

Integrating qualitative and quantitative ethnomedicinal knowledge: A comprehensive assessment of traditional medicine in West Hararghe Zone, Oromia, Ethiopia

Melaku Masresha Woldeamanuel¹, Belay Sitotaw Goshu², Geletu Nuredin Mushike³, Sitna Dawude Ahmed³ & Molla Fente Tasew³

¹ Department of Chemistry, Dire Dawa University, Dire Dawa, Ethiopia

² Department of Physics, Dire Dawa University, Dire Dawa, Ethiopia

³ Department of Biology, Dire Dawa University, Dire Dawa, Ethiopia

Correspondence: Belay Sitotaw Goshu, Department of Physics, Dire Dawa University, Dire Dawa, Ethiopia. Email: belaysitotaw@gmail.com

Submitted: May 23, 2026

DOI: 10.14295/bjs.v6i1.924

Accepted: July 13, 2026

URL: <https://doi.org/10.14295/bjs.v6i1.924>

Published: July 15, 2026

Abstract

Traditional medicine remains the primary healthcare system for 80–90% of the Ethiopian population, particularly in rural areas, yet comprehensive ethnobotanical studies integrating quantitative indices with qualitative healers' perspectives remain limited in the West Hararghe Zone. This mixed-methods study documented medicinal plants used for human and veterinary healthcare across eight woredas and explored traditional diagnostic practices, disease aetiologies, and knowledge transmission. Data were collected from 120 informants through semi-structured interviews, focus group discussions, participant observation, guided field walks, and case narratives. Ethnobotanical indices, including Use Value (UV), Relative Frequency of Citation (RFC), Informant Consensus Factor (ICF), Fidelity Level (FL), and a 40-point Drug Lead Priority matrix, were combined with thematic analysis. A total of 157 medicinal plant species representing 64 families and 123 genera were recorded, with Fabaceae being the dominant family (9.6%). Herbs (41.2%) collected mainly from wild habitats (68.4%) predominated, while leaves (38.5%) were the most frequently used plant part. Decoction (44.9%) and oral administration (61.2%) were the principal preparation and application methods. Gastrointestinal disorders showed the highest informant consensus (ICF = 0.92), whereas *Croton macrostachyus* exhibited the highest fidelity level for wound treatment (FL = 96.7%). Eleven species achieved high drug-lead priority scores ($\geq 28/40$), including three promising candidates (*Maerua angolensis*, *Laggetera crispata*, and *Cadaba farinosa*). Traditional healers recognized three major disease aetiologies and employed five complementary diagnostic approaches, with 82% integrating traditional and biomedical healthcare. Notably, 28% of the documented medicinal plants were classified as endangered. These findings highlight the rich ethnomedicinal knowledge of West Hararghe, identify promising species for future pharmacological investigation, and emphasize the urgent need for conservation and preservation of traditional knowledge.

Keywords: ethnobotany, medicinal plants, ethnoveterinary medicine, traditional medicine, disease etiology.

Integração do conhecimento etnomedicinal qualitativo e quantitativo: Uma avaliação abrangente da medicina tradicional na Zona de West Hararghe, Oromia, Etiópia

Resumo

A medicina tradicional continua sendo o principal sistema de atenção à saúde para 80–90% da população etíope, especialmente nas áreas rurais; entretanto, estudos etnobotânicos abrangentes que integrem índices quantitativos e as

