Ecological insight

ETHNOBOTANICAL STUDY OF MEDICINAL PLANTS IN HORO DISTRICT, HORO GUDURU WOLLEGA ZONE OF OROMIA REGION, ETHIOPIA.

MERERA TESO, MESFIN WOLDEAREGAY
Debre Berhan University, www.dbu.edu.et
mesfinwa@gmail.com

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ABSTRACT

The ethnobotanical study conducted in the Horo district of the Horo Guduru Wollega Zone, Oromia regional state, Ethiopia, aimed to investigate the traditional uses of medicinal plants and document the indigenous knowledge held by the local population. The research spanned from September 2019 to June 2020, involving 70 informants (50 males, 20 females) aged between 20 and 100 years, randomly selected from five kebeles. Ten key informants were purposefully chosen based on local input and background knowledge. Data collection methods included semi-structured interviews, guided field walks, group discussions, and market surveys. The study identified 112 medicinal plant species, distributed across 104 genera and 50 families, with 62.5% collected from the wild and 37.5% from home gardens. The Asteraceae family dominated with 10 species, followed by Solanaceae with nine. Of the identified plants, 71.43% were reported for human ailments, 17.86% for livestock, and 10.71% for both. Leaves (47.61%) and roots (21.43%) were the primary plant parts used for remedies, with crushing (27.94%) as the most common preparation method. Oral administration (61.03%) was the primary mode, followed by dermal application (29.41%). Medicinal plants served various purposes, including food, firewood, charcoal, construction, and forage. Conservation threats included agricultural expansion, overgrazing, firewood collection, charcoal production, and tree cutting for construction and furniture. Despite positive attitudes toward conservation, severe impacts from overharvesting were not evident. The study recommends environmental education to enhance conservation efforts, emphasizing sustainable resource utilization of medicinal plants.

Keywords: Ailments, Ethnobotany, Horo district, Indigenous knowledge, Medicinal plants

Introduction

1.1 Background of the Study

Ethnobotany, as defined by Martin (1995) and Cotton (1996), is the scientific exploration of the intricate relationship between people, plants, and the environments they inhabit. Coined by John Harshberger in 1895, the term "ethnobotany" delineates a specific field within botany, elucidating the varied uses of plants. Indigenous communities across different regions possess distinct knowledge on utilizing, classifying, and conserving plant resources (Cotton, 1996).

Throughout history, diverse cultures have relied on plants for fundamental necessities such as food, shelter, medicines, firewood, and charcoal, demonstrating a profound understanding of plant resources (Cotton, 1996). Ethnobotany extends to the examination of plant knowledge and utilization in both past and present primitive societies (Cotton, 1996). Traditional medicine, rooted in locally available and affordable plants, has been a historical means of combating diseases (Tesfaye Awas and Sebsebe Demissew, 2009).

According to Zemede Asfaw (2001), conserving medicinal plants through gene banks, botanical gardens, and home gardens is crucial. Ethiopia, endowed with rich biodiversity, has grappled with diseases through herbal remedies and religious beliefs (Dawit Abebe and Ahadu Ayehu, 1993).

Despite the acknowledged wealth of plant resources in Horo District, similar to other areas in Ethiopia, a lack of conservation initiatives prevails. The current trend reveals environmental challenges, resource depletion, and the erosion of indigenous knowledge. Ethnobotanical research becomes pivotal in gathering information on plant usage and indigenous knowledge for conservation and sustainable utilization.

Since the 15th century, Ethiopians have employed medicinal plants for treating various diseases (Tilahun Teklehymanot, 2009). Traditional medicines, constituting 80% of therapeutic sources for almost 80% of the population, with 95% being plant-based, play a significant role in addressing health issues (Dawit Abebe, 2001).

Ethnobotanical studies are essential for establishing direct contact with authentic information on plant uses, both wild and cultivated. In Ethiopia, with its diverse flora and fauna, traditional medicinal plants are widely used, particularly in low-income rural areas. However, indigenous knowledge is waning due to modern lifestyles, echoing global trends (Zemede Asfaw, 2001). Many developing countries lack comprehensive studies on medicinal plants, and in Ethiopia, the decline in knowledge transmission is evident as oral traditions diminish (Dawit Abebe, 2001; Giday Yirga, 2010).

The transfer of knowledge on plant use for medicine relies on oral traditions, susceptible to loss or alteration. Ethnobotanical research becomes crucial in capturing and preserving this knowledge system, given that plants serve as potential sources for the discovery of novel drugs (Wright, 2005). In Horo District, such research is imperative to document indigenous knowledge, recording the plant biodiversity vital for community-based traditional medicine.

Objectives

To investigate the use of medicinal plants used by local people of Horo district as remedy for various human and livestock ailments.

Method

2.1 Description of the Study Area and Location

The study took place in Horo District, situated in the Horo Guduru Wollega Zone of the Oromia regional state, approximately 314 km northwest of Addis Ababa. The district shares borders with Abay Commen district to the east, Horo Buluk to the north, Jimmaa Genati to the south, and Abe Dongoro district to the west. Horo District is geographically divided into three agroecological zones: Dega (49.8%, 7 kebeles), Wainadega (48.96%, 3 kebeles), and Kola (1.24%, 1 kebele), as per the Agricultural and Rural Development report of 2018 (ARD, 2018).

2.2 Population

As of 2019, data from the District Agricultural and Rural Development office indicates a total population of 47,866 in Horo District, comprising 23,454 males and 24,412 females. The predominant livelihood in the study area is based on mixed cultivation, combining livestock rearing and crop production.

2.3 Climate: Temperature and Rainfall

Temperature and rainfall data spanning from 2004 to 2019 were sourced from the Ethiopian National Meteorological Service Agency (EMSA, 2019). The town of Horo is located in Shambu, at coordinates 9.034° N latitude and 37.006° E longitude, with an altitude of 2430 meters above sea level. The rainfall pattern in the study area is unimodal, characterized by a prolonged wet season from June to the end of September (Big Rain), and short dry spell showers from mid-February to April. A lengthy dry period extends from October to the end of February (H.D.R.D.O., 2019).

