Medicinal plants used in the treatment of human ailments in Kulbo forest, Maji district, southwest Ethiopia

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Research

Abstract

Background: Kulbo Forest in southwestern Ethiopia harbours a rich diversity of medicinal plants and associated indigenous knowledge. Despite its importance for local healthcare, ethnobotanical information from the area remains largely undocumented.

Methods: A cross-sectional ethnobotanical study was conducted using semi-structured interviews with 138 informants. Additional information was gathered through focus group discussions, guided field walks, and market surveys. Data were analysed using descriptive statistics, Informant Consensus Factor (ICF), and preference ranking techniques.

Results: A total of 70 medicinal plant species belonging to 37 families were documented for the treatment of 55 human ailments. Asteraceae was the most represented family, accounting for 14.3% of the recorded species. Herbs constituted the dominant growth form (61.4%), while leaves were the most frequently utilized plant parts (39.3%). Oral administration was the primary route of remedy application (54.6%). Informant Consensus Factor values were highest for respiratory ailments (ICF = 0.92) and skin diseases (ICF = 0.83), indicating strong agreement among informants regarding treatments for these conditions. Most medicinal plants (68.2%) were harvested from wild habitats, and agricultural expansion was identified as the leading threat to medicinal plant resources.

Conclusions: The findings demonstrate the continued importance of medicinal plants and indigenous knowledge in supporting primary healthcare in rural communities. However, increasing anthropogenic pressures threaten both medicinal plant diversity and associated traditional knowledge. Conservation measures, sustainable harvesting practices, and further phytochemical and pharmacological investigations are needed to ensure the long-term sustainability and utilization of these valuable resources.

Keywords: Ethnobotany; Indigenous knowledge; Medicinal plants; Traditional medicine; Kulbo Forest; Ethiopia.

Background

Medicinal plants remain a fundamental component of healthcare systems worldwide, particularly in developing countries where access to modern medical services is limited. In Africa, approximately 80% of the population relies on traditional medicine, with plant-based remedies serving as the primary means of treating common diseases (Tugume & Nyakoojo, 2019;

WHO, 2023). Their continued use is largely attributed to accessibility, affordability, perceived effectiveness, and deep-rooted cultural acceptance.

Ethiopia is one of the most biologically diverse countries in Africa, harboring approximately 6,000 vascular plant species, nearly 10% of which are endemic (EBI, 2016; Kelbessa & Demissew, 2014). This rich floristic diversity supports extensive indigenous knowledge systems associated with the use of medicinal plants for treating human ailments. Traditional medicine plays a vital role in primary healthcare, particularly in rural communities where access to modern healthcare services is limited and the ratio of traditional healers to the population is substantially higher than that of modern health professionals (Giday *et al.* 2009; Lulekal *et al.* 2008; Ameni *et al.* 2022).

Despite their importance, medicinal plant resources and the associated indigenous knowledge are increasingly threatened by deforestation, agricultural expansion, overexploitation of natural resources, and socio-cultural changes that hinder the transmission of traditional knowledge between generations (Chekole *et al.* 2015; Yineger & Yewhalaw, 2007; Wendimu *et al.* 2024). The gradual erosion of both biological and cultural diversity poses significant challenges to the sustainable use and conservation of medicinal plants in Ethiopia.

Several ethnobotanical studies have been conducted across different regions of Ethiopia, including Bale (Lulekal *et al.* 2008), Borana (Regassa, 2013), Bench Maji (Wondimu *et al.* 2007), Aseko District (Ameni *et al.* 2022; Jara *et al.* 2024), and Yem Zone (Lulesa *et al.* 2025). These studies have highlighted the importance of medicinal plants in local healthcare systems while revealing considerable regional variation in plant species composition, indigenous knowledge, utilization patterns, and conservation challenges. However, southwestern Ethiopia, particularly remnant Afromontane forests such as Kulbo Forest, remains insufficiently documented in the ethnobotanical literature.

Previous studies conducted in nearby forest ecosystems, including Majang Forest (Fekadu *et al.* 2021) and Sheka Forest (Hunde *et al.* 2015), reported high medicinal plant diversity and extensive indigenous knowledge. Nevertheless, these investigations did not comprehensively assess quantitative ethnobotanical indicators such as Informant Consensus Factor (ICF), cultural importance, or local perceptions of conservation threats. Consequently, there remains a significant knowledge gap regarding the interaction between medicinal plant diversity, indigenous knowledge, and conservation challenges in Kulbo Forest, where local communities continue to depend heavily on forest resources for healthcare and livelihood support.

Therefore, this study was undertaken to fill this gap by: (i) documenting medicinal plants used for the treatment of human ailments in Kulbo Forest, (ii) analyzing indigenous knowledge using quantitative ethnobotanical tools, including Informant Consensus Factor (ICF) and preference ranking, and (iii) identifying major threats to medicinal plant resources and local conservation priorities. By situating Kulbo Forest within the broader ethnobotanical context of Ethiopia, this research provides valuable baseline information and comparative insights that can support biodiversity conservation, sustainable resource management, and the preservation of traditional healthcare practices.

Materials and Methods

Study Area

Kulbo Forest is located in Maji Woreda, Mirab Omo Zone, South West Ethiopia Regional State, Ethiopia (6°06′00″-6°18′30″ N and 29°24′00″-29°39′00″ E) (Figure 1, Table 1). The forest lies approximately 34 km from Tum, the district capital, and ranges in elevation from 1,929 to 2,500 m above sea level.

Maji Woreda comprises four major agroecological zones: Dega (12%), Woyna Dega (42.8%), Kola (40.6%), and Bereha (4.6%). The mean annual temperature is 16.1°C, ranging from 7.9°C in November to 24.7°C in March. The area receives an average annual rainfall of 1,321.1 mm, characterized by a bimodal distribution pattern.

The vegetation is predominantly moist Afromontane forest interspersed with shrublands and grasslands (Mihret & Yohannes, 2015). These ecosystems support high plant diversity, including numerous medicinal plant species, while providing important ecological services.

The local population depends primarily on mixed subsistence agriculture, including cereal production, root crops, cash crops, and livestock rearing. Forest resources such as medicinal plants, fuelwood, and construction materials contribute substantially to local livelihoods. However, agricultural expansion, fuelwood extraction, and settlement growth are increasingly threatening forest ecosystems and reducing the availability of medicinal plant resources.

