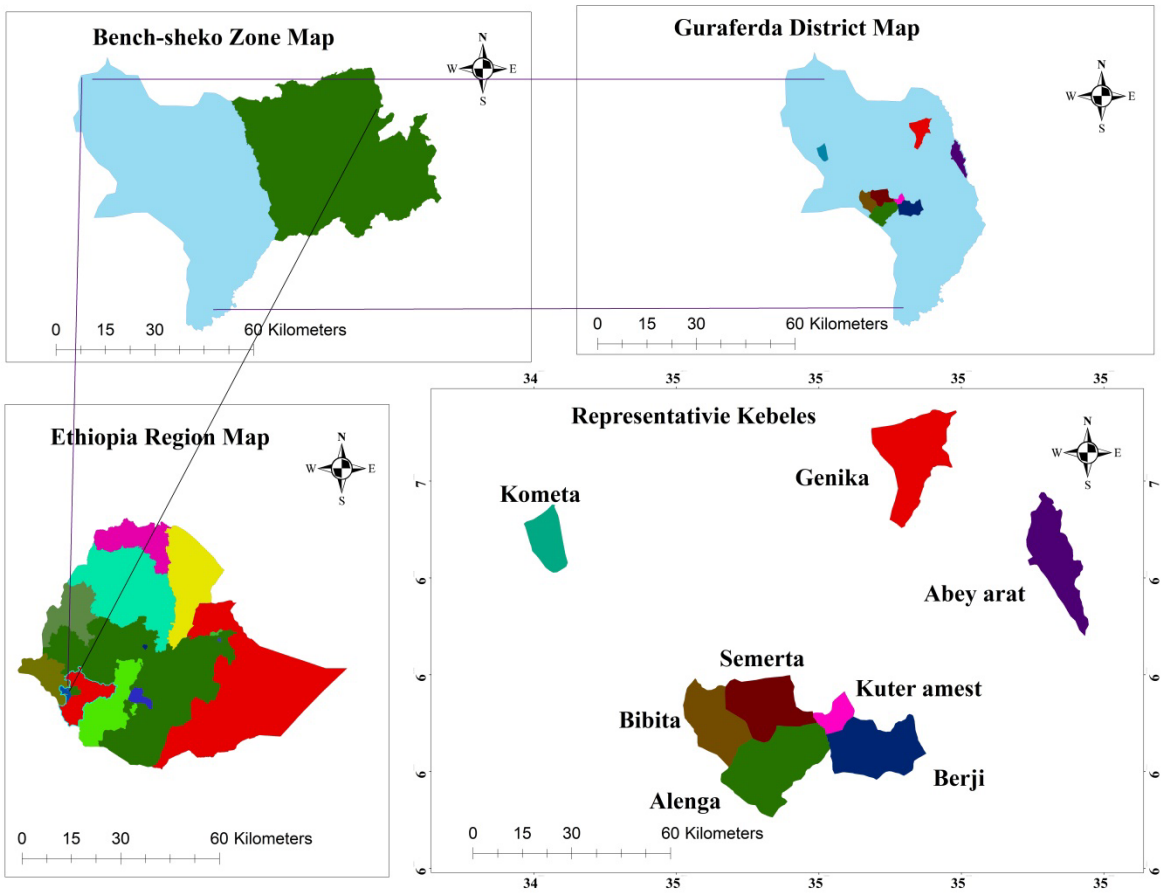

Figure 1. Map of the study site (Maps shown in this paper were generated by using Arc GIS 10.4.1)

Climatic characteristics

The climate data obtained from the Ethiopian National Meteorological Agency for the years 2003 to 2023 indicates that the study area recorded a minimum monthly temperature of 14.4°C, a maximum of 32.3°C, and an annual average value of

21.1°C. Additionally, the area received an average annual rainfall of 1914 mm (Figure 2). The rainfall pattern in this region is classified as unimodal, occurring predominantly throughout the year. This substantial rainfall contributes to the presence of partly moist evergreen Afromontane Forest vegetation, which is characterized by a variety of unique plant species as noted by Kassa *et al*. (2020). In the Guraferda district, the agro-ecosystems are primarily comprised of lowland (wet qolla) regions, which account for 78% of the total area, while midland (Woynadaga) regions constitute the remaining 22% (Awoke *et al*.2024).

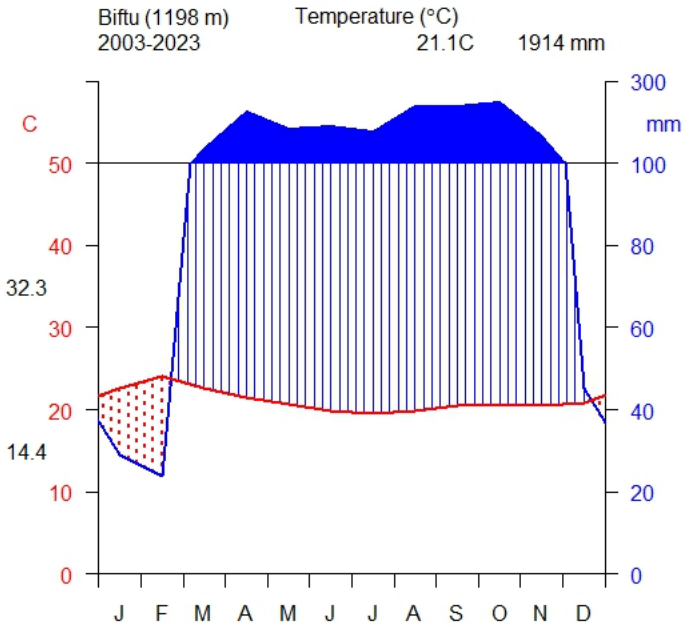

Figure 2. The climate diagram of the study area

Study Site and Informant Selection

The selection of study sites and informants was conducted after gathering preliminary information from multiple sources, including the Guraferda district administration office, health office, agricultural office, and local residents. This approach was intended to facilitate a thorough understanding of the region prior to data collection. A total of eight kebeles (Table 1) were selected for data collection through purposive sampling, considering factors such as proximity to administrative towns, the availability of healers and traditional medicine practitioners, vegetation cover, and infrastructure (Chekole 2017 and Kassa *et al*. 2020). Throughout the study, 96 informants were interviewed, with 12 individuals from each kebele, representing both males and females aged between 18 and 80. Additionally, 32 key informants were identified through purposive sampling based on local recommendations, while 64 general informants were recruited using snowball sampling techniques (Martin 1995 and Cochran 1997). Participants were divided into three age groups: young adults (18–30), middle-aged (31–55), and elderly (56–80) following (Bekele *et al*. 2022). The focus was on individuals under 30 to study knowledge transfer on medicinal plants across generations following (Dulal *et al.* 2022 and Awoke *et al.* 2024).

Table 1. Altitude, Latitude, Longitude of Selected Sample Kebeles

Name of Kebeles	Altitude	Latitude (N,S)	Longitude (E,W)
Abey arat	1030m	6°56'20.3"N	35°22'26.3"E
Semerta	1053m	6°50'29.5"N	35°09'30.0"E
Kometa	1078m	6°56'41.9"N	35°04'26.2"E
Kuter amist	1090m	6°49'48.2"N	35°12'10.8"E
Genika	1244m	7°01'05.5"N	35°16'13.9"E
Alenga	1340m	6°47'57.6"N	35°09'24.8"E
Berji	1361m	6°48'22.6"N	35°13'52.5"E
Bibita	1688m	6°50'19.7"N	35°07'23.0"E

Source: Google earth map

Methods of Ethnobotanical Data Collection

A preliminary survey was conducted from September 12 to September 29, 2023, to gather data from the selected kebeles. Participants were identified, and a data collection schedule was established. Strategies were formulated for collecting and organizing information on current Traditional Medicinal Plant Knowledge (TMPK). The study utilized a cross-sectional research design that integrated both qualitative and quantitative approaches.

Semi-Structured Interview

The semi-structured interview guide was formulated subsequent to the guidance provided by Martin (1995) and Cotton (1996). Participants in the study were interviewed on an individual basis, utilizing the primary local languages prevalent within the community, including Sheko and Meinit, which are native to the region, as well as Benchi, Wolaytta, Amharic, Oromiffa, Kaffa, and Sidamo, introduced by settlers from various parts of Ethiopia. A translator assisted in facilitating these interviews. The semi-structured format allowed for an exploration of diverse topics concerning the participants' personal backgrounds and information regarding medicinal plants (MPs). During the interviews, participants were queried about various aspects of MPs, including their indigenous names, medicinal applications, natural habitats, availability, the specific plant parts utilized, preparation techniques, dosages, and methods of administration. Additionally, discussions encompassed conservation strategies, potential threats to plant species, supplementary ingredients in remedies, side effects, sources of knowledge, methods of knowledge transmission, and non-medicinal applications followed by Martin (1995) and Cotton (1996).

Group Discussion

To obtain additional insights regarding MPs within the community context, a sequence of group discussions was organized. These discussions comprised eight distinct groups, with each group representing a specific kebele and averaging seven participants. The topics addressed during these discussions were diverse, covering participants' perceptions of TMPK, the existing challenges and conservation initiatives, the impact of modernization, and other relevant issues, including the commercialization of MPs. The discussions were facilitated in a manner that encouraged openness and interaction, enabling participants to articulate their knowledge and viewpoints without any external constraints (Awoke *et al.* 2024).

Field Observation

Field observations were conducted to enable comprehensive interactions with individual informants, which facilitated the identification and gathering of medicinal plants that are customarily used in their natural habitats, as referenced in (Alexiades 1996). Traditional healers within the study region were invited to showcase their ethnomedicinal knowledge both in their residences and in situ, ensuring that their practices were kept confidential and not disclosed to others without their permission. Arrangements were established with the healers to safeguard their knowledge and information. After the demonstration, an in-depth explanation, discussion, and interpretation of their practices ensued.

Guided Field Work

The appropriate field guide for each specific location was referenced to implement guided field walk methodologies. Prior to commencing fieldwork, sites that are readily accessible yet may pose certain risks were identified. The choice of field guides for each kebele was determined by their interest, expertise in forest navigation, and profound knowledge of local plant species in the indigenous language (Kassa *et al*. 2020, Awoke *et al.* 2024). Guided fieldwork streamlines the identification of plant characteristics and their respective habitats. Participants partake in sensory activities, including visual assessments, olfactory evaluations, tactile interactions, and taste experiences, which enhance their comprehension of plant attributes. Traditional healers are instrumental in this process, imparting knowledge about indigenous nomenclature, medicinal applications, plant parts used, chemical compositions, dosages, and methods of use. The collection of voucher specimens, supported by photographic documentation, captures both fresh and dried samples from various environments such as natural habitats, home gardens, and marketplaces, thereby ensuring thorough documentation (Awoke *et al.* 2024).

Market Survey

An extensive market survey was conducted within the designated study area, encompassing five principal markets: Megenteya, Semerta, Bebeka, Meleya, and Gabika. This survey focused on documenting the availability of each marketable traditional medicinal plant (TMPs). Samples of TMP vouchers were obtained with the collaboration of local healers and field assistants. Additionally, verbal interviews were performed with open market retailers, herb vendors, and consumers of both sexes. The purpose of these interviews was to collect data regarding marketing strategies, cultivation methods, availability,

potential threats, pricing, and the economic significance of TMPs, as supported by previous research (Chekole *et al*. 2015, Awoke *et al.* 2024).