Over the 15-year period (2004-2019), the mean annual rainfall in the study area was approximately 896mm, with the peak rainfall occurring between May and October. Rainfall decreases in November, with minimal or no precipitation from January to February. The maximum temperature ranges around 13°C, with the hottest months from February to May recording a maximum temperature of about 23.8°C. The coldest months, experiencing a mean minimum temperature of 3.4°C, span from July to December.

According to altitude-based classifications, Horo District encompasses three agroclimatic zones: temperate (Dega) at 2300-3300m, sub-tropical (Woinadega) at 1500-2300m, and tropical (Kolla) at 500-1500m, aligning with the traditional classification system reported by the Horo District Agricultural Office (2019).

2. 4. Livestock population of the study area

Table 1. Livestock population of the study area

No.	Livestock type	Unit	Total
1.	Ox	Number	33, 896
2.	Cow	>>	44, 372
3.	Goat	>>	16, 114
4.	Sheep	>>	21, 453
5.	Donkey	>>	6159
6.	Mule	>>	1176
7.	Horse	>>	12, 050
8.	Poultry	>>	28, 554

*Source: Horo District ARD office (2019)

2. 5. Land use and Agriculture

The district has a total area of 35, 580. 94 ha of which 80% is under cultivation for growing both annual and perennial crops, while 20% of the total land area is occupied by forest and grassland. In addition, it has all weather roads, which connect few kebeles with neighbouring districts. In the District and its neighbouring districts, the forest coverage is large.

Table 2. Land allocation of the study area

No	Land type	Unit	Amount
1	Cultivated land	hectare	22, 123
2	Grazing land	>>	3312
3	Area enclosure	>>	3, 237. 10
4	Forest	>>	2, 325. 5
5	Others	>>	9324
	Total	>>	40, 321. 6

*Source- Horo district ARD office (2019).

2. 6. Major food crops grown in the study area

Horro district has an ideal agro-ecology for agriculture such as crop production, livestock rearing and cultivating different annual and perennial plants. The major food crops grown in the area are given in Table 3.

Table 3. Major food crops grown in the study area

Crop category	Scientific name	English name	Local name
Cereals	*Zea maize*	Maize	Boqqolloo
	Eragrostis tef	Tef	Boqqolloo
	Hordeum vulare	Barely	Garbu
	Triticum aestivum	Wheat	Qamadii
	Sorghum bicolor	Sorhum	Boobee
Vegetables	*Capsicum frutescns*	Chili	Barbaree
	Allium cepa	Shallot	Qulluubbii
	Lycopersicon esculentum	Tomato	Timmaatima
	Cucurbita pepo	Pumpkin	Buqqee nyaataa
	Allium sativium	Garlic	Qulluubbiiadii
	Brassica oleracea	Cabbage	Raafuu
Fruits	*Citrus sinensis*	Orange	Burtukaana
	Citrus limon	Lemon	Loomii
	Musca x paradisiaca	Banana	Muuzii
	Manifera indica	Mango	Maangoo
Pulses	*Pisum sativum*	Peas	Atara
	Visa faba	Beans	Baaqelaa
Cash crops	*Coffee Arabica*	Coffee	Buna
	Saccharum officinarum	Sugarecane	Shonkoraa
	Catha edulis	Khat	Caatii
Oil crops	*Guizotia abysinica*	Niger seed	Nuugii
	Linum usitatissimum	Lin seed	Talbaa
	Brassica napus	Kale seed	Sanyii raafuu

2.7 Vegetation of the Study Area

The natural vegetation in the study area is broadly categorized as dry evergreen montane forest and Acacia woodland, a type found in South West Ethiopia, specifically in Wolega, Ilubabor, and Kefa (Zerihun Woldu, 1999). The vegetation includes Acacia, Olea, Juniperus, gallery forest, shrubs, and a limited community forest within the district. The livelihood zone is characterized by sparse vegetation, with remnants of large old trees on the hills and bushy vegetation further down the slope.

2.8 Materials

The essential materials utilized for this study encompassed a global positioning system (GPS), digital camera, rolling meter, plant press, plant cutter, and stationary materials.

2.8.1 Methods

2.8.2 Site Selection

Out of the eleven kebeles in the district, five kebeles were chosen for ethnobotanical data collection based on accessibility and the presence of traditional medicinal practitioners. The selected kebeles are Abedulacha, Burkitu obora, Gitilodale, Lotiano, and Geber ugum.

2.8.3 Informant Selection

Informant selection followed the methodology outlined by Martin (1995). A total of 70 informants, including 50 males and 20 females, were selected. Approximately 60 individuals were randomly chosen, while the remaining 10 were key informants identified through purposive sampling based on local input, kebele administration leaders, and the researcher's background knowledge of the study area.

2.9 Ethnobotanical Data Collection

- **Semistructured Interviews:** Administered following the guidelines of Martin (1995) and Cotton (1996), ensuring a checklist of topics for discussion. The interviews covered local plant names, uses in treating diseases, parts used, methods of preparation, and threats to medicinal plants.
- **Field Observation:** Conducted on study sites, including a market survey, with the aid of local guides and interpreters. Noteworthy points on community culture, market value, and cultivation practices of medicinal plants were recorded.
- **Group Discussion:** Undertaken in Abedulacha and Lotiano study kebeles with approximately 10 community members in each group, including a traditional healer. Ethnomedicinal knowledge was gathered from residents and knowledgeable community members during these discussions.
- **Guided Field Walk:** Traditional medicinal practitioners accompanied the researcher to locations where medicinal plants grew. They provided local names and explained ethnobotaical knowledge of the plant species, which were then collected with detailed information.
- **Market Survey:** Conducted to identify herbal drugs sold in the market, observe the multipurpose role of some medicinal plants, and interview herbal drug sellers and other vendors.

2.10 Data Analysis

Ethnobotanical data were analyzed using basic analytical tools following Martin (1995) and descriptive statistical methods such as frequency and percentage. Additional data analysis techniques included:

2.10.1 Paired Comparison

Five medicinal plants with the highest informant consensus, previously identified for treating toothache, were selected. Ten key informants were presented with pairs, randomized based on Martin's method, and asked to rank them from the best to the least effective for toothache treatment.

2.10.2 Preference Ranking

Ten key informants were presented with five important medicinal plants used to treat wounds, and they were asked to rank them based on personal preference. The plants were scored from five (most preferred) to one (least preferred), and the total scores were used to rank the plants in terms of effectiveness for wound treatment within the community.