Figure 1 illustrates the location of the study area within Ethiopia's current administrative framework. The map includes an inset showing the national boundaries and regional states of Ethiopia and a detailed map highlighting Kulbo Forest and the four surveyed kebeles (Chayit, Kerisi, Chigit, and Kubit) in Maji Woreda. Geographic coordinates, scale bars, north arrows, and legends were included to ensure spatial clarity and reproducibility.

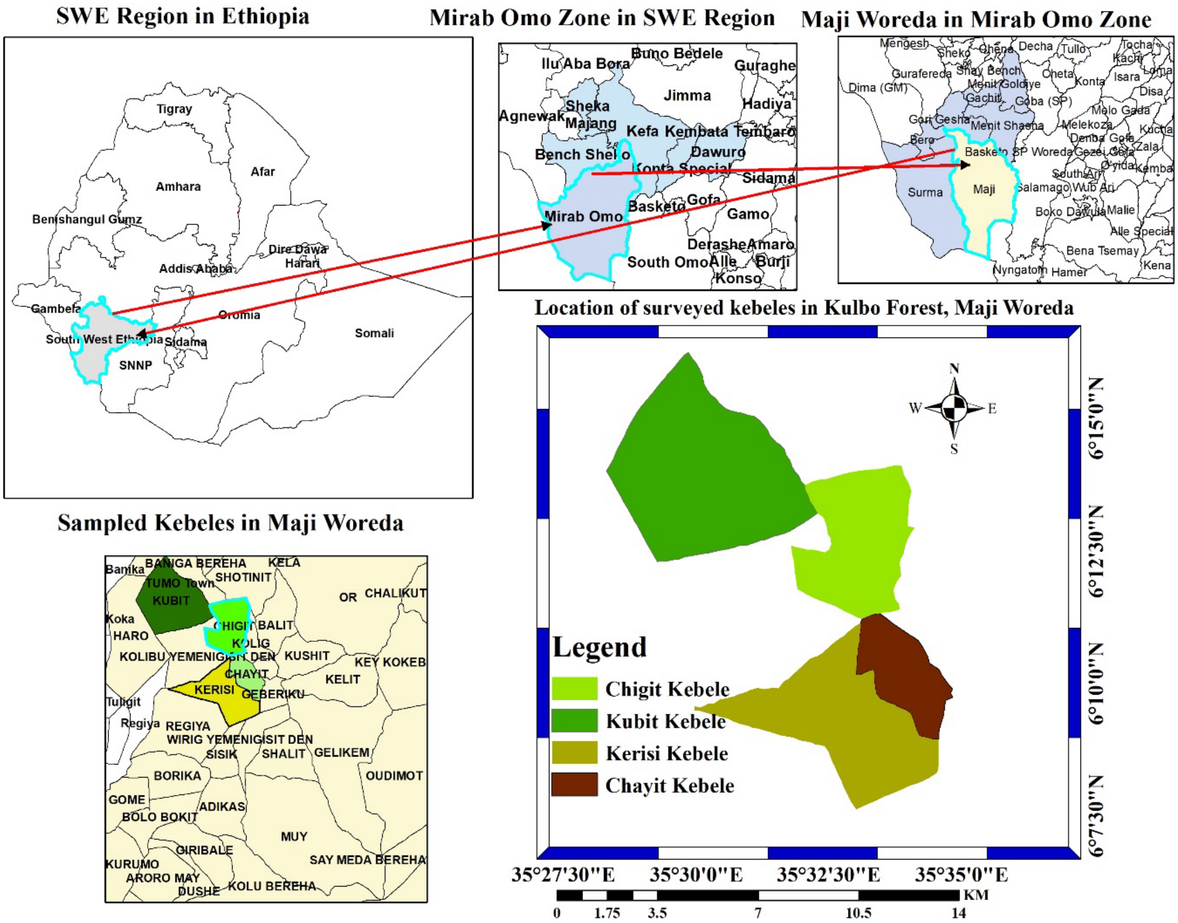

Figure 1. Map of Kulbo Forest, Southwest Ethiopia, showing the study area within Ethiopia's national administrative framework. Inset (A): Ethiopia and regional state boundaries; Inset (B): Maji Woreda and study kebeles; Main panel: Kulbo Forest boundary and sampling locations.

Study Design and Data Collection

A reconnaissance survey was conducted in February 2024 to identify representative sampling sites within Kulbo Forest and adjacent kebeles. A location map of the study area was prepared using QGIS version 3.28 based on spatial data obtained from the Ethiopian Geospatial Information Institute and field-collected GPS coordinates.

Ethnobotanical data were collected between March and August 2024 using qualitative and quantitative approaches following standard ethnobotanical methodologies (Martin, 1995; Cotton, 1996). Similar approaches have been widely employed in Ethiopian ethnobotanical studies (Lulekal *et al.* 2008; Yineger *et al.* 2008; Giday *et al.* 2009; Chekole *et al.* 2015; Fikru Ayana, 2017; Ameni *et al.* 2022).

Informant Selection and Sampling

A total of 138 informants (85 males and 53 females), aged between 20 and 78 years, were selected using purposive and snowball sampling techniques. Informants included traditional healers, elders, farmers, and other knowledgeable community members identified through consultation with local authorities and community leaders.

Purposive sampling was employed to select individuals recognized for their knowledge of medicinal plants, while snowball sampling facilitated the identification of additional knowledgeable participants through referrals from previously interviewed informants. These approaches are widely used in ethnobotanical studies to capture culturally embedded knowledge systems (Lulekal *et al.* 2008; Yineger *et al.* 2008; Jara *et al.* 2024).

The four selected kebeles surrounding Kulbo Forest and the number of respondents involved in the study are presented in Table 1.

Table 1. Selected study kebeles and respondents involved in the study

District	Woreda	Kebele	Area (km^2)	Population	Respondents
Maji	Maji	Chayit	45.32	3,247	38
Maji	Maji	Kerisi	38.76	2,895	34
Maji	Maji	Chigit	41.18	3,105	36
Maji	Maji	Kubit	36.94	2,768	30

Ethnobotanical Data Collection

Data were collected through semi-structured interviews, focus group discussions (FGDs), guided field walks, and market surveys. Semi-structured questionnaires were pre-tested with 10 respondents from a neighbouring kebele to improve clarity and cultural appropriateness. Information recorded included local plant names, ailments treated, plant parts used, preparation methods, dosage estimation, routes of administration, sources of indigenous knowledge, and perceived threats to medicinal plant resources.

Informants and Key Informants

Informants were community members who possessed knowledge of medicinal plants, including farmers, elders, traders, and livestock keepers. Key informants were individuals recognized by the community for their specialized expertise in traditional medicine, such as traditional healers and experienced herbal practitioners. These key informants participated in detailed interviews, ranking exercises, and guided field walks.