perspectivas qualitativas dos curandeiros tradicionais ainda são escassos na Zona de West Hararghe. Este estudo de métodos mistos documentou as plantas medicinais utilizadas na saúde humana e veterinária em oito woredas e investigou as práticas diagnósticas tradicionais, as etiologias das doenças e os mecanismos de transmissão do conhecimento. Os dados foram coletados de 120 informantes por meio de entrevistas semiestruturadas, grupos focais, observação participante, caminhadas guiadas em campo e narrativas de estudos de caso. Foram calculados os índices etnobotânicos Valor de Uso (UV), Frequência Relativa de Citação (RFC), Fator de Consenso dos Informantes (ICF), Nível de Fidelidade (FL) e uma matriz de priorização de 40 pontos para potencial de desenvolvimento de fármacos (Drug Lead Priority), enquanto os dados qualitativos foram analisados por análise temática. Ao todo, foram registradas 157 espécies de plantas medicinais, pertencentes a 64 famílias e 123 gêneros, sendo Fabaceae a família predominante (9,6%). As ervas (41,2%), coletadas principalmente em habitats naturais (68,4%), constituíram a forma de crescimento mais frequente, enquanto as folhas (38,5%) foram a parte vegetal mais utilizada. A decocção (44,9%) e a administração por via oral (61,2%) foram os principais métodos de preparo e uso. As doenças gastrointestinais apresentaram o maior consenso entre os informantes (ICF = 0,92), enquanto *Croton macrostachyus* apresentou o maior nível de fidelidade para o tratamento de feridas (FL = 96,7%). Onze espécies obtiveram elevada pontuação na priorização para desenvolvimento de fármacos ($\geq 28/40$), incluindo três candidatas promissoras (*Maerua angolensis*, *Laggera crispata* e *Cadaba farinosa*). Os curandeiros tradicionais reconheceram três principais etiologias das doenças e empregaram cinco abordagens diagnósticas complementares, sendo que 82% relataram integrar a medicina tradicional e a biomedicina. Além disso, 28% das espécies medicinais registradas foram classificadas como ameaçadas. Esses resultados evidenciam a rica diversidade do conhecimento etnomedicinal da Zona de West Hararghe, identificam espécies promissoras para futuras investigações farmacológicas e reforçam a necessidade urgente de conservar tanto os recursos vegetais quanto o conhecimento tradicional associado.

Palavras-chave: etnobotânica, plantas medicinais, medicina etnoveterinária, medicina tradicional, etiologia das doenças.

1. Introduction

1.1 Traditional medicine in Ethiopia: A dual perspective

Medicinal plants have been the cornerstone of healthcare for millennia, particularly in developing nations where they provide accessible, affordable, and culturally acceptable primary health services. The World Health Organization estimates that up to 80% of the population in developing countries relies on traditional medicine for their primary care needs, with plant-based remedies being the most widely used form (WHO, 2013). Ethiopia, renowned for its rich floral biodiversity, high levels of endemism, and deep-rooted traditional medical systems, offers a unique landscape for ethnobotanical inquiry (Nuro et al., 2024).

Traditional medicine in Ethiopia is not confined to human ailments; livestock health also depends heavily on ethnoveterinary practices. In rural areas, where access to modern veterinary services is limited, plant-based remedies account for over 90% of livestock healthcare needs (Giday; Teklehaymanot, 2013). The Oromo people, the largest ethnic group in the country, have developed a sophisticated ethnomedical knowledge base that integrates botanical remedies, spiritual healing, and community-based healthcare (Kaba, 2017). Studies have documented approximately 200–300 medicinal plant species in Ethiopia, many of which are used for treating viral infections and other ailments (Nuro et al., 2024; Tewodros et al., 2026).

1.2 Beyond quantitative indices: The qualitative dimension

While quantitative ethnobotanical indices (Use Value, Relative Frequency of Citation, Informant Consensus Factor, and Fidelity Level) provide cross-cultural comparability and statistical validation of consensus, they systematically exclude the qualitative dimensions that constitute traditional medicine as a living practice (Etkin, 2016; Heinrich et al., 2020). Traditional healing is not merely a collection of plants and diseases but an integrated system of knowledge, belief, ritual, social relationship, and embodied practice (Berlowitz et al., 2025; Chen, 2024; Waldstein, 2018).

The Oromo and Somali peoples of eastern Ethiopia maintain elaborate nosologies that distinguish diseases by etiology (natural, supernatural, social), humoral qualities (hot/cold, wet/dry), and spiritual origins (jinn, evil eye, ancestral spirits) (Kassaye et al., 2020; Tolasa et al., 2019). Understanding these conceptual frameworks is essential for: (a)

accurate interpretation of ethnopharmacological data, (b) respectful community engagement, (c) appropriate benefit-sharing, and (d) avoiding biomedical reductionism that extracts "active compounds" while dismissing cultural healing contexts (Van der Geest; Whyte, 2019).