Plant Collection, Identification and Herbarium Preparation

Data collection occurred from November 2023 to January 2024, facilitated by informants. An inventory of local medicinal plants was created, accompanied by photographic documentation. Each plant sample was assigned a local name, then pressed, dried, and mounted. To accommodate newspaper dimensions, plant stems were shaped into V, N, and M configurations (Seshagirirao *et al*. 2016). For effective preservation, specimens were meticulously arranged between layers of newspapers and additional cardboard, utilizing a plant press for a duration of 48 to 72 hours. Following this, the specimens were prepared for mounting and subsequent storage(Paul *et al.* 2020, Awoke *et al.* 2024). The identification of various species was performed both in situ and within the laboratory of the Department of Biology at Mizan-Tepi University, specifically in the mini herbarium room. Taxonomic keys from the Flora of Ethiopia and Eritrea were employed, supplemented by the expertise of senior lecturers in Botanical sciences for more complex identifications. Additionally, various online plant identification resources were utilized, including Plant Net Identification, Flora Finder, Plant Snap, the USDA Plants Database, Google Images, the African Plant Database, and the World Checklist of Selected Plant Families (Dulal *et al*. 2022, Awoke *et al.* 2024). To ensure precise identification, the JSTOR Global Plants website was consulted for the complete Latin binomial nomenclature of the plants. Ultimately, the voucher specimens were meticulously preserved within the mini herbarium of the Biology department to guarantee their accessibility for future research.

Statistical Data Analysis

The data from the field was systematically gathered, organized, classified, and recorded, encompassing both local and scientific nomenclature of plants, their respective families, life forms, utilized parts, and habitats, all within Microsoft Word 2019. The analytical process employed frequency tools such as pie charts, bar graphs, and tables. Descriptive statistics, including mean and standard deviation, were computed using R software version 4.3.2. Prior to conducting the t-test, the normality of the data was evaluated using the Shapiro-Wilk test. An independent t-test was performed to investigate informant groups differences in Traditional Medicinal Plant Knowledge based on the plants reported. ANOVA was utilized to examine knowledge disparities among three age groups. The relationship between age and reported medicinal plants was analyzed through linear regression and Pearson correlation (Höft *et al.* 1999).

Quantitative Analysis of Ethnobotanical Data

Plant Part Value (PPV)

The assessment of the Percentage of Used Plant Parts (PPV) entails quantifying the proportion of different plant components, including stems, leaves, roots, fruits, bark, and flowers, that are employed for medicinal applications. The calculation of PPV follows the methodology outlined by Avocèvou *et al*. (2009), and it is computed in the following manner:

$$\mathbf{PPV}(\%) = \frac{\sum \mathbf{RU\ (plant\ part)}}{\sum \mathbf{RU}} \times \mathbf{100}$$

Where $\sum RU_{(plant\ part)}$ represents the sum of the cited plant parts and $\sum RU$ represents the total number of cited uses for a given plant.

Preference Ranking

Ten key informants were selected for the preference ranking of 5 medicinal plants used to treat bloating diseases, and the scores were provided by the informants based on their preference. The efficacy of various medicinal plants was assessed and ranked through a scoring system. In addition, a preference ranking of the factors posing threats to these medicinal plants was developed by randomly selecting ten key informants according to (Höft 1999 , Awoke *et al.* 2024).

Direct Matrix Ranking

The Direct matrix ranking was conducted in order to compare multipurpose MPs commonly reported by informants following Cotton (1996). From the total of medicinal plants, five multipurpose species were identified based on their relative benefits, and seven distinct usage categories were established for these plants. A selection of five key informants was made to assign use values to each characteristic, utilizing a scale where 5 represents the highest value (best), followed by 4 (very good), 3 (good), 2 (less used), 1 (least used), and 0 (not used). By analyzing the data provided by the informants, the average use-diversity value for each species was computed, and these values were subsequently aggregated and ranked (Awoke *et al.* 2024).

Informant Consensus Factor (ICF)

The Informant Consensus Factor (ICF) was calculated to assess the consistency of the information gathered and the overall agreement regarding the treatment of various animal health disorders. followed by (Uddin and Hassan 2014). This analysis aimed to identify the most effective medicinal plants utilized for the traditional treatment of domestic animal diseases in the study area. Informants were consulted twice on the same topics to ensure the reliability of the information obtained during the initial interview. Any information that was reiterated in the same manner by the informants during both contacts was documented. Furthermore, this study sought to pinpoint medicinal plant species that could potentially provide effective treatments for the identified disease categories. As a result, traditional remedies and their associated diseases were organized into seven separate categories. This classification was based on multiple criteria, including the type of disease, its causes, the specific location of symptoms, and the signs exhibited by affected animals. The index is calculated by taking the total number of citations in each category, subtracting the number of species used, and then dividing this figure by the number of citations in that category minus one. The formula for this index is presented as follows:

$$\mathbf{ICF} = \frac{\mathbf{Nur} - \mathbf{Nt}}{\mathbf{Nur} - \mathbf{1}}$$

Where Nur is the number of informant use reports for a specific plant-use category and Nt is the total number of taxa or species used for that plant-use category across all informants. The index has a range of 0 to 1, where values close to 1 indicate that informants strongly agree that the same species is used

Fidelity Level (FL)

Fidelity level index (FL) indicates the key informants' most preferred plant species used for treating particular deomestic animal diseases. The relative healing potential of each reported medicinal plant used against domestic animal disease was evaluated using an index of fidelity level (FL) and it was calculated as proposed by Alexiades (1996).

$$\mathbf{FL}(\%) = \frac{\mathbf{IP}}{\mathbf{IU}} \times \mathbf{100}$$

Where**, FL**= fidelity level or relative healing potential, **IP** = the number of informants who independently cited the importance of a species for treating a particular ailment (frequency of citation of a species for a particular aliment), and **IU** = the total number of informants who reported the medicinal plant for a given disease (total number of citations of that species).

Ethics Clearance

The Guraferda district administration office has received a letter of collaboration from the department of biology at MTU, aimed at facilitating research within the designated kebeles. Before the commencement of fieldwork, the district administrations acknowledged the letters of cooperation and granted the necessary permissions for the research activities. Official correspondence was dispatched to the district health, agriculture, natural resources management, culture, and tourism offices, as well as to the selected kebeles. This partnership was designed to foster community engagement, supply vital data and resources, gather plant specimens, and provide support during the interview process. The chairpersons of the kebeles issued letters of cooperation, supplied information regarding sub-villages and households, identified key informants, and organized meetings. Informants granted oral consent for the collection of data during the interviews.

Result and Discussion

Sociodemographic Attributes of Informants in the Study Area

The research included a total of 96 participants, with a majority being male, representing 83.3% (n=80) of the sample, while females were 16.7% (n=16). In terms of their healing experiences, the majority was categorized as general informants, comprising 66.7% (n=64), with key informants making up the remaining 33.3% (n=32). Participants ages ranged from 18 to 80 years, with the largest age group being 56-80 years at 53.1% (n=51), followed by those aged 31-55 years at 30.2% (n=29). Educational level among participants varied from illiteracy to college education, with illiterates representing the largest group with 70.8% (n=68), followed by those having completed elementary education at 21.8% (n=21). Regarding marital status, the majority were married (82.2%; n=79), while single participants were relatively lower (13.5%; n=13) (Table 2).

Table 2. Socio demographic characteristics of respondents

Parameter	Category		N	%	Total
Gender	Male		80	83.3	96
	Female		16	16.7	
Healing experience	General informants		64	66.7	96
	Key informants		32	33.3	
Age groups	18-30	Male	12	12.5	
		Female	4	4.2	96
	31-55	Male	19	19.8	
		Female	10	10.4	
	56-80	Male	49	51	
		Female	2	2.1	
Marital status	Married		79	82.2	
	Single		13	13.5	96
	Divorced		4	4.2	
Education level	Illiterate		68	70.8	
	Literate	Elementary	21	21.8	
		High school	5	5.2	96
		Diploma and above	2	2.1	
Occupation	Farmer		67	69.8	
	House wife		14	14.6	
	Student		9	9.4	96
	Merchant		6	6.2	

Medicinal plant Knowledge among Different Ethnic Groups

The investigation of medicinal knowledge dissemination among the prominent ethnic groups in the Guraferda district sheds light on the rich tapestry of traditional healing practices that are integral to the cultural heritage of the Amhara, Kefa, Sheko, and Meinit communities. These groups, representing 33.3%, 20.8%, 14.6%, and 11.5% respectively, are acknowledged as custodians of significant medicinal knowledge that has been preserved through generations. Their strong ties to local biodiversity, coupled with cultural traditions and substantial livestock ownership, likely account for their higher reported percentages of medicinal knowledge. In contrast, the Benchi and Oromo ethnic groups, with only 3.1%, appear to have less documented medicinal expertise, suggesting a need for further exploration and recording of their traditional healing practices. This disparity emphasizes the necessity of recognizing and protecting the diverse medicinal knowledge maintained by various ethnic groups in the Guraferda district, which could enhance healthcare practices in the region. The distribution of medicinal knowledge among the most frequently cited ethnic groups in Guraferda illustrates a nuanced relationship between cultural traditions, environmental influences, and historical practices. The notably higher percentages associated with the Amhara, Kefa, Sheko, and Meinit communities reflect their profound connection to their natural environment and traditional healing methodologies. Their dependence on local plant and animal life for medicinal purposes highlights the deep interconnection between cultural identity and the natural world, where indigenous knowledge is transmitted through generations as an essential aspect of community heritage. The comparatively lower percentages of medicinal knowledge reported among the Bench and Oromo ethnic groups indicate a possible divergence in traditional healing methodologies within the Guraferda district. This phenomenon may stem from several factors, such as historical contexts, resource availability, and cultural integration. A more in-depth investigation into the unique medicinal practices of these ethnic groups could yield significant insights into the rich tapestry of healing traditions in the area, thereby facilitating improved healthcare access and comprehension.This finding is inline with (Awoke *et al*. 2024).

Medicinal Plants Naming Related to Culture in the Study Area

The classification of medicinal plants frequently encompasses meanings that pertain to their applications or other indicative characteristics. This understanding was derived from an analysis of the local nomenclature attributed to various medicinal plant species. Among these species, certain local names explicitly denote their therapeutic properties, while others characterize physical traits such as growth habit, bark color, leaf morphology, toxicity, flavor, and aroma. It is noteworthy that all medicinal plant species examined possess local names in one or more languages prevalent in the studied districts. These names may be utilized interchangeably or exhibit minor variations in pronunciation across different communities. Furthermore, there are instances where a single local name is applied to multiple species that share similar medicinal attributes. For example, the local term "*Eret*" is assigned to *Aloe Vera* Schweinf selected for its sap's bitter flavor.

Diversity of Medicinal Plant in Guraferda District

The findings of this study revealed that the local inhabitants utilize 31 distinct species of medicinal plants. These botanical resources are used to treat a variety of 28 diseases affecting domestic animals (Tabel 12). Among the different plant families, Asteraceae and Solanaceae were the most frequently mentioned, each comprising 4 species, which accounts for 13% of the total. Following them is the Euphorbiaceae family, which includes 3 species (9.7%), while the Cucurbitaceae, Bignoniaceae, and Boraginaceae families each contain 2 species (6.4%) (Tabel 3). This trend may be due to the fact that in developing countries, medicinal plants have remained the most economically feasible and readily accessible treatment option for a range of livestock health issues (Feyisa *et al*. 2021,Asfaw *et al*. 2022, Dilbato *et al*. 2023, Awoke *et al*. 2024). Similar studies conducted in Ethiopia (Alemneh 2021,Hussein 2023) and elsewhere (Matovu *et al*. 2020,Luo *et al*. 2022) have also noted the prevalence of the Asteraceae families in traditional medicines used for treating domestic animal disease. This may be the widespread distribution and abundance of these plant families in Ethiopia. Moreover, the extensive use of species from these families may be associated with their effectiveness in treating animal diseases. Moreover,this trend may be due to the fact that in developing countries, medicinal plants have remained the most economically feasible and readily accessible treatment option for a range of livestock health issues(Berhanu *et al.* 2020,Feyisa *et al*. 2021). The number of medicinal plants documented in this study was similar to that of comparable previous studies conducted in various parts of Ethiopia and other countries. For example, a study in the Adea Berga district, Oromia regional state, identified 59 ethnoveterinary medicinal plants (Feyisa *et al*. 2021). Similarly, a report by Bojago (2023) on the study in the Wolaita zone, southern Ethiopia, also indicated the identification and documentation of 54 ethnoveterinary medicinal plants for treating 20 types of domestic animal diseases. In the Yilmana densa and Quarit districts, West Gojjam Zone, 51 medicinal plants from 30 genera and 22 families were reported (Alemneh 2021).