Guided Field Walks and Plant Collection

Guided field walks were conducted with key informants to locate medicinal plant species within their natural habitats. During these walks, information was recorded on habitat characteristics, abundance, harvesting practices, and phenological conditions.

Voucher specimens were collected, pressed, dried, and labeled following standard herbarium procedures. Species identification was carried out using the Flora of Ethiopia and Eritrea (Edwards *et al.* 1995-2000; Bekele, 2007), comparison with authenticated specimens at the Mizan Tepi University Herbarium (MTUH) and the National Herbarium (ETH), Addis Ababa University, and consultation with taxonomic specialists when necessary.

Focus Group Discussions

Focus group discussions consisting of 8-10 participants were conducted to validate and triangulate information obtained from individual interviews. These discussions explored community perceptions regarding medicinal plant use, conservation status, knowledge transmission, and major threats to plant resources.

Market Surveys

Market surveys were conducted in Maji and Tum markets through direct observation and informal interviews. The surveys documented medicinal plant species sold, market prices, trade volumes, and commercialization practices.

Dosage Estimation and Routes of Administration

Dosage information was recorded according to local measurement systems, including cups, spoons, finger lengths, and other traditional units. Where exact quantification was not possible, dosage information was described qualitatively. Routes of administration were categorized as oral, dermal, nasal, ocular, auricular, or other routes following established ethnopharmacological classifications (Heinrich *et al.* 1998).

Data Quality Control

Data reliability was enhanced through triangulation among interviews, focus group discussions, guided field walks, and market surveys. Information provided by individual informants was cross-checked with key informants and field observations. Interviews were conducted in Dizi, Me'en, and Afaan Oromo languages with assistance from trained translators when necessary. Prior informed consent was obtained from all participants.

Socio-Demographic and Socio-Economic Data

Socio-demographic information, including age, sex, marital status, and educational level, as well as socio-economic characteristics such as occupation, livelihood activities, and dependence on forest resources, was recorded. These variables were analysed using descriptive statistics to assess patterns of ethnobotanical knowledge distribution among different social groups.

Data Analysis

Data were entered into Microsoft Excel and analysed using descriptive statistics, including frequencies, percentages, means, and rankings. Quantitative ethnobotanical indices employed in the analysis included Informant Consensus Factor (ICF), preference ranking, pair-wise comparison, direct matrix ranking, and threat ranking.

Informant Consensus Factor (ICF)

The Informant Consensus Factor (ICF) was calculated to assess the degree of agreement among informants regarding medicinal plants used for specific ailment categories.

$$ICF=\frac{N_{ur}-N_t}{N_{ur}-1}$$

where N_{ur} represents the number of use-reports for a particular ailment category and N_t represents the number of medicinal plant species used for that category. ICF values range from 0 to 1, with higher values indicating stronger consensus among informants.

Preference Ranking

Preference ranking was employed to identify the most preferred medicinal plant species used for treating malaria. Five frequently cited species were evaluated by 10 key informants, who assigned scores ranging from 1 (least effective) to 5 (most effective). Total scores were summed to generate the final ranking.

Pair-Wise Comparison

Pair-wise comparison was conducted to determine the relative importance of medicinal plant species used for treating rabies. Informants compared selected species in all possible pairs and identified the species considered more effective in each comparison. Preference frequencies were summed to obtain final rankings.

Direct Matrix Ranking

Direct matrix ranking was applied to evaluate multipurpose medicinal plant species. Key informants assigned scores ranging from 0 (no use) to 5 (highest importance) across different use categories, including medicine, fuelwood, construction, fodder, and food. Scores were summed to determine overall utilization pressure.

Threat Ranking

Threat ranking was used to assess perceived threats to medicinal plant resources. Informants identified major threats such as agricultural expansion, fuelwood collection, grazing, settlement expansion, and charcoal production and assigned severity scores. Scores were aggregated to establish threat priorities.

Ethical Considerations

Ethical clearance was obtained from the Research Ethics Committee of Mizan Tepi University, College of Agriculture and Natural Resources (Ref. No. MTU/CANR/RERC/004/2025) prior to commencement of the study. Informed consent was obtained from all participants after explaining the objectives and procedures of the research. Confidentiality was maintained by anonymizing participant information and restricting the publication of culturally sensitive medicinal knowledge.

The study adhered to the principles of the International Society of Ethnobiology Code of Ethics and complied with the Convention on Biological Diversity (CBD) and the Nagoya Protocol on Access and Benefit-Sharing. Community permission was obtained for plant collection activities, and potential conservation and benefit-sharing outcomes were discussed with local stakeholders.

Results

Socio-demographic and Socio-economic Characteristics of Informants

A total of 138 informants participated in the study, of whom 85 (61.6%) were male and 53 (38.4%) were female. Informants ranged in age from 20 to 78 years, with the largest proportion belonging to the 41-50-year age group. More than half of the respondents (53.6%) were illiterate, while only 3.6% had education beyond the secondary level. Farming was the dominant occupation (66.7%), followed by traditional healing (13.0%) and livestock keeping (11.6%), reflecting the predominantly agrarian nature of the study area.

Most respondents relied on crop farming (56.5%) or mixed crop-livestock production systems (28.3%) as their primary sources of livelihood. Furthermore, more than half of the respondents (52.2%) reported a high dependency on forest resources, indicating the important role of forest ecosystems in supporting local livelihoods and healthcare needs.

Wealth Distribution

Based on asset-index classification using Principal Component Analysis (PCA), households were grouped into three wealth categories. Of the 138 households surveyed, 60 (43.5%) were classified as low wealth, 50 (36.2%) as middle wealth, and 28 (20.3%) as high wealth (Table 2).

Low-wealth households reported a greater dependency on forest resources than middle- and high-wealth households, suggesting that poorer households rely more heavily on forest products, including medicinal plants, for subsistence and primary healthcare. A chi-square test of independence revealed a significant association between household wealth status and dependency on forest resources ($\chi^2 = 19.74$, df = 4, $p < 0.001$). The corresponding Cramer's V value (0.27) indicated a small-to-moderate effect size. These findings demonstrate that economically disadvantaged households are disproportionately dependent on forest resources and are therefore likely to be more vulnerable to environmental degradation and resource scarcity.

Detailed socio-demographic and socio-economic characteristics of informants are presented in Table 2.