2. 10. 3. Direct matrix ranking

Direct matrix ranking was used to compere multipurpose use of a given species. Direct matrix ranking was done following Martin (1995) to compare plant species for their multi purpose use.

Five plants which were used highly for many purposes by the community members were selected based on the information obtaind from the informants and six attributes whichincluded medicin, firewood, charcoal, construction, edible and food were listed and the species were provided to 10 key informants to give value according to the use of the species for the particular attribute list ed above and then the scores which were given to each attribute were added, and ranked so as to compare use values of the reported plant species.

2. 11. Informant Consensus Factor (ICF)

ICF was calculated for each category to identify the agreement of the informants on reported cures for the group of ailments. The ICF were calculated following Heinrich *et al.*, *(*1998).

$$\text{ICF} = \frac{nur - nt}{nur - 1}$$

Where,

ICF = informants consensus factor

nur = number of use citation in each category

nt= number of species use

2. 12. The Fidelity Level

The fidelity level (FL), the percentage of informants claiming the use of a certain plant for the same major purpose, was calculated for the most frequently reported disease or ailments using the following equation.

FL (%) = $\frac{NP}{N} \times 100$

Where NP is the number of informants that claim the use of a plants species to treat a particular disease, and N is the number of informants that use the plants as a medicine to treat any given disease.

Result

3. 1 General Information of Informants

3. 1. 1. Sex and Age of informants

Fifty (71%) male and twenty female informants (29%) were involved in this study. The ages of informants included in the study shows that the highest number was 27 ranging 40-49 (38. 57%) followed by 21 ranging from 50-59 (30%) (Table 4). Males accounted for the highest number which was 50 (70%) and females were 20 (30%).

Table 4. Sex and age of the informants

NO	Age range	Sex and number			
		Male	Female	Total	%
1	20-29	1	1	2	2. 86%
2	30-39	3	3	6	8. 57%
3	40-49	20	7	27	38. 57%
4	50-59	15	6	21	30%
5	60-69	7	2	9	12. 86%
6	70-79	1	1	2	2. 86%
7	80-89	1	-	1	1. 42%
8	90-100	2	-	2	2. 86%
	Total	50	20	70	100%

3. 1. 2. Religion and educational status of informants

Among 70 informants, the highest numbers (36) of them were Protestants followed by orthodox (31) and Muslims 3.

Table 5. Religion of the informants

Reliogin	Number of informants	Percentage
Muslim	3	4. 3%
Orthodox	31	44. 3%
Protestant	36	51. 4%
Total	70	100%

Concerning educational status, majority of informants were completed elementary level courses and twenty four informants were illiterate and seven informants attended up to high school level (Table 6).

Table 6. Educational status of informants

Educational status	Number of informants	Percentage
Illiterate	24	34. 3%
Elementary	38	54. 3%
High school	7	10%
College	1	1. 4%
Total	70	100%

3.2 Indigenous Knowledge of Local People

3.2.1 Indigenous Knowledge on Vegetation Classification

In the study area, residents classify vegetation based on the density of plant species covering the land. The classifications include:

- **Marshy Vegetation (Caffee):** This type features plant species primarily from the Poaceae and Cyperaceae families, such as Cynodon doctylon, Cynoglossum lanceolatum, and Oxalis corniculata. These areas are unsuitable for plowing but serve as suitable grazing grounds.
- **Riverine Forest (Luugoo Lagaa) and Waterfall Forest:** Found along riverbanks, this type includes plant species like Syzygium guineense subsp. guineense and Ficus sycomorus.
- **Forest Type (Bosona):** Densely populated with various plant species, including larger plants, this type is a habitat for larger wild animals. For instance, the Garchi Forest in Abedullacha kebele contains species like Acacia abyssinica, Croton macrostachyus, Albizia gumifera, Lippia adoensis, Prunus africana, and others.
- **Grass (Marga):** Grasslands predominantly used for livestock and wild animal grazing. These areas are dominated by grasses (Poaceae), with the presence of sedges (Cyperaceae), rushes (Juncaceae), and variable proportions of legumes like clover and other herbs. Cynodon doctylon and herbaceous plants are common in these areas.

3.2.2 Agroecology and Landform Classification by Indigenous People

Local residents classify the agroecology of the area into three categories based on altitude, climate, and landform into six categories based on altitude (refer to Table 7 and 8 for details).

Table 7. Agroecology of the study area

Agro ecology classification	Meaning of category	Corresponding etic category	Where in the study it found
Baddaa	Area greater than 2500m asl	Highland	Gitilo dale and burkitu obora
Badadare	Areas in b/n1500-2500 masl	Middle land	Abedulacha and Burkitu obora
Gammoojjii	Areas less than 1500 m asl	Low land	Part of Loti ano

Table 8. Land form of the study area

Land form classification	Meaning of category	Corresponding etic category	Where in the study area it is found
Gaara	An area higher than hill	Mountain	Gitilodale, Abedulacha
Tulluu	Area less in height mountain	Hill	Burkituobora
Tabba	Flat Area found at the top of the hills.	Plateau	Jagano in loti ano
lafa diriiraa	More or less straight	Plain	Bakal found in Gitilo Dale
Suluula	An area relatively lower than the surroundings and surrounded by steep slopes.	Valley	Valley of Garchi found in Abedulacha kebele.
Dhooqa	Very low depression with highest temperature.	Very low depression	Few places in Abedulacha

3.2.3 Soil Classification in the Study Area

Indigenous people in the study area classify soils based on color, texture, and suitability for cropping. The local people identify the following soil types:

- **Clay Soil (Biyyoo Diimillee):** Named for its red color and poor fertility, crops like Ipomoea batatas, Capsicum frutescens, and Cucurbita pepo are cultivated in this type of soil.
- **Black Soil (Biyyoo Kootichaa):** Recognized for its color and higher fertility compared to other soil types, it supports the growth of crops such as Pisum sativum, Vicia faba, Allium cepa, Zea mays, Eragrostis tef, Phaseolus vulgaris, and Linum usitatissimum.
- **Sandy Soil (Biyyoo Cirrachaa):** Formed by erosion and deposition, this type of soil is characterized by fine sand with silt and is suitable for specific crops.
- **Mixed Soil (Biyyoo Waliinii):** Characterized by a combination of clay, black, and sandy soils.
- **Loam Soil (Biyyoo Kosii):** Enriched with organic materials from household waste and animal excreta, this soil is suitable for vegetables such as Allium cepa, Brassica oleracea, Nicotiana tabacum, Cucurbita pepo, Solanum tuberosum, Brassica carinata, and Allium sativum.