An ethnoveterinary study conducted by Pratama *et al*. (2021) in the Bojonegoro district, East Java, Indonesia, revealed the use of 41 medicinal plants by the community to treat various cattle ailment. In Turkey, a total of 46 plant taxa from 44 genera and 25 families were traditionally used, with various plant parts and combinations, for the treatment of more than 15 domestic animal diseases(Selvi *et al*. 2023). These findings demonstrate the enduring importance of ethnoveterinary medicines in the treatment of domestic animal diseases in Ethiopia and other developing countries. The higher number of medicinal plants reported in other study districts compared to the present study could be attributed to the rich livestock population in those districts, as reported in another study Gobana (2022).

Table 3. Total List of families with number of genera, species and rank

Family Name	Genera	%	Rank	Species	%	Rank
Asteraceae	4	13	1st	4	13	1st
Solanaceae	4	13	1st	4	13	1st
Euphorbiaceae	3	9.7	2nd	3	9.7	2nd
Bignoniaceae	2	6.4	2nd	2	6.4	2nd
Boraginaceae	2	6.4	2nd	2	6.4	2nd
Cucurbitaceae	2	6.4	2nd	2	6.4	2nd
Acanthaceae	1	3.2	2nd	1	3.2	2nd
Alliaceae	1	3.2	2nd	1	3.2	2nd
Apiaceae	1	3.2	2nd	1	3.2	2nd
Brassicaceae	1	3.2	2nd	1	3.2	2nd
Caricaceae	1	3.2	2nd	1	3.2	2nd
Meliaceae	1	3.2	2nd	1	3.2	2nd
Musaceae	1	3.2	2nd	1	3.2	2nd
Myrtaceae	1	3.2	2nd	1	3.2	2nd
Phytolaccaceae	1	3.2	2nd	1	3.2	2nd
Polygonaceae	1	3.2	2nd	1	3.2	2nd
Rhamnaceae	1	3.2	2nd	1	3.2	2nd
Rutaceae	1	3.2	2nd	1	3.2	2nd
Zingiberaceae	1	3.2	2nd	1	3.2	2nd
Aloaceae	1	3.2	2nd	1	3.2	2nd
Total 20	**31**	**100**		**31**	**100**	

Diversity of life forms in the recorded plant species

According to the study conducted, the analysis of medicinal plants revealed that the majority of species belonged to the category of herbs, accounting for 48.4% of the total species. This was followed by trees, which constituted 25.8%, shrubs with 19.3%, and climbers with the smallest proportion of 6.5% species (Figure 3). Similar ethnobotanical studies have also reported a prevalent use of herbs in ethnoveterinary medicines (Feyisa *et al*. 2021,Berhanu *et al.* 2020) both in Ethiopia and

around the world (Muhammad *et al.* 2021, Pakhtunkhwa *et al*. 2022). In contrast, other researchers (Kahsay *et al*. 2020,Asfaw *et al.* 2022) found that shrub species dominated ethnoveterinary medicine preparations in different regions of Ethiopia. The widespread use of herbs in the present study for medicinal purposes may be due to their prevalent occurrence and ease of collection. Furthermore, this variation in the use of different life forms of ethnoveterinary plants indicates the presence of diverse agroecology and indigenous knowledge in various parts of Ethiopia (Asfaw *et al*. 2022, Awoke *et al*. 2024).

Figure 3. . Life forms of medicinal plants

Habitat of Medicinal Plants

In the study area, individuals collected medicinal plants from various origins, encompassing the wild, home gardens, and the market. Among the 31 medicinal plants, 15 were obtained from the wild, 7 from home gardens, 5 from the market, and 4 from both the wild and home gardens (Figurer 4). In Ethiopia, it is common to use wild or uncultivated medicinal plants for treating domestic animal ailment (Asefa *et al*. 2021,Gobana 2022,Dilbato *et al.* 2023). This suggests that the tradition of domesticating medicinal plants is not yet established among users in the country. Consequently, this may result in overexploitation and the potential threat to these plants, as there are no conservation efforts in place (Birhan *et al*. 2018, Alemneh 2021,Asfaw *et al.* 2022).

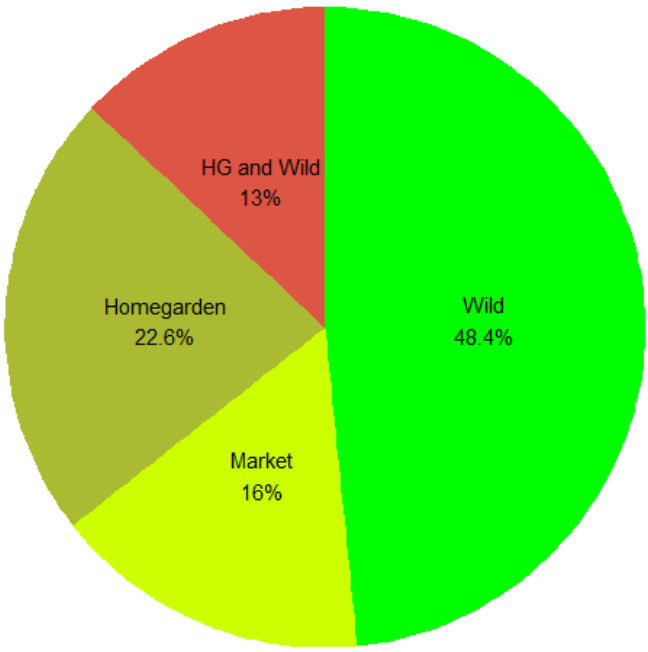

Figure 4. Habitat of Medicinal Plants

Forms of Medicinal Plant used

Upon analyzing the forms of the plant used, considering the total frequency of citations by informants, it was observed that out of the 68 reported conditions of plant used, the majority of medicinal plants were prepared using fresh plant materials followed by dry plant materials. Only a small number of medicinal plants were prepared from either fresh or dry plant (Figure 5). The majority of ethnoveterinary practitioners in the study area utilized fresh plant materials, which could be linked to the abundant availability of medicinal plants throughout the year due to continuous rainy season. The predominance of fresh plant materials in remedy preparation was also reported in many other studies in the country and elsewhere (Wodegebriel *et al.*2018,Feyisa *et al*. 2021, Asfaw *et al*. 2022, Awoke *et al*. 2024) and globally (Rizwan & Banday 2020,Barbosa *et al.*2023,Shah *et al*. 2024).

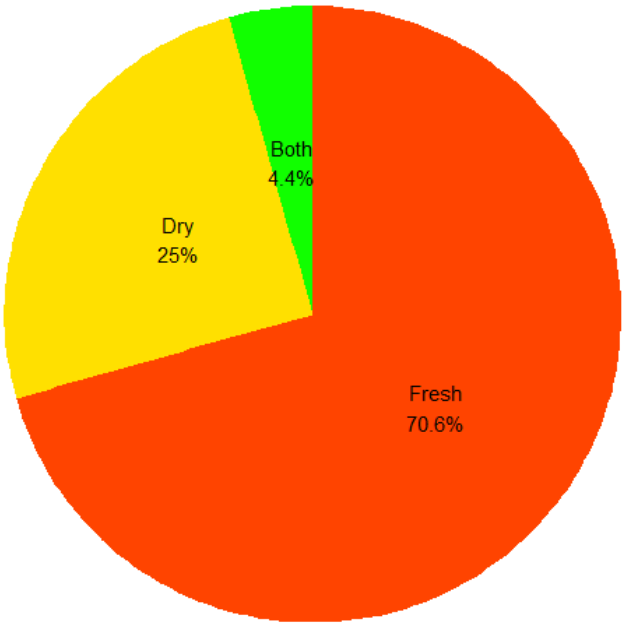

Figure 5. Forms of Medicinal Plant used

Medicinal plant parts used and mode of preparation

The findings of the investigation revealed that 12 different parts of medicinal plants were identified as the primary components utilized for the treatment of various health disease. The analysis of plant parts, based on the total frequency of citations provided by informants, indicated that leaves were the most commonly employed components for the preparation of remedies followed by, seeds and roots (Figure 6). This discovery aligns with previous reports in Ethiopia (Berhanu *et al*. 2020,Gemechu 2021,Elias Bogale & Abda 2022) and elsewhere in the world (Ou *et al*. 2020,Pratama *et al*. 2021,Singh *et al*. 2022). Leaves are more frequently used because their removal does not harm the viability of the plant and is safe for the plant itself, unlike the bark and roots. However, the indiscriminate removal of leaves can affect the chlorophyll assimilation process in plants and subsequently impact animal health. This preference for leaves may also be attributed to traditional community beliefs about their ease of collection, preparation, and their role as the main site of photosynthesis, which could explain their effectiveness against animal health issues (Deressa 2021,Bogale & Abda 2022). In contrast to this finding, other studies have reported whole parts (Hussain *et al*. 2021), and root (Birhan *et al*. 2018,Muhammad *et al*. 2021) as the most harvested plant parts. The extensive use of roots poses a threat to the conservation of medicinal plants and may lead to their extinction (Birhan *et al*. 2018,Iwaka *et al*. 2023, Awoke *et al*. 2024). Thus, Leaf harvesting does not pose a threat to plant survival compared to other plant parts and should be encouraged among local communities as a practical measure to conserve valuable traditional medicinal plants.

Different approaches were utilized to create the traditional remedy, considering the nature of the disease, the condition of the medicinal plant, and its various parts. Dried plant parts were commonly prepared by pounding, while fresh ones were crushed. The research findings demonstrated that the informants reported adifferent modes of preparation for medicinal plants. Among these, the majority of plants were prepared by crushing, followed by powdered and concoction methods (Figure 7). The majority of participants confirmed that most medicinal plant preparations involved crushing and mixing with water, aligning with previous research findings (Feyisa *et al*. 2021, Asfaw *et al*. 2022, Awoke *et al*. 2024). However, in contrast to this study, reports from Eshetu *et al*. (2015), Deressa (2021), and other sources worldwide (Bishist *et al*. 2022) suggest

that pounding the plant parts in wooden or stone-made mortar and pestle, and subsequently homogenizing them with water, is the primary method of preparation.