Table 2. Socio-demographic and socio-economic characteristics of informants (n = 138)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	85	61.6
	Female	53	38.4
Age group (years)	20-30	18	13.0
	31-40	26	18.8
	41-50	34	24.6
	51-60	32	23.2
	61-70	20	14.5
	71-78	8	5.8
Occupation	Farmer	92	66.7
	Traditional healer	18	13.0
	Livestock keeper	16	11.6
	Trader	7	5.1
	Others (students/elders)	5	3.6
Education level	Illiterate	74	53.6
	Primary education	41	29.7
	Secondary education	18	13.0
	Above secondary	5	3.6
Primary livelihood source	Crop farming	78	56.5
	Mixed farming (crop + livestock)	39	28.3
	Forest-based activities	13	9.4
	Small-scale trade	8	5.8
Dependency on forest resources	High	72	52.2
	Moderate	44	31.9

Variable	Category	Frequency (n)	Percentage (%)
	Low	22	15.9
Wealth status (PCA tertiles)	Low	60	43.5
	Middle	50	36.2
	High	28	20.3

Medicinal Plant Diversity

A total of 70 medicinal plant species belonging to 37 families were documented for the treatment of human ailments in the study area. The documented species demonstrate considerable taxonomic diversity and highlight the importance of medicinal plants in the local healthcare system. Among the recorded families, Asteraceae was the most represented, contributing 10 species (14.3%), followed by Fabaceae, Amaranthaceae, and Asparagaceae, each represented by four species (5.7%). Several other families were represented by one or two species (Table 3).

The predominance of Asteraceae is consistent with findings from other ethnobotanical studies in Ethiopia, where members of this family are frequently reported as important medicinal resources. The high diversity of medicinal plant families recorded in the present study reflects the rich floristic composition of Kulbo Forest and the extensive indigenous knowledge associated with plant-based healthcare.

For clarity, subsequent results are presented under thematic subsections focusing on growth forms, sources of medicinal plants, plant parts used, preparation methods, routes of administration, and ethnobotanical indices.

Table 3. Family distribution of medicinal plants used for treating human ailments in Kulbo Forest, Maji District

Family	Number of Species	Percentage (%)
Asteraceae	10	14.3
Fabaceae	4	5.7
Amaranthaceae	4	5.7
Asparagaceae	4	5.7
Apocynaceae	3	4.3
Solanaceae	3	4.3
Ranunculaceae	3	4.3
Boraginaceae	3	4.3
Lamiaceae	2	2.9
Amaryllidaceae	2	2.9
Sapindaceae	2	2.9
Poaceae	2	2.9
Brassicaceae	2	2.9
Euphorbiaceae	2	2.9
Cucurbitaceae	2	2.9
Other 22 families (1 species each)	22	31.4
Total	**70**	**100.0**

Growth Forms of Medicinal Plants

Analysis of growth forms revealed that herbs constituted the largest proportion of medicinal plants (61.4%), followed by shrubs, trees, climbers, and parasitic species (Figure 2).

The predominance of herbaceous species may be attributed to their abundance, accessibility, rapid regeneration capacity, and ease of collection. Similar patterns have been reported in several Ethiopian ethnobotanical studies. The heavy reliance on herbaceous taxa may also reflect their perceived therapeutic effectiveness and year-round availability. However, frequent harvesting of medicinal herbs could increase pressure on natural populations, particularly for species collected from wild habitats.

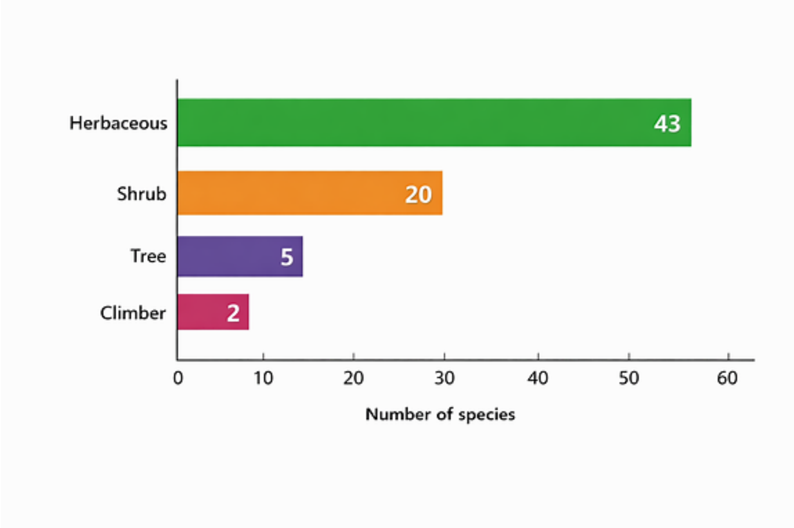

Figure 2. Growth forms of medicinal plants documented in Kulbo Forest, Maji District, Southwest Ethiopia.

Sources of Medicinal Plants

Most medicinal plant species (68.2%) were collected from wild habitats, whereas only 31.8% were obtained from home gardens.

The predominance of wild-harvested species demonstrates the continued dependence of local communities on natural ecosystems for healthcare needs. This pattern also indicates the vulnerability of medicinal plant resources to ongoing habitat degradation, forest fragmentation, and land-use changes. The relatively low proportion of cultivated medicinal plants suggests limited domestication efforts and highlights the need for community-based conservation and cultivation initiatives.

Plant Parts Used and Preparation Methods

Leaves were the most frequently utilized plant parts, accounting for 39.3% of all reported uses, followed by roots (16.6%) and bark (15.7%) (Figure 3).

The preference for leaves may be related to their ease of collection, high concentrations of bioactive compounds, and the relatively low impact of leaf harvesting on plant survival. In contrast, harvesting roots and bark can be destructive and may threaten the long-term persistence of medicinal plant populations if not conducted sustainably.

Medicinal preparations were commonly produced through crushing (18.8%), pounding (17.4%), powdering (14.0%), and squeezing (10.6%). Fresh plant materials were used in 57.2% of preparations, indicating a strong preference for freshly harvested materials in traditional healthcare practices.