3.2.4 Classification of Plant Habit by Indigenous People

Based on growth habit, the indigenous people of the district categorize plants into three groups:

- **Trees (Mukkeen):** Large and tall plants.
- **Shrubs (Miciree):** Medium-sized, woody plants taller than herbs and shorter than trees.
- **Herbs (Dagala):** Smallest in size, herbs have soft, green, delicate stems without woody tissues (refer to Table 9).

Table 9. Classification of plant habit

Plant habit	Meaning of category	Corresponding Etic category	Where in the study area it is found
Mukkeen	They have very thick, woody and hard stem	Trees	Found in all study kebeles
Miccireen	Their features include bushy, hard and woody stems with many branchs.	Shrubs	Found in all study kebeles
Dagala	a short sized plant with soft green, delicate stem without the woody tissues.	Herbs	The same with the above.

3. 2. 5. Seasonal classification

Indigenous people classify seasons in to Four main categories based on amount of rain (Table 10).

Table 10. Seasonal classification of the study area

Emic category	Etic category
Birraa	Spring
Bona	Summer

Arfaasaa	Autumn
Gannaa	Winter

3. 3. Medicinal plants obtained and their sources

From the wild

The results showed that most of medicinal plants 70 (62. 5%) were collected from the wild Like *Accacia abysinica, Prunus africana, Podocarpus falcutus, Girewia fernifolia, and Croton macrostachyus*.

From Homegardens

The results of the study indicates that some medicinal plants 42 (37. 5%) were collected in Homegardens like *Capsicum annum, Ruta chalepensis, Coriandrum sativum, Ocimum lamiifolium, Musa paradisiaca, Flacourtia indica.*

3. 4 Distribution of the medicinal plants among the plant Families.

One handred twelve plant species were by local people of the district to treat various human and livestock ailments. These medicinal plants were distributed across 104 Genera and 56 families (Appendix 3). The most popular family was Asteraceae which contributed for 10 (8. 93%) species followed by Solonaceae with 9 species (8. 93%) species (Table 11).

Table 11. Distribution of the medicinal plants among the plant families

Family	Number of species	Percentage of species
Asteraceae	10	8. 93
Solonaceae	9	8. 04
Poaceae	8	7. 14
Fabaceae	7	6. 25
Cucurbitaceae	3	2. 68
Euphorbaceae	3	2. 68

Rutacieae	3	2. 68
Others	69	61. 60
Totals	112	100

3. 4. 1. Growth forms (habit) of medicinal plants

The study showed that herbs were constituted the highest species representation by 52 species (46. 43%), followed by trees 28 species (25%) and the least lianas with 2 species (1. 79%).

3. 4. 2. Plant parts used to treat human and Livestock ailments

People of the study area harvest different plant parts for preparation of plant remedies, for e. g., from leaves, roots, seeds, barks, and fruit. In the study area the highest number of plant remedies were prepared from leaves (60 species, 47. 61%) followed by roots 27 species (21. 43%), seeds (8. 73%), flowers (7%), fruits(6%), barks (5%) and others were (4. 23%).

3. 4. 3. Medicinal plants used to treat human, livestock and both human and livestock ailments

Among the collected 112 medicinal plants, 80 species (71. 43%) were used to treat human diseases, 20 species (17. 86%) to treat livestock ailments and 12 species (10. 71%) to treat both human and livestock ailments (Table 12).

Table 12 Medicinal plants used for treating human, livestock and both human & livestock ailments

Category	Number of plants	Percentage
Human	80	71. 43
Livestock	20	17. 86
Both	12	10. 71
Total	112	100

3. 4. 4. Mode of preparation and Route of administration

The study showed that the highest mode of preparation was crushing 38 (27. 94%), followed by powdering 36 (26. 47%) and chewing 20 (14. 71%) while the most widely used route of administration was oral accouted for 83 (61. 03%) followed by dermal 40 (29. 41%) (Table 13).

Table 13 Mode of preparation and Route of administration

Methods of preparation	No of preparation	Percentage	Route of administration	No	Percentage
Crushing	38	27. 94	Oral	83	61. 03
Powdering	36	26. 47	Dermal	40	29. 41
Chewing	20	14. 71	Others	13	9. 56
Concoction	10	7. 35	-	-	-
Decoction	3	2. 21	-	-	-
Others	29	21. 32	-	-	-

3.4.5 Conditions of Preparation of Remedies

In the study area, local people prepare remedies for treating ailments in various forms, including fresh, dried, or a combination of both. The majority of medicinal plants, 102 (75%), were reported to be used in their fresh form, while 18.38% were used in dry form. A smaller percentage, 6.62%, were reported to be used either in dry or fresh form.

3.4.5 Dosage of Traditional Medicine

Dosages of plant remedies varied among traditional healers, posing a challenge as per Sofowara (1982) and Dawit Abebe (1986). Local people in the study area employed various measurements such as the local unit 'Meleke,' coffee cups, spoons, glasses, and bottles.

Most medicinal plant preparations encountered in the study area were derived from a single plant or plant part. Some involved pounding in a pestle with a mortar to extract juice, while others chewed and administered it to patients. Additives like honey, salt, sugar, and milk were used to enhance flavor.

The dosage of medicine was adjusted based on the patient's age. Adolescents received a full cup of medicine, whereas children were given half a cup. The inclusion of such details in the administration of traditional medicine reflects the nuanced approach taken by local healers in the study area.

3. 5. Ranking and Scoring of medicinal plants

3. 5. 1. Preference ranking

In the study area, wound infection was reported to be the most common disease. Five medicinal plants were reported as effective to treat wound infection. Ten traditional healers (key informants) ranked these five plant taxa based on their perception of the degree of effctiveness Accordingly, *Prunus africana* was rated the most effective in treating wound and followed by *Ekebergia capensis* and *Pavonia urens* (Table 14).