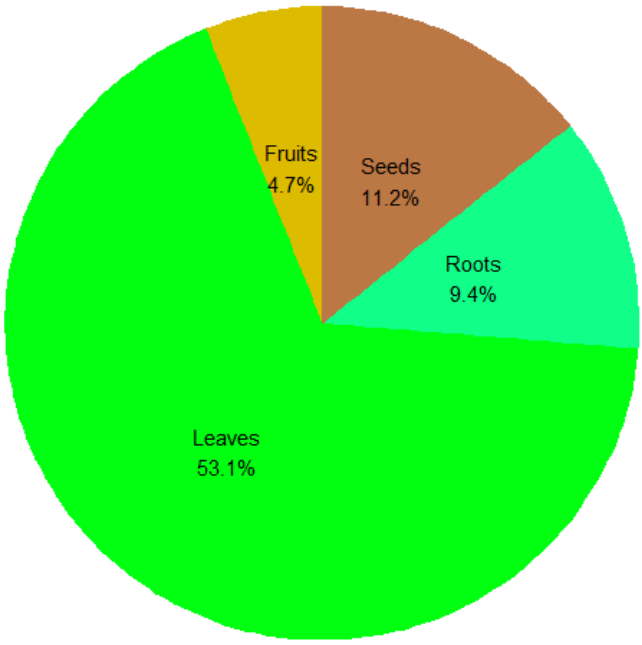

Figure 6. Medicinal plant parts used

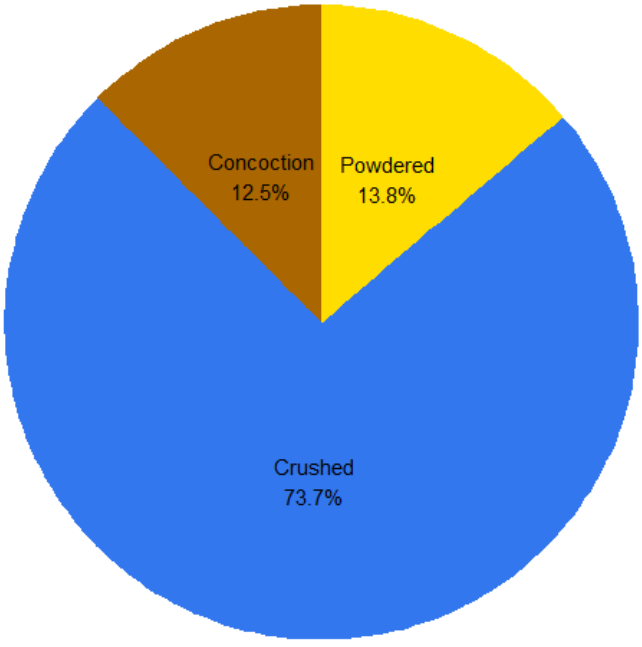

Figure 7. Mode of Medicinal Plant Preparation

Routes of administration of herbal remedies

The findings of the study indicated that the route of administration varied among the informants. Out of the 41 reports on route of administration, the majority of the cases involved oral administration. This was followed by dermal administration and nasal administration. The remaining cases included optical and vaginal administration (Figure 8). Drenching domestic animals has been found to be the most commonly employed method of administering remedies orally. Various studies conducted in different regions of Ethiopia, as well as in other parts of the world, have also highlighted the preference for oral administration of remedies (Birhan *et al*. 2018,Deressa 2021,Asfaw *et al*. 2022). The widespread use of the oral route can be attributed to its rapid onset of action and the sustained physiological effects it offers. Even in human health remedies

based on plants, Awoke *et al*. (2024) highlighted the predominance of the oral administration. This confirms the efficiency of this route in traditional medicine.

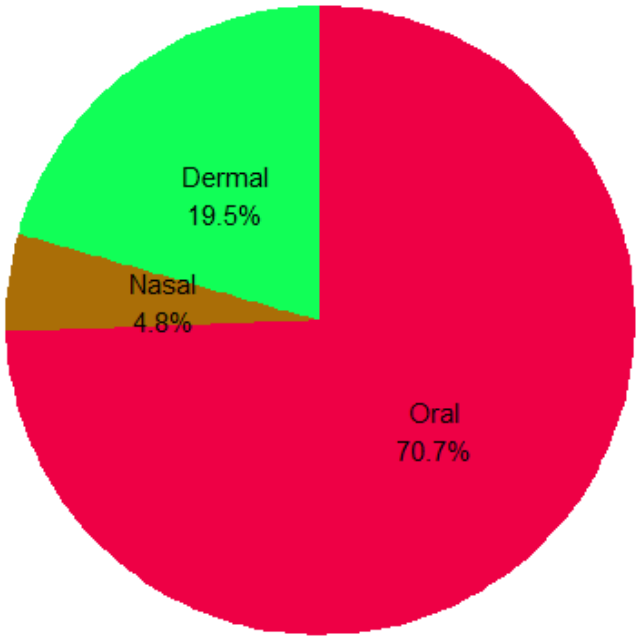

Figure 8. Routes of Medicinal Plant Administration and Application

Traditional Diagnosis and Treatment Methods

In the study area, the local community reported a total of 28 different types of domestic animal disease. Among these, the most prevalent ailment types were bloating, trypanosomiasis, wound, foot and mouse disease, ectoparasite, diarrhea, and newcastle. According to the informant report, the traditional practice was to administer veterinary treatment after a visual examination of the animal by a traditional healer. This examination focused on identifying any symptoms present in the animal's mouth or foot parts, throat, eyes, nose, and ears, as well as assessing the occurrence and condition of wounds on its skin. The identification of animal ailment relied on the observation of diseased animals, as well as gathering information from the animal's owner through interviews regarding the main symptoms exhibited by the animals. These findings align with previous reports in other part of the country (Lulekal *et al*. 2014, Yenesew *et al*. 2015, Alemneh 2021).

Medicinal Plants Dosage Measurement

As per the responses of the informants in the Guraferda district, the dosage and frequency of administration of remedies vary based on the age, size, and species of the animal being treated. For smaller animals like sheep, goats, dogs, and cats, a relatively smaller quantity of plant-based remedies, measured using coffee cups, teacups, and water glasses, was prescribed. Conversely, larger animals such as cows, oxen, horses, and donkeys required a dose measured using plastic jugs equivalent to one liter. Furthermore, while some remedies were administered once, others were given until the desired outcome or cure was achieved. However, it is important to note that these measurement techniques were not standardized, leading to potential inconsistencies in dosing. Furthermore, there were no reported antidotes specifically provided for domestic animal disease. It is worth mentioning that water emerged as the most commonly used solvent for preparing remedies in the study area. These findings align with similar study conducted by other researchers in different regions of the country (Lulekal *et al.* 2014, Birhan *et al.* 2018, Alemneh 2021, Awoke *et al*. 2024).

Marketability of Medicinal Plants

Out of the five species of medicinal plants that were examined for their marketability in treating domestic animal diseases, only two species were found to be actively traded and purchased for their medicinal applications. These two species are *Aloe Vera Schweinf*. var. aethiopica and *Artemisia abyssinica* Sch. Bip. ex A. Rich. The remaining medicinal plants that were listed as being marketed were primarily sold in large quantities for their non-medicinal uses, but they were also utilized as medicine when necessary. At local markets such as Megenteya, Semerta, Gabika, Meleya, and Bebeka, the average price for a bunch of *Aloe Vera* Schweinf. var. aethiopica and *Artemisia abyssinica* Sch. Bip. ex A. Rich was 20 Ethiopian Birr. The other reported medicinal plants were primarily sold in bulk for their non-medicinal uses, such as in food, and spice. However, they were also

used as a source of traditional medicine when the need arose. Some examples of these plant species include *Zingiber officinale* Roscoe, *Ruta chalepensis* L., *Coriandrum sativum* L., and *Allium sativum* L. This finding aligns with the report of Awoke *et al*. (2024).

Efficacy of Medicinal Plants

The ICF results of the study showed that common diseases in domestic animals in the area had high levels of agreement among informants, especially in the dermal category with an ICF value of 0.90. This was followed by the digestive system category with an ICF value of 0.89. On the other hand, the musculoskeletal and nervous system category had the lowest ICF value of 0.33 (Table 4), indicating limited sharing of knowledge among traditional healers, possibly due to distance and a desire to keep their knowledge private. Moreover, traditional healers in different habitats may use different medicinal plants to treat the same ailment. The consensus values among informants also showed that people shared information about the most crucial medicinal plants for treating the prevalent ailment in the community. Furthermore, although most medicinal plant species had lower usage values in the area of study, this didn't necessarily imply they were less effective in treating disease. This is because the few effective medicinal plant species were only mentioned by one or two healers, indicating highly confidential knowledge. These results align with the findings of (Eshetu *et al*. 2015, Deressa 2021,Asfaw *et al.* 2022). Hence, further studies should consider the bioactive compounds found in different medicinal plants reported in this study to enlighten future drug development.

Table 4. ICF values of TMPs used for treating Domestic Animal diseases

Diseasescategory	Nt	Nur	Nur-Nt	Nur-1	ICF	%	Rank
Dermal	10	94	84	93	0.90	90	1st
Digestive system	13	118	105	117	0.89	89	2nd
Reproductive system	3	16	13	15	0.86	86	3rd
Respiratory systems	6	23	17	22	0.77	77	4th
Unclear illness	8	19	11	18	0.61	61	5th
Ecto-parasitic and animal bite	12	25	13	24	0.54	54	6th
Musculoskeletal and sense organs	3	4	1	3	0.33	33	7th

ICF= Informant Consensus Factor, **Nur** = number of use reports by informants, **Nt** =number of plant taxa or species used. One informant cited more than one ailment**.**

Relative Healing Potential of Medicinal Plants

The level of fidelity of medicinal plants indicates their potential effectiveness in treating specific disease. This study identified medicinal plants with higher fidelity levels for addressing various health issues in domestic animals. *Ehretia cymosa* Thonn was highly effective for treating febrile illness, with fidelity levels of 1 (100%) (Table 5). This suggests that plants with high fidelity levels could be prioritized for conservation, management, and sustainable use, provided their bioactivities are properly evaluated and confirmed. In contrast, the study by Gobana *et al.* (2023) found that *Nicotiana tabacum* had a fidelity level of 0.93 (93%) for treating wound management, and *Aloe vera* Schweinf had a fidelity level of 1 (100%) for treating Rh disease (Birhan *et al.* 2018). Furthermore, a lower fidelity level suggests that a specific medicinal plant species was mentioned by more informants in comparison to those with higher fidelity levels. For instance, in the present study, *Datura stramonium* L. was documented as having low FL (0.26, 26%) for managing mastitis. Therefore, further studies should consider the bioactive compounds found in high FL medicinal plants reported in this study to enlighten future drug development.

Table 5. FL of 8 most cited TMPs for Domestic Animal Diseasestreatments

Scientific name	DA Disease	IP	IU	FL	%	R
Ehretia cymosa Thonn.	Febrile illness	10	10	1.0	100	1st
Croton dichogamus pax.	Trypanosomiasis	8	10	0.80	80	1st
Aloe Vera Schweinf.	Newcastle	11	16	0.68	68	2nd
Phytolacca dodecandra L'Herit.	Diarrhea	10	15	0.66	66	3rd
Nicotiana tabacum L.	Leech	13	24	0.54	54	4th
Melia azedarach L.	Ringworm	12	34	0.35	35	5th
Vernonia amygdalina Del.	Bloating	14	46	0.30	30	6th
Datura stramonium L.	Mastitis	11	41	0.26	26	7th

R= Rank. **FL**= Fidelity Level, **Ip** = number of informants who independently cited the importance of a species for treating a particular disease, **Iu** = total number of informants who reported the plant for any given disease.

The Most Preferred Plants for Treating Domestic Animal Diseases

In order to evaluate the effectiveness of medicinal plants in treating bloating, a preference ranking was carried out. The results showed that the local community's choice of medicinal plants was influenced by their experiences and their skill in identifying effective plants for treating their domestic animals' diseases. Among the plants employed for treating bloating, *Vernonia amygdalina* Del. was the most popular species, followed by *Allium sativum* L. and *Datura stramonium* L (Table 6). In contrast, *Zingiber ofcinale* emerged as the most favored plant species for bloating, contradicting previous findings (Hussein 2023).