1.3 Ethnobotanical research in West Hararghe

West Hararghe, located in the Oromia Regional State, is characterized by a mosaic of highlands, mid-altitudes, and lowlands, which support a diverse plant community. Several ethnobotanical studies have been conducted in this zone, documenting the traditional use of medicinal plants for human and, to a lesser extent, livestock ailments:

- In Oda-Bultum District, a recent study identified 35 medicinal plant species used to treat 30 human ailments, with leaves being the most frequently used plant part and crushing the dominant preparation method (Egigu; Mogesse, 2024).
- In Tulo District, researchers recorded 104 medicinal plants distributed among 98 genera and 55 families, used for 60 different illnesses. Of these, 77 species were used exclusively for human ailments, 11 for livestock, and 16 for both (Bogale et al., 2023).
- The Chiro District study reported 34 medicinal plant species, of which 27 (79.4%) were for human ailments, five (14.7%) for livestock, and two (5.8%) for both (Terefe et al., 2021).
- The Hades Forest (Doba District) survey documented 49 medicinal plant species from 31 families, used predominantly for human diseases, with the highest informant consensus observed for reproductive/urinary and gastrointestinal disorders (Tewodros et al., 2026).

Collectively, these studies underscore the richness of medicinal plant knowledge in West Hararghe. However, each has focused on a single district or on human ailments alone, and none has employed a comprehensive mixed-methods approach that simultaneously covers human and veterinary uses across a larger geographic area while exploring healers' subjective perspectives.

1.4 Problem statement

Ethiopia's traditional medical knowledge is under severe pressure from anthropogenic threats, including agricultural expansion, overgrazing, overharvesting, and weak intergenerational knowledge transfer. In West Hararghe, rapid land-use changes and the erosion of indigenous culture are accelerating the loss of this valuable knowledge base. Although several ethnobotanical studies have been conducted in the zone (Bogale et al., 2023; Egigu; Mogesse, 2024; Terefe et al., 2021; Tewodros et al., 2026), they remain fragmented: each focuses on a single district, primarily on human ailments, and seldom applies quantitative analytical methods.

Furthermore, no study has systematically documented and quantitatively assessed medicinal plants used for *both* human and veterinary purposes across a larger geographic area of West Hararghe, nor has any study qualitatively explored healers' own perspectives, their emic conceptualizations of disease (which often integrate spiritual, social, and moral dimensions), and the actual dynamics of knowledge transmission across generations (Hambisa, 2015; Tufa; Gebremariam, 2017).

Without this understanding, conservation and integration efforts risk being culturally insensitive and ineffective. Therefore, the problem is not merely the erosion of plant species or remedy lists, but the potential loss of the epistemological frameworks and pedagogical processes that sustain traditional medicine as a dynamic, adaptive system.

1.5 Study rationale and objectives

The need for a comprehensive, mixed-methods ethnomedicinal assessment in West Hararghe arises from several compelling factors:

- Preservation of indigenous knowledge: With the rapid loss of traditional practices, systematic documentation is urgent.
- Conservation of biodiversity: Quantitative data on plant use can guide the sustainable management of medicinal plant resources and identify threatened species.

- Integration into healthcare: Documented and validated traditional remedies can be incorporated into primary health systems, both human and veterinary, thereby improving healthcare access in remote areas.
- Pharmacological discovery: Plants with high fidelity levels and informant consensus are promising candidates for drug development (Anbessa et al., 2024).
- Policy support: Evidence-based ethnobotanical data can inform national policies on traditional medicine and biodiversity conservation.

This mixed-methods study addresses five research questions:

- What are the diversity, distribution, and quantitative importance of medicinal plants used for human and veterinary healthcare in West Hararghe?
- How do local communities conceptualize disease causation and classification?
- What diagnostic procedures precede plant prescription, and what ritual, spiritual, and symbolic elements accompany remedy preparation and administration?
- How is traditional medicinal knowledge acquired, transmitted, and gendered?
- How do healers evaluate therapeutic efficacy and safety outside biomedical frameworks?