Table 14 Preferance ranking of medicinal plants used to treat wound in the study area

	Respondents ($R_1 – R_{10}$)											
List of medicinal Plants	**R_1**	**R_2**	**R_3**	**R_4**	**R_5**	**R_6**	**R_7**	**R_8**	**R_9**	**R_{10}**	**Total**	**R**
Ekebergia capences	5	4	4	3	3	2	3	3	5	3	35	2
Prunus africana	5	3	5	4	5	4	4	3	3	3	39	1
Guizotia abyssinica	3	2	2	3	2	2	3	4	1	2	24	4
Justicia schimperiana	2	2	3	1	2	3	4	1	1	1	20	5
Pavonia urens	5	4	3	3	3	2	3	4	3	3	33	3

3. 5. 2. Paired comparison ranking

For medicinal plants that were identified by the informants to be used in treating toothache. A paired comparision was made among seven medicinal plants. Eight informants participated in this activity. Accordingiy, *Olia rochitiana* stood first followed by *Preminia schimperi*, and *Clutia abyssinica* Table 15).

Name of species	**R_1**	**R_2**	**R_3**	**R_4**	**R_5**	**R_6**	**R_7**	**R_8**	Total	Rank
Clutia abyssinica	4	3	3	3	4	4	5	4	30	3
Ehretia cymosa	4	2	4	2	2	3	3	4	24	5
Olinia rochetiana	4	5	5	3	5	4	6	5	37	1
Juniperus procera	1	2	1	1	0	1	1	1	8	7
Premina schimperi	4	3	4	5	3	4	4	5	32	2
Datura strumanium	5	4	3	3	4	3	2	4	28	4
Albizia gummifera	2	0	1	1	1	2	1	1	9	6

Table 15 Paired comparison of medicinal plants used to treat toothache

3.5.3 Direct Matrix Ranking

In the study area, numerous medicinal plants were found to serve purposes beyond their medicinal value. Key informants, a total of five, were engaged in the direct matrix ranking activity. Eucalyptus globulus emerged as the top multipurpose species, followed by Prunus africana and Cordia africana (refer to Table 16).

Table 16. Direct matrix ranking of medicinal plants with different uses, average scorce of 5 key informants.

Name of species	Use categories						Total	Rank
	Medic Ine	Fire wood	Char Coal	Construc tion	Food	Fence		
Croton	4	4	4	3	0	1	16	5
Accacia abyssinica	3	4	5	3	0	2	17	4
Eucalyptus globulus	3	5	5	4	0	4	21	1
Prunus africana	4	4	4	4	0	3	19	2
Cordia africana	3	3	3	5	0	4	18	3

3. 5. 4 Informant consensus

Of 112 reported medicinal plants in the study area, not all were equally important. From the application of informant consensus analysis some medicinal plants were more popular than others. Accordingly *Allium sativium* was cited by 22 informants followed by *Croton macrostachyus* 21 informants (Table 17).

Table 17 Informant consenses of medicinal plants in the study area

Scientific name	No of informants cited	Rank
Calpuria aurea	20	3
Croton macrostachyus	21	2
Ekebergia capensis	16	6
Brucea antidysentrica	18	5
Nicotinia tabacum	10	10
Prunus africana	19	4
Girardinia bullosa	16	6
Allium sativium	22	1
Vernonia amaygdalina	14	8
Ocimum urticifolium	12	9

3. 5. 5. Informant Consensus Factor

The result of the study showed that, diseases that are frequent in the study area have higher informant consensus factor. Medicinal plants that are effective in treating certain disease and well known by community members also have high ICF. Accordingly, plant used against wound and bleeding had high ICF scoring (71%) followed by plants used against fibril illness and evil eye (70%) (Table 18).

Table 18 Informant consenses Factor

Disease categories	No of species	No of use citation	ICF	Rank
Wound and bleeding	10	32	0. 71	1
Fibril illness and evil eye	7	21	0. 70	2
Common cold and Cough	9	20	0. 58	5
Stomach ache and Gastrities	12	36	0. 68	3
Cattle ailments (Black leg, Anthrax, Leech)	5	14	0. 64	4
Tooth ache	16	24	0. 35	7
Rabies	10	16	0. 40	6

3. 5. 6 Fidelity level

Fidelity level (FL) quantifies the importance of a species for a given purpose. Hence, fidelity level values were calculated for community used individual medicinal plants against the following ailments; *Clausena anista* (againist Toothache), *Vernonia hymenolypsis* (againist Gonorroea), *Phytolecca dodecandra* (againist Rabbies) *Eucalyptus globulus* (against Headache), *Rumex nepalensis* (against Black leg), *Nicotinia tabacum* (against Leech), *Pavonia urens* (against wound), *Hygenia abyssinica* (against tapeworm), *Justicia schimpearian* (against snake bite) and *Bruceae antidyssintrica* (against diarrhoea) the fact that these medicinal plants had the highest Fidelity Level values which could be an indication of their good healing potential (Table 19).

Table 19 Relative healing potencial of individual plants used against human and livestock ailments

No	Medicinal plants	Examples of ailment treated	Np	N	FL	FL%	Rank
1	*Phytoleca dodecandra*	Rabbies	54	54	1	100	1
2	*Nicotina tabacum*	Leech	50	52	0. 96	96	2

Discussion

5.1.1 Medicinal Plants Used to Treat Human and Livestock Ailments in the Study Area

A total of 112 medicinal plants were documented in the study area, reflecting the rich indigenous knowledge of local people regarding the diverse applications of these plants. Among these, 80 species were reported for treating human diseases, 20 for livestock ailments, and 12 for both. The prioritization of medicinal plants for human health over livestock aligns with the local preference for addressing personal health concerns first. This pattern has been observed elsewhere, emphasizing the need for enhanced knowledge on medicinal plants for livestock ailments. Similar findings have been reported by Seyoum Getaneh (2009).

In terms of plant families, Fabaceae led with 10 species (8.93%), followed by Solanaceae with 9 species (8.04%). This aligns with comparable studies in Ethiopia, indicating the prominence of Fabaceae in medicinal plant usage (Mirutse Giday and Gobena Ameni, 2003; Kebu Belami et al., 2004; Amenu Amenu, 2007).