Table 6. Preference ranking of TMPs reported for treating Bloating

Medicinal plants for **Bloating**	Respondents(R_1-R_{10})											
	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}	Total	Rank
Vernonia amygdalina Del.	4	5	3	5	5	4	5	4	5	5	45	1st
Allium sativum L	5	4	5	4	4	5	4	5	3	4	43	2nd
Datura stramonium L.	3	3	1	2	3	3	2	3	4	3	27	3rd
Acmella caulirhiza Delile.	1	2	4	3	1	2	3	1	2	2	21	4th
Lycopersicon esculentum Mill.	2	1	2	1	2	1	1	2	1	1	14	5th

Direct Matrix Ranking of Multipurpose Medicinal Plants

The output of the direct matrix ranking (DMR) exercise on five multipurpose medicinal plants used for treating domestic animal diseases helped identify which of the multipurpose plants is under greater pressure than other species in the area along with the respective factors that threaten the plants. Accordingly, *Ehretia cymosa* Thonn was ranked first (most - threatened) followed by *Melia azedarach* L. and *Croton dichogamus* pax. (Table 7). Results indicated that these multipurpose medicinal plant species are currently exploited more for construction, and firewood purposes than for their medicinal uses. As a result, highly ranked species like *Ehretia cymosa* Thonn are expected to encounter significant threats in the near future, highlighting the need for collaborative conservation efforts to safeguard these versatile plant species. In contrast to this finding, the report by Dilbato *et al*. (2023) indicated that *Melia azedarach* L.was the least threatened medicinal plant.

Table 7. DMR score of five TMPs for Domestic animal diseases

Use categories	**Plant Species**																									**Total**	**Rank**
	Croton dichogamus pax.					*Ehretia cymosa* Thonn**.**					*Vernonia amygdalina* Del*.*					*Melia azedarach* L*.*					*Allium sativum* L						
	R1	R2	R3	R4	R5	R1	R2	R3	R4	R5	R1	R2	R3	R4	R5	R1	R2	R3	R4	R5	R1	R2	R3	R4	R5		
Medicine	1	2	2	2	2	4	4	3	4	4	3	1	4	3	3	2	3	1	1	1	5	4	5	5	5	74	**1st**
Construction	3	2	3	3	1	4	5	4	5	5	2	1	1	2	3	5	3	2	1	4	0	0	0	0	0	59	**2nd**
Firewood	1	2	2	2	2	5	4	4	3	3	2	1	1	4	1	4	5	3	5	4	0	0	0	0	0	58	**3rd**
Agri.tool	3	4	2	5	4	4	3	3	4	3	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	38	**4th**
Charcoal	2	3	3	1	2	3	5	4	2	3	0	0	0	0	0	1	2	1	0	2	0	0	0	0	0	34	**5th**
Furniture	1	0	0	1	2	4	1	3	5	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	20	**6th**
Food	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	3	1	5	15	**7th**
SubTotal	11	13	12	14	13	24	22	21	23	20	7	3	6	9	7	13	14	7	7	13	9	6	8	6	10		
Grand Total	**63**					**110**					**32**					**54**					**39**						
Rank	**2nd**					**1st**					**5th**					**3rd**					**4th**						

N.B. R=respondent, **Agri.tool** =Agricultural tool

Jaccard's Similarity Index

The study found that the study area of Wolita had the highest Jaccard coefficient of similarity in medicinal plants' composition at 17%, followed by Siltie at 16%. In contrast, the Kersa district showed a lower degree of similarity at 9% (Table 8).

Table 8 Comparison of MPs in the present study area with other study areas of Ethiopia

Study Area	Species No.(a or b)	Common species(c)	Jaccard Index	Similarity (%)	References
Guraferda	31	-	-	-	Present study area
Wolita	54	17	0.17	17	(Wendimu, and Bojago 2023)
Siltie	39	14	0.16	16	(Gensa *et al.* 2023)
Ambo	55	16	0.15	15	(Berhanu *et al*. 2020)
Adea berga	59	13	0.13	13	(Feyisa *et al*. 2021)
East Wollega	28	8	0.12	12	(Tadesse *et al.* 2014)
Gulomekeda	8	5	0.11	11	(Teklay Girmay and Teshome 2017)
Enarj Enawuga	34	8	0.10	10	(Birhan *et al*. 2018)
Dess'a Forest,	37	7	0.10	10	(Kahsay *et al*. 2020)
Kersa	53	9	0.09	9	(Gemechu 2021)

Comparison of Knowledge between Key and General Informants

The disparity in TMPK between key and general informants was examined by conducting t-test using R software. The obtained t-test results revealed a statistically significant distinction in MPK between these two groups ($t = 9.6$, $P < 0.05$). Key informants displayed a notably higher average score for MPK ($M = 5.6$, $SD = 1.5$) in comparison to general informants ($M = 2.5$, $SD = 1.4$) (Table 9). This discovery aligns with the research conducted by Kidane *et al*. (2018), Bose (2021), Tahir *et al*. (2023), Awoke *et al*. (2024). This result suggests that elderly informants have a greater perceived use of traditional knowledge, likely due to both cultural influences and their extensive, sustained interaction with plant resources compared to general informants. The notable difference in knowledge levels between key informants and general informants carries several implications. Firstly, it underscores the importance of recognizing and leveraging the expertise of key informants in the realm of medicinal plant knowledge. Key informants can play a crucial role in preserving traditional knowledge and practices related to medicinal plants, as well as in promoting sustainable harvesting and cultivation methods. Additionally, the significant knowledge gap emphasizes the need for targeted educational and capacity-building initiatives designed to enhance the understanding of medicinal plants among general informants. By equipping the broader community with relevant knowledge and skills, we can foster the sustainable use of medicinal plants while also cultivating a deeper appreciation for traditional healing practices.

Comparison of Knowledge between Gender

To investigate the variation in MPK between male and female informants, a t-test was conducted using R software. The results of the t-test indicated a statistically significant difference in MPK between the two genders ($t = 5.3$, $P < 0.05$). Specifically, male informants demonstrated a significantly higher mean MPK score ($M = 3.9$, $SD = 1.9$) compared to female informants ($M = 1.8$, $SD = 1.2$) (Table 9). This outcome aligns with the findings of Bose (2021),Usman *et al.*(2022),Silambarasan *et al*.(2023)**,** Awoke *et al*. (2024). Contrary to this discovery, Gnahore *et al*.(2022) found that females possess more knowledge about MPs than males. Moreover, other researchers, such as Kidane *et al.*(2018) and Tahir *et al*.(2021), reported that both males and females have equal knowledge of MPs. These differences may be influenced by cultural, social, or historical factors that have led to variations in the skill of MPK between genders. Another possibility is that male was more likely to spend time in areas where wild MPs are found, such as forests or fields. Furthermore, other researchers (Chekole 2017, Usman *et al.* 2022) noted that IK on medicine is passed down to sons rather than daughters. However, it is important to note that this belief is not always accurate. Many women are equally capable as men when it comes to accessing remote areas and collecting plant species. In fact, numerous cultures have historically seen women playing significant roles in hunting and gathering. Therefore, it is essential to challenge the notion that only males can contribute to the collection of plant species and to acknowledge the contributions of both genders. Further exploration of the factors underlying this inequality is crucial to inform the development of effective programs and policies that empower female informants and promote gender-inclusive approaches to traditional medicine and resource management.

Table 9. MPK among Informant Groups (Independent t-test)

Parameters	Informant groups	N	Mean ± SD	t –value	p – value
Gender	Male	80	3.9±1.9	5.3	*P<0.05*
	Female	16	1.8±1.2		
Literacy level	Illiterate	68	4.1±1.9	5.7	*P<0.05*
	Literate	28	2.1±1.3		
Experience of Informant	Key informant	32	5.6±1.5	9.6	*P<0.05*
	General informant	64	2.5±1.4		

Comparison of Knowledge between Education Level

To examine the variation in medicinal plant knowledge (MPK) between informants based on their education levels, a t-test was conducted using R software. The results demonstrated a statistically significant difference in MPK between the two groups ($t = 5.7$, $P < 0.05$). Specifically, illiterate informants exhibited a significantly higher mean MPK score ($M = 4.1$, $SD = 1.9$) compared to literate informants ($M = 2.1$, $SD = 1.3$) (Table 9). This suggests that formal education may impact the acquisition and transmission of traditional medicinal knowledge, leading to disparities in the awareness and understanding of medicinal plants across different educational backgrounds. This finding is consistent with previous studies conducted in various regions of the country (Bose 2021, Tahir *et al*. 2021, Gnahore *et al*. 2022). Furthermore, limited exposure to traditional practices within formal educational settings, especially in higher education institutions, may contribute to a decline in medicinal plant knowledge among those with advanced degrees. Cultural factors, such as the transmission of traditional knowledge within specific communities, also play a role in shaping individuals' awareness of medicinal plants across different educational levels. The emphasis on Western medicine within educational curricula may further diminish attention to traditional medicinal practices, resulting in a lack of knowledge among individuals with higher education. Consequently, the findings of this study have significant implications for public health and education policies, highlighting the need for targeted interventions to bridge the gap in awareness of medicinal plants among individuals with varying educational levels. It is essential to incorporate traditional medicinal knowledge into formal education and healthcare systems to promote a more integrated approach to healthcare.

Comparison of Knowledge among Different Age Groups

An ANOVA in R showed a significant impact of age category (young, middle, elder) on TMPK scores ($F(2, 93) = 15.53$, $p < 0.05$). Variance between age groups ($SS = 118.2$, $MS = 59.08$) was much higher than within-groups variance ($SS = 353.7$, $MS = 3.80$) (Table 10), indicating age influenced disparities in TMPK (Table 10). Further analysis using Tukey's HSD post-hoc tests revealed that the elder group exhibited significantly higher mean scores ($M = 4.3$, $SD = 2.2$, $p < 0.05$) compared to both the middle group ($M = 3$, $SD = 1.6$, $p < 0.05$) and the young group ($M = 1.3$, $SD = 0.9$, $p < 0.05$). This suggests a threat to the diminishing perceived value of traditional knowledge across generations. This study is consistent with the findings of several authors (Bekele *et al*. 2022, Tahir *et al*. 2023, Awoke *et al*. 2024) as well as research from other countries (Liu *et al*. 2023), all of which indicate that older individuals are more likely to report the use of medicinal plants than younger individuals. This discrepancy may stem from the elders' extensive experience with local medicinal plants for treating various diseases in traditional ways, while younger generations are increasingly influenced by modernization and globalization, resulting in reduced interest in traditional practices. Local communities observe that younger individuals are less inclined to learn about ethnomedicinal knowledge and are more focused on contemporary education, leading to migration for different occupations. This phenomenon contributes to the erosion of indigenous and local ethnobotanical knowledge. Thus, the notable variation in medicinal plant knowledge across informant age categories underscores the necessity of acknowledging and appreciating the wisdom and proficiency of older generations in traditional medicinal practices. It also underscores the importance of safeguarding traditional medicinal practices and transmitting them to succeeding generations. The correlation coefficient of 0.81 demonstrates a positive association between age categories and MPk (Figure 9). This indicates that as age increases, the level of knowledge about MPs among informants also increases. This finding aligns with the findings of (Bose 2021,Bekele *et al.* 2022, Awoke *et al*. 2024). The regression analysis results revealed that the $\beta 0$ and $\beta 1$ estimates were -2.3 and 0.12, respectively, with a significance level of $p< 0.05$. The $\beta 1$ estimate indicates a positive association between age categories and MPk, signifying an increase of 0.12 in the projected value of MPK for each rise in age category (Figure 10). The R-squared value of 0.65, indicating that age categories account for 65% of the variance in MPK among informants, implies that age significantly influences the level of knowledge about MPs. Approximately 35% of the variation in informant knowledge is attributed to other factors or random variation. Thus, these findings have important implications for the preservation and transmission of TMPK, highlighting the need to prioritize and support older generations as repositories of valuable information.