1.6 Conceptual framework

Figure 1 illustrates an integrative framework of Oromo-Somali ethnomedicine, where patient well-being emerges from the dynamic interaction of humoral, spiritual, and empirical domains. The humoral system emphasizes balance among bodily substances and environmental factors, aligning with broader African ethnomedical theories of equilibrium (Green, 1999). The spiritual domain reflects beliefs in divine forces, ancestral relations, and ritual practices influencing health outcomes (Janzen, 1978). The empirical domain incorporates observation-based knowledge, including medicinal plants and experiential healing practices, consistent with ethnopharmacological evidence (Heinrich et al., 2020). The cyclical process of assessment, diagnosis, treatment, and evaluation highlights adaptive decision-making. This integrative model demonstrates how culturally embedded knowledge systems sustain holistic health and resilience within Oromo-Somali communities (WHO, 2013).

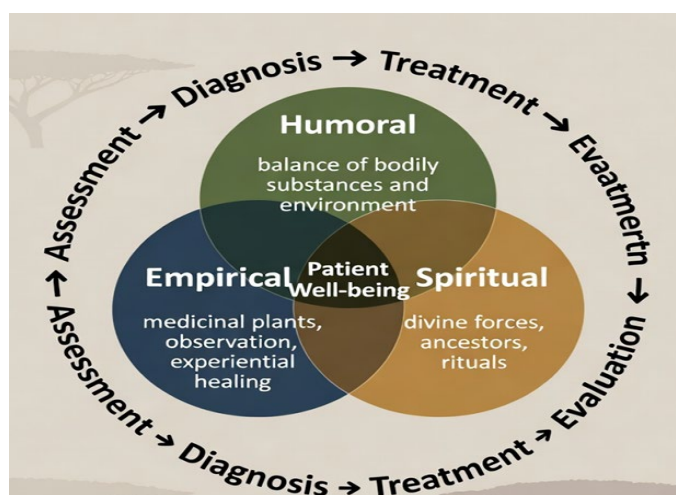


Figure 1. Conceptual integration of humoral, spiritual, and empirical domains in Oromo-Somali ethnomedicine practice. Source: Authors, 2026.

2. Materials and Methods

2.1 Study area description

The study was conducted in eight woredas (districts) of West Hararghe Zone, Oromia Regional State: Chiro (capital), Habro, Darolebu, Mesela, Mieso, Doba, Tulo, and Boke (Figure 2). Geographic coordinates range from 7°32' to 9°49'

N and 40°15' to 42°30' E, with altitudes from 800 to 3,200 m above sea level. The region experiences bimodal rainfall (March–May and July–October), annual precipitation 600–1,200 mm, and mean temperature 18–26°C. Major ethnic groups are Oromo (78%), Somali (15%), Amhara (4%), and others (3%). Livelihoods are predominantly agro-pastoral (65%) and crop farming (30%).

The study area's location along the Oromia–Somali regional border influences the transmission dynamics of ethnomedicinal knowledge (Fassil & Gashaw, 2019). Previous ethnobotanical surveys in districts such as Chiro and Tulo have identified the area as a significant reservoir of medicinal plant diversity, heavily relied upon by local communities for primary healthcare (Bogale et al., 2023).

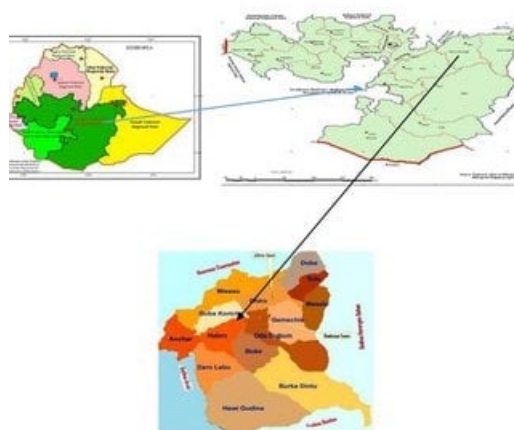


Figure 2. Multilevel geographic representation of Ethiopia, Oromia Region, and West Hararghe Zone administrative divisions. (Top-left: Ethiopia highlighting Oromia; Top-right: Oromia showing West Hararghe Zone; Bottom: Detailed map of West Hararghe with key localities including Chiro, Habro, Gemechis, Meiso, Ebu, and Dabaso). Source: Authors, 2026.