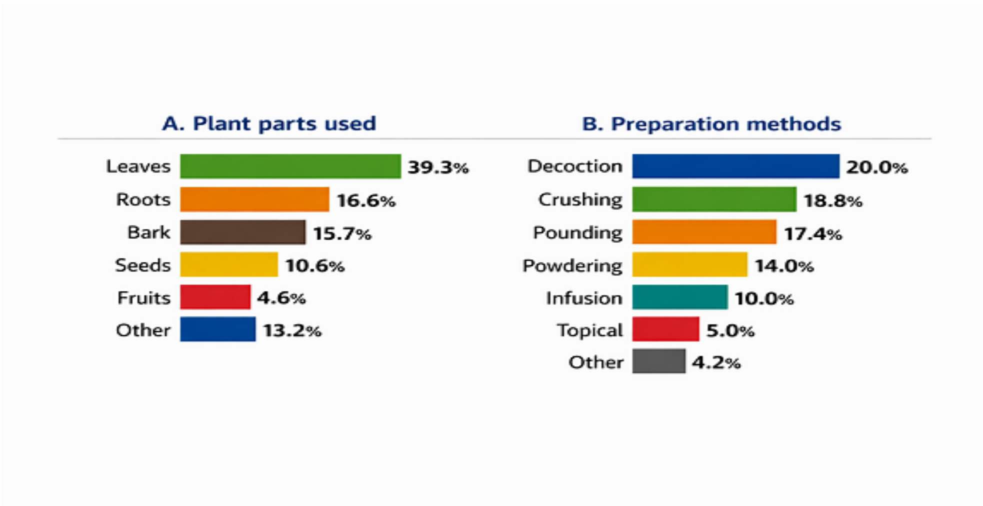

Figure 3. Plant parts used and preparation methods of medicinal plants in the study area.

Routes of Administration and Dosage

Oral administration was the most common route of remedy application, accounting for 54.6% of reported treatments, followed by dermal application (28.1%) and nasal administration (7.7%) (Figure 4).

The predominance of oral administration reflects the high frequency of remedies used to treat internal ailments such as gastrointestinal disorders, respiratory illnesses, and febrile conditions. Similar findings have been reported from numerous ethnobotanical studies conducted throughout Ethiopia.

Dosage determination lacked standardization and was commonly based on traditional measurement systems such as cups, spoons, finger lengths, and local experiential knowledge. This variability highlights an important limitation of traditional healthcare systems and underscores the need for pharmacological validation and dosage standardization.

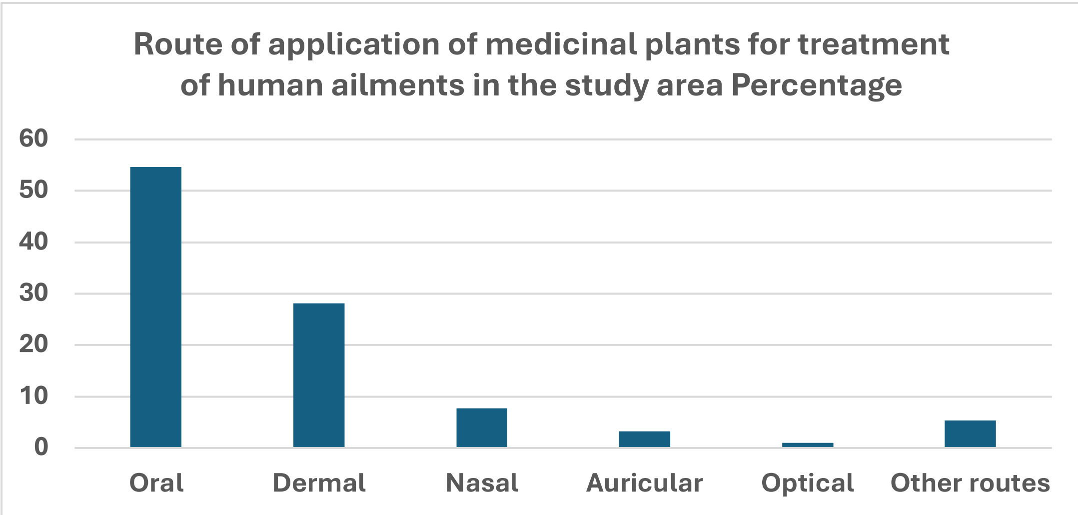

Figure 4. Routes of administration of medicinal plant remedies used for treating human ailments in the study area.

Ailments Treated and Informant Consensus

The documented medicinal plants were used to treat a total of 55 human ailments, reflecting the broad therapeutic scope of traditional medicine in the study area.

Informant Consensus Factor (ICF) values varied among disease categories (Table 4). The highest ICF value was recorded for febrile illnesses, common cold, cough, and related respiratory conditions (0.92), followed by skin diseases and wounds (0.83), evil spirit and evil eye ailments (0.83), organ-related diseases (0.82), and placental or urinary retention disorders (0.82).

High ICF values indicate strong agreement among informants regarding the use of particular medicinal plants for specific ailments and may suggest greater therapeutic effectiveness or stronger cultural acceptance of those remedies. Conversely, lower ICF values indicate greater variation in plant selection among informants.

The high consensus observed for respiratory and dermatological conditions suggests that these ailments are common within the community and that effective traditional remedies are widely recognized and consistently used.

Preference Ranking and Sources of Indigenous Knowledge

Preference ranking identified *Allium sativum* as the most preferred medicinal plant for malaria treatment, followed by *Lepidium sativum* and *Zingiber officinale*. The high ranking of these species reflects widespread community confidence in their perceived therapeutic effectiveness.

Indigenous knowledge regarding medicinal plants was primarily transmitted through parents and close family members (62.3%). This finding demonstrates the central role of family-based knowledge transfer in maintaining traditional healthcare systems. However, reliance on oral transmission also increases the vulnerability of indigenous knowledge to erosion as younger generations become less engaged in traditional practices.

Table 4. Informant Consensus Factor (ICF) values for human ailments treated in Kulbo Forest, Maji District, Southwest Ethiopia

Disease category	Number of species (Nt)	Number of use reports (Nur)	ICF
Febrile illness, common cold and cough	8	84	0.92
Skin diseases and wounds	9	48	0.83
Evil spirit and evil eye	11	58	0.83
Organ diseases	10	52	0.82
Placental and urine retention	7	34	0.82
Malaria and febrile illness	8	30	0.76
Gastrointestinal disorders	19	51	0.64

Note: ICF = Informant Consensus Factor; Nt = number of medicinal plant species used for a disease category; Nur = number of use-reports recorded for that category.

Threats to Medicinal Plants

Informants identified agricultural expansion as the most serious threat to medicinal plant resources (24.3%), followed by firewood collection (20.3%) and climate change (18.2%).

Additional threats included overgrazing, settlement expansion, charcoal production, and unsustainable harvesting practices. These pressures contribute to habitat degradation, declining plant populations, and reduced availability of medicinal resources.