Local healers predominantly prepare remedies from single plants or plant parts, deviating from the use of multiple components for a single health problem, as reported by Dawit Abebe (1986) and Kebu Belemie et al. (2004). However, the observed trend in this study suggests that healers often combine multiple plants or plant parts to enhance the strength and efficacy of the remedy. For instance, the treatment of rabies involves a mixture of bark, leaves, and roots from different plants. Various additives such as soil, ash, honey, salt, sugar, local areke, milk, and butter are incorporated to improve flavor and acceptability, reducing the perceived sourness associated with traditional medicine.

The collection of a significant number of medicinal plants from the wild (68.85%) compared to home gardens (25.41%) indicates a heavy reliance on natural habitats. This trend is consistent with studies conducted in Ethiopia and globally, emphasizing the importance of wild resources in traditional medicine (Itana Tolasa, 2007; Ermias Lulekal et al., 2008; Ugulu et al., 2009).

5.1.2 Habit and Part of the Medicinal Plant Used for the Preparation of Remedies

In the study area, traditional medicinal plants have been utilized for an extended period. The preference for specific plant growth forms is influenced by their distribution, leading to the predominant use of herbs (46.43%) and trees (25%) for medicinal purposes. This observation aligns with similar studies in Ethiopia (Bayafer Tamene, 2000; Mirutse Giday and Gobena Amen, 2003; Tesfaye Awas and Sebsebe Demissew, 2009).

Regarding plant parts, leaves were highly utilized for the preparation of remedies (47.61%), followed by roots (21.43%). This pattern resonates with findings from Mirutse Giday et al. (2003) and Fisseha Mesfin (2007), highlighting the significance of leaves in traditional medicinal practices.

5.1.3 Preparation Methods, Routes of Administration, and Dosage of Medicinal Plants

The preparation methods for medicinal remedies varied, with fresh forms being the most common (75%), followed by dry forms (18.38%). However, some professional traditional healers preferred selling and storing dried plant medicines, indicating diversity in preparation approaches. This finding aligns with Kebu Belamie et al. (2004). End products of traditional medicinal remedies included powdering, crushing, decoction, and concoction forms. The administration of remedies predominantly occurred orally (61.03%) and dermally (29.41%), consistent with other studies in Ethiopia (Dawit Abebe and Ahadu Ayehu, 1993; Tilahun Teklehaimanot and Mirutse Giday, 2007).

The absence of standardized measurements for dosage poses a challenge to the recognition of traditional healthcare systems. Lack of precision and standardization, as indicated by Sofowara (1982) and Dawit Abebe (1986), is a drawback in traditional medicine. Common measurements, such as coffee cups, small areke glasses, digits of a finger, teaspoons, glasses, and palm-of-hand measures, were reported, with consideration given to age, sex, and the stage of illness. While variations in dosage were acknowledged during group discussions, the consensus emphasized the potential negative impacts of overdosing or underdosing, leading to health complications or ineffectiveness in treating the disease.

5.1.4 Threats to Medicinal Plants in the Study Area

Numerous threats to medicinal plants in the study area parallel those affecting plant diversity in general. Habitat loss and degradation, including factors like agricultural expansion, fire, construction, overgrazing, and urbanization, pose serious threats. Overharvesting of known medicinal plants also contributes to the risks. The findings align with studies reporting overgrazing as a principal threat in certain areas (Kebu Belami et al., 2004) and intense deforestation as a major threat in others (Mirutse Giday, 2001).

Human-made factors, such as habitat destruction for supplementary income generation, were identified as major threats. The degree and type of threats varied across locations and species, with firewood collectors, timber and charcoal sellers posing risks to specific medicinal plants near the town of Horo. In contrast, agricultural expansion was identified as a significant threat to

medicinal plants in kebeles with higher population density, such as Abedullacha, Gitilo dale, Lotiano, Burkitu obora, and Gabarugum. These findings emphasize the need for targeted conservation efforts considering the localized nature of threats.

5.1.5 Ranking and Scoring of Medicinal Plants

Various ranking methods, including paired comparison, preference ranking, and direct matrix ranking, were employed to assess the importance of medicinal plants. Results indicated a hierarchy of preference among local people, showcasing their ability to differentiate the effectiveness of medicinal plants. Eucalyptus globulus emerged as the most preferred medicinal plant due to its highest multipurpose uses, followed by Prunus africana. The ranking reflects the experiential knowledge of the local community in identifying and prioritizing medicinal plants based on their efficacy for treating specific ailments.

Conclusions

The study highlights the significant indigenous knowledge accumulated by the people in the study area, showcasing a rich tradition of using traditional medicine derived from plants. Despite the establishment of modern health centers in most parts of the district, the community still heavily relies on traditional medicine. Certain diseases, such as fibril illness, evil spirit afflictions, toothache, spider poison, jaundice, hepatitis, stomachache, hemorrhoids, headaches, wounds, malaria, common colds, and even livestock ailments like leech, ectoparasites, trips, stomachache, and wounds, are predominantly treated using plant remedies.

The preference for using traditional medicine is attributed to its perceived effectiveness, particularly in treating ailments like evil spirit afflictions, hepatitis, and spider poison. The study indicates that people often prepare remedies from leaves, minimizing the pressure on medicinal plants compared to using roots or whole plants. However, a substantial number of medicinal plants are still collected from the wild, emphasizing a need for conservation efforts, as local healers turn to wild areas when the demand arises.

The knowledge of medicinal plants varies across age and gender groups. Elders, particularly those aged 40-59, hold a significant amount of knowledge, with males generally able to mention more medicinal plants than females, especially those found in the wild. Female knowledge tends to be more limited to medicinal plants cultivated in home gardens.

The distribution of medicinal plants reveals that 70 plant species are sourced from wild vegetation, while 42 species come from home gardens and farmlands. The 112 medicinal plants belong to 50 plant families, with Asteraceae, Solanaceae, and Poaceae being the most prominent. Leaves, roots, seeds, flowers, fruits, barks, and other plant parts are commonly utilized in preparing remedies.

The study identifies various modes of remedy preparation, including pounding, crushing, powdering, and chewing. Oral administration is the most prevalent route of application, followed by dermal administration. The main threats to medicinal plants in the area include agricultural expansion, firewood collection, charcoal production, overgrazing, and overharvesting. These findings emphasize the importance of conservation strategies to safeguard the wealth of indigenous knowledge and preserve the diverse plant species integral to traditional medicine in the study area.