Table 10. Age categories with informant MPK (One way ANOVA)

Source of Variation	Df	SS	MS=SS/Df	F Ratio	*P-value*
Between Groups	k – 1 3-1=2	118.2	59.08	15.54	*P<0.05*
Residual (within)	n-k 96-3=93	353.7	3.80		
Total	n – 1 96-1=95	471.9	62.88		

Note: **K**=number of level, **n**=number of observation, **Df**=degree of freedom, **SS**= Sum of Squares, **MS**= Mean of Square, Significant codes: 0.05

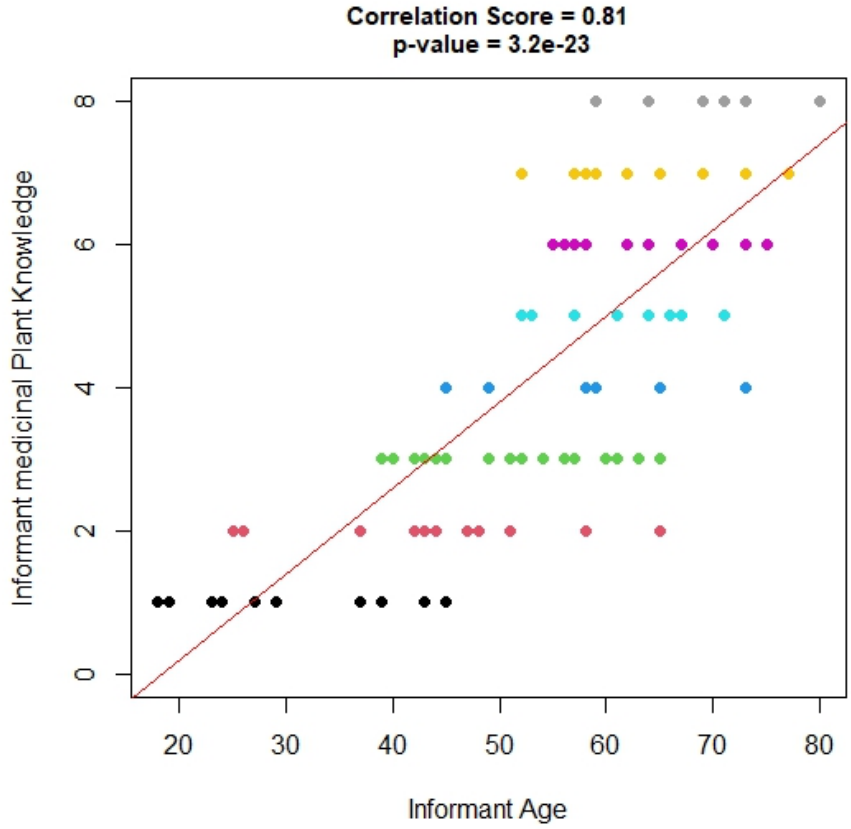

Figure 9. Correlation Model for Medicinal Plant Knowledge by Informant Age

Transmission of Traditional Medicinal Knowledge

The transmission of ancestral wisdom regarding the utilization of MPs within the research area is predominantly dependent on verbal exchange, as there are no written documents available for reference. Most participants transfer this knowledge within their families, with the eldest sons typically shouldering the responsibility of preserving and continuing this information. A few others share traditional knowledge with trusted neighbors and other relatives. Our results corroborate those obtained by other authors (Tafesse *et al*. 2023,Alemu *et al*. 2024, Awoke *et al*. 2024). Presently, the older generations within the study area possess valuable IK about MPs. However, this knowledge is at risk of being lost due to the passing of these knowledgeable elders. According to informants, factors such as modern medicine, education, religious beliefs, and societal modernization have contributed to the decline of IK about Mps in the area. A significant issue noted in the study area is that elderly traditional healers often keep their knowledge private, believing that revealing it could diminish the healing power of the plants and reduce their potential for income generation. This finding aligns with the outcomes of various other investigations (Mekonnen *et al*. 2022, Alemu *et al*. 2024, Awoke *et al*. 2024). Other study in Ethiopia (Awoke *et al*. 2024) indicated that the younger age group is unwilling to learn and apply traditional medicinal practices, potentially leading to the loss of valuable information when older traditional healers pass away without passing on their knowledge (Abdela *et al*. 2022,Kindie 2023). Thus, increasing awareness about the significance of IK among the general population is crucial, and can be achieved through public environmental and medical education initiatives or other media campaigns.

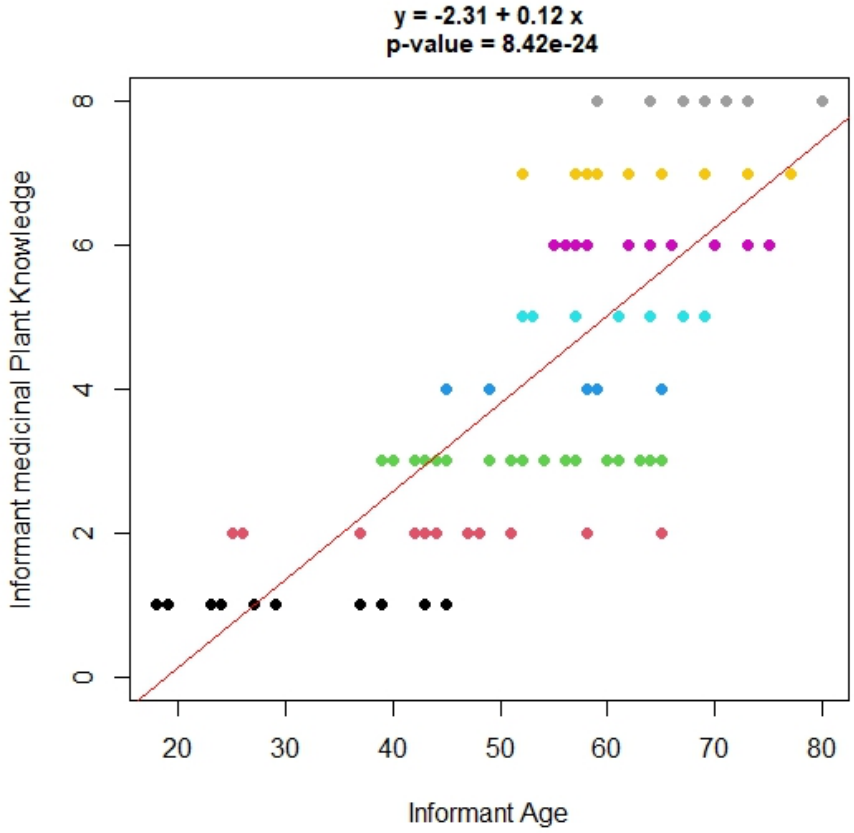

Figure 10. Regression Model for Medicinal Plant Knowledge by Informant Age

Threats and Conservation Practices of Medicinal Plants

The findings from the ethnobotanical study indicated that the primary threat to medicinal plants in the study area was deforestation for agricultural expansion followed material culture, invasive alien species, overharvesting, firewood collection, modernization, charcoal production (Table 11). In the current research area, the regularly over harvesting of *Ehretia cymosa* Thonn has been reported. The findings of the study indicate that deforestation for agricultural land expansion emerges as the primary threat to MPs in the study area, which aligns with the report of (Tamene 2020, Girmay *et al*. 2021, Alemu *et al*. 2024). The rapid proliferation of IAS, such as *Parthenium hysterophorus* and *Lantana camara* in the Gurafeda District, poses a significant threat to MPs, as indicated by the study's respondents. These IAS are harmful due to their ability to rapidly spread and dominate, leading to alterations in the existing ecosystem upon their introduction. Their capacity to out-compete local species disrupts the natural balance, posing a risk of extinction to the indigenous plants (Shiferaw *et al.* 2018,Kahsay *et al*. 2020,Karki *et al*. 2023). This has emerged as a key factor contributing to the decline of herbaceous MPs. Furthermore, other researchers have highlighted *Prosopis juliflora* as another IAS posing a threat to MPs (Beche *et al.*2016, Megersa & Woldetsadik 2022). Likewise, the research indicates that multipurpose MPs are especially at risk, as they encounter various threats. This discovery aligns with earlier studies (Agize *et al*. 2022,Alemu *et al.* 2024, Awoke *et al*. 2024). Furthermore, the application of herbicides and the removal of medicinal plants, regarded as weeds, have been observed in agricultural regions, paralleling findings in Hamar district, southwestern Ethiopia (Bekele *et al*. 2022). This situation may stem from the local community's limited awareness regarding the ecological, economic, and health advantages of medicinal plants. Additionally, issues such as wildfires, destruction by animals, and attacks from insects or fungi on medicinal plants have been reported in the area. This situation necessitates immediate conservation efforts to safeguard the availability of medicinal plants both in the study area and throughout the nation. Among the 31 medicinal plant species documented, a significant majority of medicinal plant species were found to be unprotected in the study area.These plant species with medicinal plants were cultivated not only for their medicinal benefits but also for their utilization in culinary, aromatic, spices, economic, and various other applications. The most commonly employed cultivation methods for MPs included home gardens (*Ruta chalepensis* L.), coffee shade (*Croton dichogamus* pax), live fences (*Justicia schimperiana* (Hochst. Ex Nees) T. Anders.), roadsides (*Eucalyptus globulus* Labill.), and agricultural fields mixed with other crops. The findings also suggest a lack of community-based conservation efforts undertaken by the local population in the study area. This statement is

consistent with the finding of (Ssenku *et al*. 2022,Kindie 2023, Awoke *et al*. 2024). Hence, it is essential to encourage the conservation habits of local communities and implement both *in situ* and *ex situ* conservation strategies for the sustainable use of medicinal plant resources while preserving the associated indigenous knowledge across the country. Besides, it is crucial to increase awareness regarding the significance of MPs and the challenges they encounter. This can be achieved through educational initiatives, outreach campaigns, and media platforms.

Table 11. Preference ranking to find out the most threatening factors of TMPs

Threatening factors TMPs	Respondents(R_1-R_{10})											
	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}	Total	Rank
Deforestation	7	6	7	5	7	6	7	4	7	6	62	1st
Material culture	6	5	6	6	5	7	5	7	4	7	58	2nd
Invasive Alien Species	5	7	5	4	6	4	6	6	5	5	53	3rd
Overharvesting	1	5	4	7	1	3	4	2	6	1	34	4th
Fire wood	4	2	2	1	4	5	3	3	2	2	28	5th
Modernization	2	4	3	2	3	1	2	5	1	4	27	6th
Charcoal Making	3	1	1	4	2	2	1	1	3	3	21	7th

Limitation of the Study

The research encountered several challenges, including communication barriers and difficulties in data interpretation due to language differences, a limited sample size particularly among females that may not accurately reflect the population, non-standardized dosage measures, and obstacles in accessing remote communities. Additionally, there is a concern about the potential loss of Indigenous Knowledge (IK) resulting from rapid social and environmental changes, as well as ethical issues surrounding intellectual property rights and informed consent. Despite these challenges affecting the research process, the study achieved its objectives by implementing alternative strategies, such as encouraging informants to participate by consent form, using translators, and navigating transportation obstacles by walking or renting horses and motorcycles. As a result, future researchers could consider investigating phytochemical analysis and antimicrobial testing of this important phytomedicine within the study area.