Particularly vulnerable are woody species harvested for roots and bark, as destructive harvesting practices can impair regeneration and ultimately lead to local population decline. The findings emphasize the urgent need for conservation interventions, including habitat protection, sustainable harvesting practices, community awareness programs, and cultivation of priority medicinal species.

A total of 70 medicinal plant species belonging to 37 families were documented and are presented in Table 5. Voucher specimens were deposited at the Mizan Tepi University Herbarium (MTUH). Scientific names and taxonomic authorities follow current nomenclature standards, and taxonomic updates were verified using Plants of the World Online (Kew, 2026).

Table 5. Medicinal Plant Species Used to Treat Human Ailments in Kulbo Forest, Maji District, Southwestern Ethiopia (N = 70)

Scientific Name	Family	Local Name	Habitat	Growth Form	Ailments Treated
Vachellia abyssinica	Fabaceae	Dhaze (Dizi)	Wild	Tree	Tonsillitis, Wound
Acanthus sennii	Acanthaceae	Kosoru (Me'en)	Wild	Shrub	Sore, Rheumatism, Tuberculosis, Skin lesion, Evil eye
Achyranthes aspera	Amaranthaceae	Darguu (Oromo)	Wild	Herb	Gastritis, Impotency, Leishmaniasis
Acmella caulirhiza	Asteraceae	—	Wild	Herb	Amoebiasis, Toothache
Acokanthera schimperi	Apocynaceae	Qararuu (Oromo)	Wild	Shrub	Gonorrhoea, Tonsillitis, Sore
Agave sisalana	Asparagaceae	Qaca (Oromo)	Wild	Shrub	Wound, Syphilis
Ajuga integrifolia	Lamiaceae	Armagusa (Oromo)	Wild	Herb	Diarrhoea, Malaria
Albizia schimperiana	Fabaceae	Ziinu (Oromo)	Wild	Tree	Pyelonephritis, Syphilis
Alectra sessiliflora	Orobanchaceae	—	Wild	Herb	Minor bleeding, Wound
Allium sativum	Amaryllidaceae	Qulubii (Oromo)	Cultivated	Herb	Malaria, Ringworm, Asthma, Common cold, Pneumonia, Cough, Bronchitis, Dandruff
Allium cepa	Amaryllidaceae	Shinkurt (Oromo)	Cultivated	Herb	Jaundice, Asthma

Allophylus abyssinicus	Sapindaceae	Xhiyashi (Dizi)	Wild	Tree	Wound, Syphilis
Amaranthus caudatus	Amaranthaceae	Iyaso (Me'en)	Wild	Herb	Constipation, Wound
Apodytes dimidiata	Metteniusaceae	Calalaaqa (Dizi)	Wild	Tree	Cough, Tinea pedis
Arceuthobium juniperi-procerae	Viscaceae	Digaluu Hidheessaa (Oromo)	Parasitic	Parasitic Herb	Asthma, Tuberculosis
Arisaema enneaphyllum	Araceae	Carana (Me'en)	Wild	Herb	Bloating, Atopic eczema
Oldeania alpina	Poaceae	Ceekata (Oromo)	Wild	Herb	Headache
Artemisia abyssinica	Asteraceae	Chikugn (Dizi)	Wild	Herb	Eczema, Cough, Bronchitis
Asparagus africanus	Asparagaceae	Uutn Gorkn (Me'en)	Wild	Shrub	Jaundice, Spider bite, Gastritis, Impotency
Asparagus racemosus	Asparagaceae	Kinkang (Me'en)	Wild	Shrub	Jaundice, Febrile illness
Bersama abyssinica	Francoaceae	Zokuknaabuchuo (Dizi)	Wild	Tree	Amoebiasis, Constipation, Diarrhoea
Bidens pilosa	Asteraceae	Kech-a-chila (Me'en)	Wild	Herb	Burns
Bothriocline schimperi	Asteraceae	Uleehare (Oromo)	Wild	Shrub	Warts, Evil eye
Brassica carinata	Brassicaceae	Gomanzara (Oromo)	Cultivated	Herb	Bloating
Brassica nigra	Brassicaceae	Senafic (Oromo)	Cultivated	Herb	Bloating, Common cold, Asthma
Brucea antidysenterica	Simaroubaceae	Diyagn (Dizi)	Wild	Shrub	Toothache, Gonorrhoea, Diarrhoea
Buddleja polystachya	Scrophulariaceae	Dekn (Me'en)	Wild	Tree	Ascariasis, Amebiasis, Hepatitis, Evil eye
Calpurnia aurea	Fabaceae	Hirshun (Oromo)	Wild	Shrub	Rabies, Tuberculosis, Diarrhoea
Canarina abyssinica	Campanulaceae	Gomen (Oromo)	Wild	Herb	Leprosy
Capsicum annuum	Solanaceae	Barbarree (Oromo)	Cultivated	Herb	Malaria
Carduus leptacanthus	Asteraceae	—	Wild	Herb	Wound, Gonorrhoea
Carduus schimperi	Asteraceae	—	Wild	Shrub	Hepatitis, Jaundice
Carica papaya	Caricaceae	Papaya (Oromo)	Cultivated	Tree	Gastritis, Constipation
Carissa spinarum	Apocynaceae	Niyadin (Dizi)	Wild	Shrub	Rheumatism, Headache, Ascariasis, Impotency, Rabies, Evil eye
Catha edulis	Celastraceae	Chat (Dizi)	Cultivated	Shrub	Impotency, Common cold, Ascariasis
Cassipourea malosana	Rhizophoraceae	—	Wild	Tree	Gonorrhoea, Gingivitis
Caylusea abyssinica	Resedaceae	—	Wild	Herb	Ringworm
Celtis africana	Cannabaceae	Caa'ii (Oromo)	Wild	Tree	Asthma, Evil spirit
Chenopodium schraderianum	Amaranthaceae	—	Wild	Herb	Evil eye
Chionanthus mildbraedii	Oleaceae	—	Wild	Shrub	Toothache, Syphilis