Reference

Abebe Demissie (2001). "Biodiversity Conservation of Medicinal Plants: Problems and Prospects." In: Conservation and Sustainable Use of Medicinal Plants in Ethiopia, Proceedings of the National Workshop on Biodiversity and Sustainable Use of Medicinal Plants in Ethiopia, 28 April - 01 May 1998, pp. 56-64. (Mendhin Zewdu and Abebe Demissie, eds.) IBCR, Addis Ababa.

Abbink, J. (1993). "Me'en Ritual, Medicinal, and Other Plants: A Contribution to Southwest Ethiopia Ethnobotany." Journal of Ethiopian Studies, 26(2), 1-21.

Andy, C. (1999). "Methods on the Above: A Review of Veterinary Uses of Participatory Approaches and Methods, Focusing on Experiences in Dry Land Africa." London, 97pp.

Alcorn, B. J. (1984). "Huastec Mayan Ethnobotany." University of Texas Press, Austin, USA.

Alternative for Livestock Development. Proceedings of an International Conference Held in Pune.

Amare Dassalegn (1970). "Some Common Medicinal and Poisonous Plants Used in Ethiopia Folk Medicine." Addis Ababa University, Addis Ababa, pp. 3-63.

Asfaw Debela, Dawit Abebe, and Kelbessa Urga (1999). "An Overview of Traditional Medicine in Ethiopia: Prospective and Development Efforts." In (Tamirat Ejigu, ed.) Ethiopian Pharmaceutical Association Silver Jubilee Anniversary, Special Issue. pp. 45-53. Ethiopian Pharmaceutical Association, Addis Ababa, Ethiopia.

Balcha Abera. (2014), "Medicinal Plants Used in Traditional Medicine by Oromo People, Ghimbi District, Southwest Ethiopia." Journal of Ethnobiology and Ethnomedicine, 10(40).

Balick, M. J. (1996). "Plants, People, and Culture: Science of Ethnobotany." Scientific American Library, New York.

Cotton, C. M. (1996). "Ethnobotany: Principles and Applications." John Wiley and Sons, Manchester, England, pp. 347.

Cunningham, A. B. (1993). "African Medicinal Plants: Setting Priorities at the Interface of Healthcare between Conservation and Primary Health Care." UNESCO Paris, pp. 1-50.

Cunningham, A. B. (1996). "People, Park, and Plants: Use Recommendations for Multiple Use Zones and Development Alternatives around Bwindi Impenetrable National Park, Uganda." In: People and Plants Working Paper 4, pp. 18-25 (Sample, A., ed). UNESCO, Paris.

Dati Abebe (2001). "The Role of Medicinal Plants in Healthcare Coverage of Ethiopia: The Possible Benefits of Integration." In Proceedings of the Workshop on Biodiversity

Conservation and Sustainable Use of Medicinal Plants in Ethiopia, Medhin Zewdu, Abebe Demmissies (eds). Institute of Ethiopia, 28 April – May 2001, pp. 6-21.

Dawalt, B. R. (1994). "Using Indigenous Knowledge to Improve Natural Resource Management." Human Organization, 53(2), 113-132.

Dawit Abebe and Ahadu Ayehi (1993). "Medicinal Plants and Enigmatic Health Practices of Northern Ethiopia." B.S.P.S. August 1993.

Dawit Abebe (1986). "Traditional Medicine in Ethiopia: The Attempts Being Made to Promote It for Effective and Better Utilization." SINET: Ethiopia. J. Sci. (Sup.), 62–69.

Debela Hunde, Zemede Asfaw, and Ensermu Kelbesa (2004). "Use and Management of Ethnoveterinary Medicinal Plants of Indigenous People in 'Boosat' Welenchiti Area." Ethop. J. Biol. Sci., 3(2), 113–132.

Endalew Amenu (2007). "Ethnobotanical Study of Medicinal Plants in West Shoa Zone of Oromia Region, Ethiopia." MSc. Thesis, Addis Ababa University, Ethiopia.

Endashaw Bekele (2007). "Study on the Actual Situation of Medicinal Plants in Ethiopia." Prepared for JAKRF (Japan Association for International Collaboration of Agriculture and Forestry), pp. 70-74.

Ensermu Kelbessa, Sebsebe Demissew (1992). "Some Threatened Endemic Plants of Ethiopia." In: The Status of Some Plants in Parts of Tropical Africa. (Edwards, S. and Zemede Asfaw, eds) Botany 200: NAPRECA, Monograph Series, No. 2, 35–55. Addis Ababa University, Ethiopia.

Emery, A. R. (1996). "The Participation of Indigenous Peoples and Their Knowledge in Environmental Assessment and Development Planning (Draft)." Centre for Traditional Knowledge, Ottawa, Canada.

EFAP (Ethiopia Forestry Action Program, Volume III, 1994). "The Challenge for Development." Ministry of Natural Resources, Addis Ababa.

Ford, R. I. (1994). "Ethnobotany, Historical Diversity, and Synthesis." In: The Nature and Status of Ethnobotany (Anthropological Papers), Museum of Anthropology, University of Michigan No. 67, Ford R. I (Ed). Ann Arbor, Michigan, pp. 35–50.

Fassil Kibebew (2001). "The Status and Availability of Oral and Written Knowledge on Traditional Healthcare in Ethiopia." In: (Medhin Zewdu and Abebe Demmissie eds). "Conservation and Sustainable Use of Medicinal Plants in Ethiopia." Proceedings of the National Workshop on Biodiversity Conservation and Sustainable Use of Medicinal Plants in Ethiopia, 28 April–01 May 1998, pp. 107–119. IBCR, Addis Ababa.

Farnsworth, N. R. (Ethiopharmacology and Drug Development. In: Ethnobiology and the Search for New Drugs, pp. 42–59, (Wiley Chichester, Ciba Foundation, eds). Chicago, USA.

Frankel, O., Brown, H., and Burden, J. J. (1995). "The Conservation of Plant Biodiversity." Cambridge University Press, Britain.