Conclusion

This study aims to identify and document the traditional use of medicinal plants for treating diseases in domestic animals within the Guraferda District. The residents of this district possess extensive knowledge of medicinal plants used for addressing various diseases in domesticated animals. The ethnobotanical research uncovered a total of 31 medicinal plant species utilized by locals to treat 28 different diseases affecting these animals. Prominent species include *Ehretia cymosa* Thonn., *Vernonia amygdalina* Del., *Allium sativum* L., *Acmella caulirhiza* Delile., *Aloe Vera* Schweinf., and *Phytolacca dodecandra* L'Herit. The most frequently treated conditions were related to the digestive system and skin. However, traditional methods for the preparation, formulation, and administration of these herbal remedies often lack standardized guidelines and quality control. An analysis of the socio-demographic characteristics of informants revealed significant differences in knowledge of medicinal plants based on factors such as gender, education level, type of informant, and age groups. There is an identified need for government and stakeholder intervention to build trust among practitioners and users, as well as to establish an accreditation system for healers and ensure thorough evaluation of traditional diagnoses and products. Hence, it is essential to develop protocols, promote traditional knowledge through public education, and gradually integrate these practices into the official health system. The study highlights concerns regarding the potential extinction of medicinal plant species due to factors such as deforestation, overexploitation, firewood collection, and invasive alien species. It underscores the urgent need to document both plant species and traditional knowledge to safeguard cultural practices and medicinal flora, thereby preventing the loss of valuable ancestral knowledge. A notable lack of collaborative efforts aimed at conserving medicinal plants and indigenous knowledge in the study area is a major issue. Traditional healers are vital in preserving this rich heritage, yet their limited cultivation practices emphasize the necessity for external support. The findings of this study suggest that premature uprooting of medicinal plant species should be avoided, advocating instead for the use of alternative plant parts, such as leaves, which is critical for species preservation and preventing extinction. Engaging traditional healers in scientific research could help validate the efficacy and safety of their remedies. It is essential to develop both *in situ* and *ex situ* conservation strategies, particularly for plants with valuable roots. Collaborating with the agriculture office to establish medicinal plant nurseries will also encourage the propagation of preferred species for cultivation. Therefore, this study recommends further research into the phytochemical and pharmacological properties of the documented medicinal plants.

Table 12. Traditionally Used Medicinal Plants for Domestic Animal Diseases in Guraferda District

Family	Scientific Name	Local Name	Ha	PU	CPU	Method of Preparation and Mode of Application	RoA	Ailment Treated (English)	Source	Voucher Number
Acanthaceae	*Justicia schimperiana* (Hochst. Ex Nees) T. Anders.	**Shersharo (Kf)**	Sh	Lf	Fresh	Livestock is provided with a single water glass quantity of a mixture obtained by crushing leaves and combining them with water for three days.	Oral	Trypanosomiasis	Wild	AA01
				Lf	Fresh	The process involves crushing the leaf, mixing it with water, and then squeezing it. Afterward, the mixture is decanted, and a quantity equivalent to that of a water glass is administered to livestock. Additionally, a quantity equivalent to half a coffee cup is given to treat chicken disease.	Oral	Intestinal parasites		
				St	Fresh	The method involves gathering stems that are approximately the size of a hand, removing the bark, and then inserting them into the cow's vagina.	Vaginal	Retained placenta		
				Lf	Fresh	Livestock is provided with a single water glass quantity of a mixture obtained by crushing leaves and combining them with water.	Oral	Bloating		
				Lf	Fresh	For a period of three days, a concoction is prepared by crushing the leaf and combining it with *Croton macrostachyus* in water. This mixture is then administered to various animals including cattle, chicken, sheep, dog, goat, and cat.	Oral	Diarrhea		
Alliaceae	*Allium sativum* L.	**Tuma (Sd)**	H	Bu	Dry	To treat ringworm in livestock, it is recommended to obtain a bulb of *Allium sativum* and gently apply the cut surface onto the affected areas. This process should be repeated on a daily basis until the ringworm infection subsides.	Dermal	Ringworm	Market	AA02

				Bu	Dry	After crushing the bulb, pour water into it, and subsequently strain the resulting solution. Administer the filtered solution to livestock by means of ingestion through the mouth and nasal passages.	Oral	Diarrhea		
				Bu	Dry	During times of pain, a mixture of crushed *A. sativum* bulb and *A. afra* shoot is combined with water. The resulting solution is then administered to sheep and goats in half a water glass quantity, while cows and oxen are given one full water glass.	Oral	sudden illness		
				Bu	Dry	Take a single bulb of Allium sativum and combine it with one liter of water. Utilize the resulting mixture to cleanse the animal once daily until it is completely rid of parasites.	Dermal	Ectoparasite		
				Bu	Dry	The bulb of this plant given for cttle alongside Enjera or Bread for three days.	Oral	Typhoid		
				Bu	Dry	To administer the solution to the cattle, first crush the bulb and mix it with water. After filtering the mixture, provide two coffee cup amounts of the resulting solution to the animal through both its mouth and nose.	Oral	Bloating		
				Bu	Dry	To aid in the recovery of respiratory issues, it is recommended to crush three bulbs of *Allium sativum* and combine with two liters of water. For cattle, administer one liter of the mixture, while for sheep, goats, chickens, dogs, and cats, half a liter is sufficient as a drench.	Oral	Respiratory problem		
Aloaceae	*Aloe Vera* Schweinf. var. *aethiopica*	**Eret(Am)**	H	Rt	Fresh	During the sixth month of pregnancy, livestock are provided with a mixture of powdered fresh roots that have been grounded and diluted with water after undergoing filtration.	Oral	Rh disease	HG	AA03

				Lax	Fresh	The process involves extracting and gathering the juice, which is subsequently blended with water and administered to the chickens over a period of three days.	Oral	Newcastle		
Asteraceae	*Acmella caulirhiza* Delile	**Gutichaa (Or)**	H	Flw	Fresh	Eye disease can be effectively treated in cattle, sheep, dogs, cats, and goats through the process of crushing and painting. This method involves crushing the appropriate medication and applying it directly to the affected area of the animal's eye. By doing so, the medication can penetrate the eye tissues and provide targeted treatment for the specific eye disease. This approach has been proven to be successful in managing eye ailment in various animals, ensuring their overall health and well-being.	Optical	Eye disease	Wild	AA04
				Flw	Fresh	The flowers undergo a process of pounding, mixing, and squeezing, resulting in a solution equivalent to one glass of water, which is then administered to the cattle.	Oral	Bloating		
	Artemisia abyssinica Sch. Bip. ex A. Rich	**Sukundee (Or)**	H	Lf	Fresh	During episodes of pain, a mixture of crushed shoots and leaves from the *E. globulus* plant is administered to livestock. The recommended dosage is half a liter for sheep and goats, while cows and oxen are given one liter.	Oral	Bloating	HG	AA05
	Guizotia abyssinica (L.f.) Cass.	**Nuugii (Or)**	H	Sd	Dry	The ground roasted seed of this plant is combined with water and subjected to boiling. Subsequently, water glass of the resulting filtrate is drenched for duration of 3 days.	Oral	Pneumonia	Market	AA06
	Vernonia amygdalina Del.	**Baka (Sh)**	Sh	Lf	Fresh	Fluid equivalent to two cups of coffee is extracted from squeezed leaves and administered to Sheep, Goat, Cow, and Ox.	Oral	Abdominal problem	HG/W	AA07

				Lf	Fresh	Livestock owners utilize a method wherein they crush the stems of *Euphorbia abyssinica* leaves and subsequently administer the resulting paste onto the skin of their animals. This application is repeated consistently for a duration of one week.	Dermal	Trypanaso miasis		
				Lf	Fresh	Cattle, sheep, and goats are administered a solution made by pounding leaves, mixing them with water, squeezing the mixture, and filtering it, resulting in a single glass of the solution.	Oral	Diarrhea		
				Lf	Fresh	In case of swelling around the fractured bone, immerse a piece of cloth in warm salt solution and place it on the affected area. Another option is to crush fresh *Vernonia amygdalina* leaves and use the resulting mixture to apply on the swelling.	Dermal	Brocken bone		
				Lf	Fresh	Combine one tea glass quantity of edible oil with a handful of freshly crushed *Vernonia amygdalina* leaves and 2 teaspoons of salt. Administer one liter of this mixture to adult cattle, while calves, goats, and sheep should be given half a liter.	Oral	Bloating		
				Lf	Fresh	The *Vernonia amygdalina* Del. leaf crushed, combined with water, boiled, and drenched for three days.	Oral	Ascariasis		
				Lf	Fresh	Fluid equivalent to two cups of coffee is extracted from squeezed leaves and administered to Sheep, and Goat	Dermal	Orf		

				Lf	Fresh	To prepare a medicinal solution for animals, fresh roots and leaves of *Vernonia amygdalina* should be pounded and mixed with rice powder in water. The resulting mixture should be sieved and used to drench the animals. The recommended amount of solution is two liters for cattle and one liter for calves, dogs, cats, sheep, and goats. This process should be repeated twice a day, in the morning and evening, until the animal has fully recovered.	Oral	Foot and mouth disease		
Apiaceae	*Coriandrum sativum* L	**Dimbilal (Am)**	H	Sd	Dry	Seeds are pulverized, combined with water, and administered orally to cattle, sheep, goats, and donkeys in the form of a diluted solution.	Oral	Cough	Market	AA08
Bignoniaceae	*Stereospermum kunthianum* cham.	**Qeri (Sh)**	T	Ba	Fresh	The *Stereospermum kunthianum* cham bark was crushed, after which a solution of one coffee cup was drench to the cattle.	Oral	Bloating	Wild	AA09
	Spathodea campanulata P.Beauv.	*Nebelbal (Am*)	T	Lf	Fresh	The *Spathodea campanulata* P.Beauv leaf was crushed, after which a solution of one coffee cup was drench to the cattle.	Oral	Poison	Wild	AA10
Boraginaceae	*Cynoglossum lanceolatum* Forssk.	**Ketibaro (Mn)**	H	Rt	Fresh	The roots are pulverized, combined with water, and immersed; then, gently massage the impacted region of the Donkey and Horse with the pulverized root.	Oral	Swelling	Wild	AA11
	Ehretia cymosa Thonn.	**Derma(Sh)**	T	Lf	Fresh	The leaf crushed and drenched one glass water amount of the solution for cattle.	Oral	Febrile illness/ Mich	Wild	AA12
Brassicaceae	*Lepidium sativum* L.	**Silfa (Mn)**	H	Sd	Dry	To provide nmedicine to cattle, a solution is prepared by mixing dry seeds that have been ground into a fine powder with water. This solution is then administered to the animals in the form of one glass of water.	Oral	Diarrhea	Market	AA13

				Sd	Dry	Chicken is fed with a mixture of dry seeds that have been ground with rice grain and then mixed with water to form a powder.	Oral	Coccidiosis		
Caricaceae	*Carica papaya* L.	**Papaya (Am)**	T	Lf	Dry	Administer half a cup of freshly crushed *Carica papaya* seeds to the affected animal or mix the crushed seeds with water and use it as a drench for chickens.	Oral	Watery diarrhea	HG	AA14
Cucurbitaceae	*Momordica foetida* Schumach.	**Bererit (Mn)**	Cl	Lf	Fresh	The leaves undergo boiling and fumigation for infected cattle.	Oral	Febrile illness/Mich	Wild	AA15
	Peponium vogelii (Hook. f.) Engl.	**Berktiamu(Sh)**	Cl	Fr	Fresh	The fruit of this plant crushed, and then mix with water and drenched one glass amount of solution for cattle.	Oral	Constipation	Wild	AA16
Euphorbiaceae	*Croton dichogamus* pax.	**Sefa (Am)**	T	Ba	Fresh	The bark of this plant is crushed, mixed with water, and stirred until foam produced. The cattle are given a glassful of the solution in the morning after soaking for a day.	Oral	Trypanosomiasis	Wild	AA17
	Euphorbia tirucalli L.	**Kinchib (Am)**	T	Rt	Fresh	The root is cut into small pieces, crushed, and blended with water to create a solution that is administered orally to dogs and cats for a period of three days, using a single coffee cup.	Oral	Rabies	Wild	AA18
	Ricinus communis L.	**Bolut (Mn)**	Sh	Sd	Dry	To extract the oil, it is necessary to take a small amount of crushed *Ricinus communis* seeds and subject them to heat. Additionally, the dried leaves of *Ricinus communis* can be crushed into a fine powder and utilized. The resulting oil or leaf powder can then be applied to the wounds of various animals such as dogs, cats, cattle, sheep, goats, and donkeys. It is recommended to repeat this application on a daily basis until the wounds have fully healed.	Dermal	Wound	HG/W	AA19