Cirsium vulgare	Asteraceae	—	Wild	Herb	Weight loss, Malaria
Clausena anisata	Rutaceae	Uwilaushim (Me'en)	Wild	Shrub	Impotency
Clematis simensis	Ranunculaceae	Hidafeetii (Oromo)	Wild	Climber	Rheumatism, Toothache, Ascariasis
Clematis longicauda	Ranunculaceae	Hidaadi (Oromo)	Wild	Climber	Rheumatism, Sore, Tetanus
Clerodendrum myricoides	Lamiaceae	Mulmuuzu (Dizi)	Wild	Shrub	Malaria, Infertility
Clutia abyssinica	Euphorbiaceae	Tiartiar (Me'en)	Wild	Shrub	Tinea corporis, Hepatitis, Mumps
Coffea arabica	Rubiaceae	Giyanu (Dizi)	Cultivated	Tree	Diarrhoea
Conyza nana	Asteraceae	—	Wild	Herb	Hemorrhoids, Leishmaniasis
Cordia africana	Boraginaceae	Abshi (Oromo)	Wild	Tree	Toothache, Snake bite
Crassula alba	Crassulaceae	—	Wild	Herb	Skin lesion, Swelling
Crotalaria rosenii	Fabaceae	—	Wild	Shrub	Amoebiasis
Croton macrostachyus	Euphorbiaceae	Makkanni (Oromo)	Wild	Tree	Tinea corporis, Epistaxis, Headache, Wound, Rabies, Hemorrhoids
Cucumis ficifolius	Cucurbitaceae	Y'medir embay (Me'en)	Wild	Climber	Ascariasis
Cyathula uncinulata	Amaranthaceae	Maxanne (Oromo)	Wild	Herb	Infertility, Minor bleeding
Cucurbita pepo	Cucurbitaceae	Dabaqula (Oromo)	Cultivated	Herb	Taeniasis, Ascariasis
Cymbopogon citratus	Poaceae	—	Cultivated	Herb	Influenza
Cynoglossum lanceolatum	Boraginaceae	Maxannee (Oromo)	Wild	Herb	Febrile illness, Gingivitis
Cyphostemma cyphopetalum	Vitaceae	Hiddaboffa (Oromo)	Wild	Herb	Snake bite, Spider bite
Datura stramonium	Solanaceae	Banjii (Oromo)	Wild	Herb	Dandruff
Delphinium dasycaulon	Ranunculaceae	—	Wild	Herb	Epilepsy, Snake bite, Cough
Discopodium penninervium	Solanaceae	Cacuunga (Dizi)	Wild	Tree	Tinea pedis, Goitre, Breast ulcer
Dodonaea angustifolia	Sapindaceae	Xadachaa (Oromo)	Wild	Shrub	Diarrhoea, Eczema, Back pain
Dombeya torrida	Malvaceae	Buoshn (Me'en)	Wild	Tree	Snake bite
Dovyalis abyssinica	Salicaceae	Daanisaa (Oromo)	Wild	Shrub	Menstrual disorder, Leprosy
Dracaena afromontana	Asparagaceae	Lekut (Dizi)	Wild	Tree	Hepatitis, Chancroid
Dregea schimperi	Apocynaceae	—	Wild	Climber	Tinea pedis, Skin lesion
Echinops ellenbeckii	Asteraceae	Sokoru (Oromo)	Wild	Shrub	Wound, Rabies
Echinops kebericho	Asteraceae	Qabaricho (Oromo)	Wild	Shrub	Rabies, Gonorrea, Evil eye, Evil spirit
Ehretia cymosa	Boraginaceae	Kuumu (Dizi)	Wild	Tree	Retained placenta, Blood disorder
Ekebergia capensis	Meliaceae	Xsuwi (Me'en)	Wild	Tree	Menstrual disorder, Chancroid

Discussion

This study documented 70 medicinal plant species belonging to 37 families, demonstrating substantial medicinal plant diversity and the continued importance of traditional medicine in Kulbo Forest, southwestern Ethiopia. The high reliance on medicinal plants reflects limited access to modern healthcare services, economic constraints, and the strong cultural acceptance of traditional healing practices. Similar patterns have been reported throughout Ethiopia, where traditional medicine remains an integral component of primary healthcare, particularly in rural communities (Giday *et al.* 2009; Tilahun *et al.* 2020; Ameni *et al.* 2022; WHO, 2023). The diversity of medicinal plants recorded further supports Ethiopia's recognition as one of Africa's major centers of plant biodiversity and indigenous knowledge (EBI, 2016; Kelbessa & Demissew, 2014). Although the number of species documented in the present study is slightly lower than that reported in some neighbouring areas of southwestern Ethiopia, such variation may be attributed to differences in ecological conditions, sampling intensity, cultural practices, and knowledge distribution among communities.

Herbaceous species constituted the largest proportion (61.4%) of the medicinal flora, indicating a preference for readily available and easily harvested plant resources. This finding agrees with previous ethnobotanical studies conducted in Ethiopia and elsewhere in Africa, which have reported the predominance of herbs in traditional medicinal systems (Teklehaymanot & Giday, 2007; Njoroge & Bussmann, 2006; Lulekal *et al.* 2013; Jara *et al.* 2024; Jara *et al.* 2026). The widespread use of herbs may be associated with their abundance, rapid regeneration, and accessibility. Nevertheless, woody species such as *Croton macrostachyus* and *Cordia africana* continue to play important therapeutic roles, particularly in the treatment of chronic and complex ailments. This pattern suggests that medicinal plant selection is influenced by both ecological availability and perceived therapeutic effectiveness.

Leaves were the most frequently utilized plant parts (39.3%), followed by roots (16.6%) and bark (15.7%). The predominance of leaves is ecologically favorable because harvesting leaves generally causes less damage to plants and allows continued growth and regeneration. Similar findings have been widely reported in Ethiopian ethnobotanical studies (Birhanu *et al.* 2015; Lulekal *et al.* 2013; Ameni *et al.* 2022; Wendimu *et al.* 2024; Jara *et al.* 2026). However, the considerable use of roots and bark raises conservation concerns because these harvesting practices are often destructive and may threaten the long-term survival of medicinal plant populations, particularly slow-growing woody species. Comparable concerns have been reported from other regions of Ethiopia, emphasizing the need for sustainable harvesting practices and conservation awareness programs (Giday *et al.* 2009; Chekole, 2017; Lulesa *et al.* 2025; Jara *et al.* 2026).

The high Informant Consensus Factor (ICF) values recorded for respiratory ailments (0.92) and skin diseases (0.83) indicate strong agreement among informants regarding the use of specific medicinal plants for these disease categories. High consensus values are often interpreted as indicators of culturally important remedies that may possess genuine therapeutic efficacy and therefore warrant further phytochemical and pharmacological investigation (Heinrich *et al.* 1998). Similar levels of consensus have been reported in several Ethiopian ethnobotanical studies (Giday *et al.* 2009; Teklehaymanot, 2009; Jara *et al.* 2024; Lulesa *et al.* 2025). Notably, species such as *Echinops kebericho* are widely recognized for treating respiratory and spiritual ailments, supporting their potential for future scientific validation. Variations in ICF values among studies may reflect differences in disease prevalence, environmental conditions, and cultural knowledge systems.