Giday Yirga (2010). "Assessment of Traditional Medicinal Plants in Endarta District, South Eastern Tigray, Northern Ethiopia." African Journal of Plant Science, 4(7): 255–260.

Getachew Berhan and Shiferaw Dessie (2002). "Medicinal Plants in BongaS Forest and Their Uses." In: Biodiversity Newsletter. Vol. No. 2, pp. 9–10.

Heinrich, M., Ankli, A., Frei, B., Weimann, C., and Sticher, O. (1998). "Medicinal Plants in Mexico: Healers' Consensus and Cultural Importance." Social Science and Medicine, 47: 1863–1875.

ITDG and IIRR (1996). "Ethnoveterinary Medicine in Kenya: Field Manual of Traditional Animal Healthcare Practices." Intermediate Technology Development Group and International Institute of Rural Reconstruction, Nairobi, Kenya, 254pp.

Jansen, P. C. M (1981). "Species, Condiments, and Medicinal Plants in Ethiopia: Their Taxonomy and Agricultural Significance." Center for Agricultural Publishing and Documentation, Wageninge.

Mirutse Giday, Zemede Asfaw, Thomas Equist, and Zerihun Woldu (2003). "An Ethnobotanical Study of Medicinal Plants Used by Zay People in Ethiopia." Journal of Ethnopharmacology, 85: 45–52.

Kebu Balemie, Ensermu Kelbessa, and Zemede Asfaw (2004). "Indigenous Medicinal Plant Utilization, Management, and Threats in Fentalle Area, Eastern Shewa, Ethiopia." Ethiopian Journal of Biological Sciences, 3(1): 37–58.

Macorkel, C. M. (1995). "Back to the Future: Lessons from Ethnoveterinary Research, Development Extension for Studying and Applying Knowledge." Journal of the Agricultural, Food, and Human Values Society, 22(2): 52–80.

Mathias, E. (1996). "How Can Ethnoveterinary Medicine Be Used in Field Projects? I. K. Minor, 4: 6–7.

Maundu, P., Pariuki, P., and Eyong-Mating, O. (2004). "Conserving Medicinal Species: Securing a Healthy Future." In: Threats to Medicinal Plant Species: An African Perspective, pp. 48–51, (Miththapala, S., ed). Ecosystems and Livelihoods Group, Asia Asian Regional Office and the World Conservation Union (WCU), Sri Lanka.

McCorkle, C. M., and Mathias, E. (1996). "Animal Health Biology: Building on Farmers' Knowledge." In: Bunders, J., Haverkort, B., and Heiemstra, W. (eds), pp. 22–25. Macmillan Education Ltd, London.

Martin, G. J. (1995). "Ethnobotany: A Method Manual." Chapman and Hall, London, pp. 265–270.

Mirutse Giday (2001). "An Ethnobotanical Study of Medicinal Plants Used by the Zay People in Ethiopia." CBM: Skriftserie 3: 81–99.

Muthuswamy, R., and Solomon Meguanente. (2009). "Ethnomedicinal Survey of Folk Drugs Used in Bahirdar Zuria District, Northwestern Ethiopia." Indian Journal of Traditional Knowledge, 2: 281–284.

Parrota, J. A. (2002). "Restriction and Management of Degraded Tropical Forest Landscapes." In: Modern Trends in Applied Terrestrial Ecology, (Ambashet, R. S., and Ambashet, N. k, eds), pp. 135–148.

Philips, R., Hyma B., and Ramesh, A. (1992). "A Comparison of the Use of Traditional and Modern Medicine in Primary Health Centers in Tamil Nadu." Geo Journal, 26: 21–30.

Sofowara, A. (1982). "Medicinal Plants and Traditional Medicine in Africa." John Wiley and Sons, New York.

Stephen A. H. and Justin W. V. (2003). "Traditional Knowledge and Intellectual Property: A Handbook on Issues and Options for Traditional Knowledge Holders in Protecting Their Intellectual Property and Maintaining Biological Diversity." American Association for the Advancement of Science and Human Rights Program, Washington.

Tesema Tanto, Mirutse Giday, and Nigus Akililu (2002). "National Biodiversity Strategy and Action Plan Project: Resource Base of Medicinal Plants of Ethiopia, First Phase Report."

Tesfaye Awas and Sebsebe Demissew (2009). "Ethnobotanical Study of Medicinal Plants in Kafficho People, Eastern Ethiopia." In Proceedings of the 16th International Conference of Ethiopia Studies, Bysveinage, Harald Aspen, Birhanu Tefera, and Shiferaw Bekele, Trondheim 2009.

Tesfaye Mesfin and Mekonnen Lemma (2001). "The Role of Traditional Veterinary Herbal Medicine and Its Constraints in Animal Health Care System in Ethiopia." In (Medhin Zewdu and Abebe Demmissie). "Proceedings of the National Workshop on Biodiversity Conservation and Sustainable Use of Medicinal Plants in IBCR, Addis Ababa."

Tilahun Teklehymanot (2009). "Ethnobotanical Study of Knowledge and Medicinal Plants Used by the People in Dek Island in Ethiopia." Journal of Ethnopharmacology, 124(2009): 69-78, Addis Ababa, Ethiopia.

Thomas, H. (1995). "Indigenous Knowledge, Emancipation, and Alienation." Journal of Knowledge Transfer and Utilization, 8(1): 63-73.

Yibrah Tekele (2014). "An Ethnoveterinary Botanical Survey of Medicinal Plants in Kochove District of Gedeo Zone, SNNPRS, Ethiopia." Journal of Scientific and Innovative Research, 3(4): 433-445.

Zemede Asfaw (2001). "The Role of Home Gardens in the Production and Conservation of Medicinal Plants." Pp., 76-91.

Zemede Asfaw (1997). "Survey of Indigenous Food Plants, Their Preparations, and Home Gardens in Ethiopia." In: Indigenous Africa Food Crops and Useful Plants. UNU/IRNA Assessment Series No. B6. N. Okigbo (Series Editor).

Walter, H. (1995). "Vegetation of the Earth and Ecological Systems of the Geobiosphere, Third Ed." Berlin, Hedeberg, New York, 318pp.

Wright, C. W. (2005). "Plants Derived Antimalarial Agents: New Leads and Challenges." Phytochemistry, 4: 55-61.