Meliaceae	*Melia azedarach* L.	**Mimi (Am)**	T	Lf	Fresh	The process involves crushing and boiling the leaves and fruits of the plant, followed by mixing it with the leaves of *Vernonia amygdalina*. The liquid part is then separated and a half cup of it is used to drench chicken.	Oral	Coccidiosis	HG	AA20
				Ba	Dry	Combine a single portion of *Melia azedarach* L.bark with two handfuls of roasted *Ricinus communis* seeds. Grind these components together until they form a fine powder. Incorporate a small amount of butter. Thoroughly mix the ingredients to create a paste. Securely restrain the infected animal and gently remove any disease crusts present. Apply the paste onto the affected areas of the skin on a daily basis for a duration of five days, or until the infection subsides.	Dermal	Skin disease		
				Lf	Fresh/dry	To prepare a medicinal remedy, a small quantity of *Melia azedarach* L.seeds should be taken and crushed before being cooked until they turn a rich brown color and achieve a sticky consistency. Subsequently, half a liter of water should be added to the mixture to form a paste. This paste should then be squeezed to extract the oil, which can be applied topically on animals that are experiencing the specific condition.	Dermal	Ectoparasite		
				Lf	Fresh/dry	Crush a small quantity of fresh *Melia azedarach* L.seeds to create a paste. Gently apply the paste onto the skin of cattle.	Dermal	Tsetse fly and Mosquito repellent		
				Sd	Dry	To clear affected areas, one should crush a few seeds of *Melia azedarach* L. and create a paste. This paste should then be applied onto the affected areas.	Dermal	Ringworm		

				Ba	Fresh	Extract the juice from freshly chopped and pounded finger-sized pieces of *Melia azedarach* L.bark, and incorporate it into the regular feed of livestock.	Oral	Intestinal problem		
Musaceae	*Ensete ventricosum* (Welw.) Cheesman	**Odu (Sh)**	H	St	Fresh	The stem of this plant, which is as small as a little finger, along with a leaf from the *C. arabica* plant, is crushed and then boiled. A quantity of 1-2 liters of the resulting concoction is administered to cows, while sheep and goats are given one liter. This treatment is aimed at facilitating the expulsion of the placenta.	Oral	Retained placenta	HG	AA21
Myrtaceae	*Eucalyptus globulus* Labill.	**Bootta zaafiya (Wol)**	T	Lf	Fresh	During times of pain, it is recommended to crush the leaf of *A. sativum* with its bulb, mix it with water, and administer one glass of the solution to cows, oxen, sheep, and goats.	Oral	Sudden illness	HG/W	AA22
Phytolaccaceae	*Phytolacca dodecandra* L'Herit.	**Shorshu (Sh)**	Sh	Rt	Fresh	Over the course of three days, the roots are pulverized and a single glass of liquid is drenched onto both the Dog and the Donkey.	Oral	Rabies	Wild	AA23
				Lf	Fresh	The leaf should be crushed and combined with water, followed by drenched half a coffee cup of the resulting solution to chicken.	Oral	Diarrhea		
Polygonaceae	*Rumex nepalensis* Spreng	**Germach (Ben)**	H	Rt	Fresh	The root of this plant should be crushed and then mixed with water. The resulting mixture, equivalent to two cups of coffee, should be administered to cows, sheep, goats, and oxen.	Oral	Abdominal pain	Wild	AA24
				St	Dry	The affected area of cattle, sheep, goat, donkey, and dog can be treated by topically applying a mixture of powdered stem and butter..	Dermal	Wound		

Rhamnaceae	*Rhamnus prinoides* L'Hér	**Xaddo (Sd)**	Sh	Lf	Fresh	The application of a concoction made by crushing the fresh leaves of *Rhamnus prinodes* and combining it with water is commonly employed for the treatment of livestock, as well as for dogs and chickens.	Dermal	Ectoparasite	HG	AA25
				Fr	Fresh	In the morning, two cups of a solution made by crushing and mixing fruit with water are used to drench cattle.	Oral	Leech		
Rutaceae	*Ruta chalepensis* L.	**Tserti (Sh)**	H	Lf	Fresh	In the event of poisoning of cattle, sheep, goat, or dog, it is recommended to administer a solution of concentrated salt and crushed *Ruta chalepensis* L leaf directly into the affected animal's mouth.	Oral	Poisoning	HG	A26
Solanaceae	*Datura stramonium* L.	**Bolute-rosun(Mn)**	H	Lf	Fresh	Crush a few leaves of *Datura stramonium* and warm the remaining ones over a fire. Administer the crushed leaves onto the swollen area and position the heated leaves on top. Secure with a bandage. Repeat this procedure twice daily until the swelling matures. Subsequently, gently press the abscess to rupture it (or use a sharp knife to puncture the skin above the abscess) and discharge the pus. Thoroughly cleanse the wound and reapply crushed *Datura stramonium* leaf.	Dermal	Wound	Wild	AA27
				Lf	Fresh	a few leaves crushed and paint the breast.	Dermal	Mastitis		
				Rt	Fresh	Take a sufficient quantity of newly harvested roots, proceed to crush them thoroughly, and allow them to soak in a volume of three liters of water overnight. Afterward, strain the mixture and thoroughly saturate the desired area with approximately one liter of the resulting liquid.	Oral	Trypanosomiasis		

				Lf	Fresh	The leaves was pulverized, compressed, blended with a small quantity of water, and then administered to livestock in the form of two glasses of water.	Oral	Blotting		
				Lf	Fresh	The leaves were crushed, and a single coffee cup was allocated for a wounded cattle. Half of it was reserved for the calves, while two coffee cups were provided for the donkey.	Oral	Rabies		
				Lf	Fresh	The process of eliminating parasites from livestock involved crushing leaves and spraying them onto the animals' fur.	Dermal	Ectoparasite		
				Lf	Fresh	Obtain several leaves of *Datura stramonium* when the plant is in bloom or during the period of low rainfall. Grind the leaves and apply the extracted juice onto the affected regions of livestock, dogs, and cattle. Following the application, gently massage a small amount of cooking fat onto the affected areas. Continue this treatment regimen for a duration of three consecutive days until the affected regions are visibly improved.	Dermal	Ringworm		
	Lycopersicon esculentum Mill.	**Timatim (Am)**	H	Lf	Fresh	A concoction of fresh leaves that have been ground and mixed with fresh water is administered to livestock in a quantity equivalent to one tea glass.	Oral	Bloating	HG	AA28
				Lf	Fresh	The leaves were pulverized, combined with a single cup of water, strained, and administered through the nasal passage of the cattle.	Nasal	Leech		
	Nicotiana tabacum L.	**Tinbaho (Am)**	H	Lf	Fresh	The leaf of this particular plant is crushed and combined with water. Afterwards, a half-filled coffee cup of the resulting filtrate is administered nasally in order to eliminate the leech.	Oral	Leech	Wild	AA29

				Lf	Fresh	The plant's leaf is pulverized and combined with water, whereupon a single glass of this mixture is administered to a cow, ox, donkey, and horse, while sheep and goats are given half a glass of the concoction daily for a duration of three days.	Oral	Coughing		
				Lf	Dry	To address the issue with the affected domestic animal, immerse a small quantity of *Nicotiana tabacum* leaves in a four-liter water container and bring it to a boil. Subsequently, incorporate a piece of soap into the solution. Employ this mixture to cleanse or apply as a spray on the infected animal.	Dermal	Ectoparasite		
	Solanum incanum L.	**Hidi (Or)**	H	Fr	Fresh	Extract the juice from a mature, yellow fruit of *Solanum incanum* by gently mashing the flesh, being careful not to break the skin. Then, elevate the animal's head and create a small opening in the fruit. Proceed to squeeze the juice into the nostril of the sheep or cattle. As a result, the animal will begin to sneeze, effectively expelling the larvae.	Nasal	Nasal bot (fl larvae)	Wild	AA30
Zingiberaceae	*Zingiber officinale* Roscoe	**Gamchalech(Mn)**	H	Rz	Fresh	The rhizome should be crushed and blended with rice powder before administering it to the chicken.	Oral	Newcastle ailment	Market	AA31
				Rz	Fresh/Dry	To prepare a solution for livestock, crush a handful of *Psidium guajava* leaves with a fresh piece of *Zingiber officinale* root. Boil the mixture in a liter of water for 15 minutes and add half a teaspoon of salt. Administer one liter of the solution to cattle and half a liter to sheep, goats, and calves.	Oral	Diarrhea		

Key: Habit (Ha) (**T**=Tree, **Sh**=Shrub, **H**=Herb, **Cl**=Climber), **PU**=Parts Used ((**Lf**=Leaf, **Rt**=Root, **Ba**=Bark, **Fr**=Fruit, **Sd**=Seed, **St**=Stem, **Lax**=Latex, **Bub**=Bulb, **Flw**=Flower, **Wp**=Whole part, **Rz**=Rhizome, **Tub**=Tuber). **RoA**=Route of Administration. **Source**=**W**=Wild and **HG**=Home garden. **NUR**=Number of Use Report. **CPU**=Condition of Plants used, **Local Name**: **Or**=Afan Oromo, **Am**=Amharic, **Sh**=Sheko, **Kf**=Kaffnano, **Mn**=Meinit, **Sd**= Sidamo, **Ben**=Bench, **Wol**=Wolyita.

Declarations

List of abbreviations: ANOVA - Analysis of Variance; CSA- Central Statistical Agency of Ethiopia; FL- Fidelity Level; IAS-Invasive Alien Species; ICF- Informant Consensus Factor; IK- Indigenous Knowledge; MTU - Mizan-Tepi University; PPV- Plant Part Value;TMPK- Traditional medicinal plants knowledge; TMPs- Traditional medicinal plants;MPs- Medicinal plants

Ethics approval and consent to participate: Before initiating data collection, we obtained permission letters from the Guraferda District Administration Offices. Informants were verbally asked for their consent prior to conducting interviews and group discussions, and their data was recorded only with their approval. Additionally, consent was secured from the informants for the publication of the individual data gathered from them. Our research adhered to the ethical guidelines established by the Declaration of Mizan Tepi University, which governs studies involving human and animal subjects. The Institutional Review Board of Mizan Tepi University provided approval for the study. We ensured that all participants gave informed consent and followed protocols aimed at safeguarding their rights and welfare throughout the research process. Furthermore, our research protocol underwent review and received approval from an institutional review board to guarantee adherence to ethical standards. Participants were made aware of the study's objectives, anticipated outcomes, benefits, and any potential risks associated with their involvement. Written consent was obtained from each participant prior to the commencement of the interviews. Ethical measures put in place to ensure equitable representation and benefit-sharing with informants and their communities.

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