The ethnobotanical findings were further supported by local healthcare records. Morbidity data from the Maji District Health Office (2023-2024) identified malaria, acute respiratory infections, gastrointestinal disorders, and skin infections as the leading causes of outpatient consultations in rural health facilities. These disease categories closely correspond to the ailments most frequently treated using medicinal plants in the present study. This convergence suggests that traditional medicine continues to complement formal healthcare services, particularly where access to health facilities is limited. Strengthening collaboration between traditional practitioners and public health institutions may enhance healthcare accessibility while preserving valuable indigenous knowledge.

Preference ranking identified *Allium sativum* as the most effective medicinal plant for malaria treatment according to local informants. This finding is consistent with previous reports describing the antimicrobial, antiparasitic, and immunomodulatory properties of garlic (Sofowora, 2008; Tilahun *et al.* 2020). Other highly valued species, including *Calpurnia aurea* and *Croton macrostachyus*, have also been widely documented in Ethiopian traditional medicine (Asfaw & Abebe, 2004; Teklehaymanot, 2009; Wendimu *et al.* 2024). The prominence of these species reinforces the reliability of indigenous knowledge systems and highlights their relevance for future pharmacological research and drug discovery.

Traditional medicinal knowledge in the study area is transmitted primarily through oral communication within families. Although this mechanism has facilitated the preservation of knowledge over generations, it also makes the knowledge system vulnerable to erosion. Increasing urbanization, modernization, formal education, and declining interest among younger generations threaten the continuity of traditional knowledge. Similar challenges have been reported in Ethiopia and other African countries (Njoroge & Bussmann, 2006; Chekole, 2017; Jara *et al.* 2024). Consequently, systematic documentation, community-based knowledge preservation initiatives, and the integration of ethnobotanical knowledge into local educational programs are essential for safeguarding this cultural heritage.

Agricultural expansion (24.3%) and fuelwood collection (20.3%) were identified as the most significant threats to medicinal plant resources in the study area. These findings are consistent with previous studies that identify land-use change and unsustainable resource extraction as major drivers of biodiversity loss in Ethiopia and elsewhere (CBD, 2010; EBI, 2016; Hunde *et al.* 2015; Fekadu *et al.* 2021; Wendimu *et al.* 2024). Given that more than two-thirds of medicinal plants are harvested from the wild, continued habitat degradation may directly reduce the availability of medicinal resources and erode associated indigenous knowledge. Addressing these challenges requires participatory forest management, sustainable land-use planning, and community-based conservation strategies that integrate local ecological knowledge into resource management frameworks.

The dominance of Asteraceae, together with the prevalence of herbaceous species, leaf-based remedies, and wild-harvested medicinal plants, reflects patterns commonly reported across Ethiopia. While the composition and relative abundance of medicinal plant families may vary among regions, the overall similarities suggest the existence of broadly shared ethnobotanical traditions shaped by local ecological conditions and cultural practices. These findings provide valuable baseline information for future conservation planning, sustainable utilization initiatives, and pharmacological investigations of medicinal plants in southwestern Ethiopia.

Conclusion

Kulbo Forest harbours a rich diversity of medicinal plants, with 70 species belonging to 37 families documented for the treatment of 55 human ailments. The findings demonstrate the continued importance of traditional medicine in primary healthcare, particularly in rural communities where access to modern healthcare services remains limited. High Informant Consensus Factor (ICF) values for respiratory and skin-related ailments indicate strong agreement among informants and suggest the existence of well-established therapeutic knowledge with potential for future phytochemical and pharmacological investigation.

The predominance of wild-harvested medicinal plants highlights the community's dependence on natural ecosystems for healthcare. Although leaves were the most frequently utilized plant parts, the substantial use of roots and bark raises concerns regarding the long-term sustainability of medicinal plant resources, particularly for slow-growing woody species.

Despite the resilience of indigenous knowledge systems, both medicinal plant resources and associated traditional knowledge are increasingly threatened by agricultural expansion, fuelwood collection, habitat degradation, climate-related pressures, and declining intergenerational knowledge transfer. These challenges underscore the need for integrated conservation approaches that simultaneously address biodiversity protection and cultural heritage preservation.

To ensure the sustainable utilization of medicinal plant resources, priority actions should include: (i) domestication and cultivation of high-demand medicinal plant species; (ii) implementation of both in situ and ex situ conservation measures; (iii) phytochemical, pharmacological, and toxicological evaluation of widely used medicinal plants; and (iv) systematic documentation and safeguarding of indigenous knowledge through community-based initiatives and educational programs.

Strengthening collaboration among traditional healers, health extension workers, researchers, and conservation practitioners could facilitate the integration of validated traditional remedies into local healthcare and natural resource management systems. Such collaboration would contribute to improved healthcare accessibility while promoting biodiversity conservation and sustainable resource use.

Overall, the long-term sustainability of medicinal plant use in Kulbo Forest depends on a holistic approach that integrates conservation, sustainable utilization, scientific validation, and preservation of indigenous knowledge to support both ecosystem integrity and community well-being.

Declarations

List of Abbreviations: DBH-Diameter at Breast Height; ERA- Ethnobotany Research & Applications; ETH-National Herbarium of Ethiopia, Addis Ababa University; ICF- Informant Consensus Factor; MTUH- Mizan Tepi University Herbarium

Ethics Approval and Consent to Participate: This study was conducted in accordance with established ethical guidelines for ethnobotanical research involving human participants and indigenous knowledge systems. Ethical approval was obtained from the Research Ethics Review Committee of Mizan Tepi University, College of Agriculture and Natural Resources (Ref. No. MTU/CANR/RERC/004/2025).

Prior informed consent was obtained from all participants verbally and in writing after providing a clear explanation of the study objectives, methods, and intended use of the information. Permission to undertake the research was also secured from relevant local authorities, including district agricultural and health offices. Participants were informed of their right to withdraw from the study at any stage and to decline sharing any knowledge they considered sensitive. All information was treated with confidentiality and cultural respect.

The study adhered to the principles of the Convention on Biological Diversity (CBD), the Nagoya Protocol on Access and Benefit Sharing, and the International Society of Ethnobiology (ISE) Code of Ethics.

Consent for Publication: Not applicable.

Availability of Data and Materials: The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request. Voucher specimens are deposited at the Mizan Tepi University Herbarium (MTUH) and are available for scientific examination upon request.

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