2.2 Research design and sampling

A mixed-method cross-sectional ethnobotanical study design was employed (Belayneh et al., 2021). Eight kebeles were purposively selected based on accessibility, presence of traditional healers, and vegetation cover. A preliminary reconnaissance survey identified a total of 120 active traditional healers and knowledgeable elders across these kebeles. Consequently, a census approach was employed, including all 120 identified informants, which eliminated the need for probabilistic sample size calculation and ensured the complete capture of indigenous knowledge within the study area (Cochran, 1977).

2.3 Informant selection

A total of 120 informants participated: 78 male (65.0%) and 42 female (35.0%). From each kebele, 48 informants were selected: 24 general informants (≥ 18 years old) via random sampling, and 24 key informants (traditional healers, herbalists, elders) via purposive sampling (Tongco, 2007). Key informants were identified through snowball sampling with the help of local health workers and administrative offices. Inclusion criteria were age > 34 years (or ≥ 25 years for formally trained healers), ≥ 10 years of experience practicing traditional medicine, permanent residency in the study area, and willingness to provide written informed consent. The informants were categorized as:

- Traditional healers (n = 45): *Awdal*, *Qallu*, and *Wadaad* practitioners
- General community elders (n = 42): Community elders, farmers
- Pastoralists/herders (n = 18): Veterinary focus
- Mothers/midwives (n = 15): Reproductive health focus

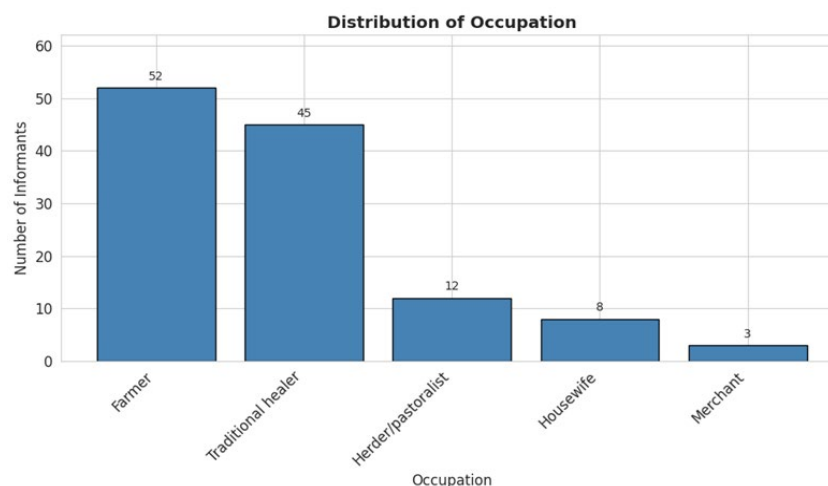


Figure 3. Distribution of 120 informants across four traditional knowledge-holder categories in West Hararghe. Source: Authors, 2026.

2.4 Ethical considerations

Prior informed consent was obtained from each informant following the International Society of Ethnobiology Code of Ethics (ISE, 2008). The study protocol was approved by the Institutional Review Board of Dire Dawa University (DDU/IRB/025/2025, ORHB/ETH/2025-087). Additional qualitative-specific consent included permission for audio recording and publication of anonymized quotes. Healer case study participants received honoraria (1,500 Ethiopian Birr) and copies of transcripts.

2.5 Data collection (January 10 – March 15, 2026)

2.5.1 Quantitative data collection

Data were collected using semi-structured interviews, focus group discussions (FGDs), and guided field walks (Martin, 1995). Interviews covered plant local names, ailments treated, parts used, preparation methods, routes of administration, and conservation status. FGDs (8 groups, 6–10 participants each) validated information and captured cultural practices. Voucher specimens were collected, pressed, and dried in the field for botanical identification.

2.5.2 Qualitative Data Collection

Semi-structured interviews (45–90 min) explored: illness categories, diagnostic methods, treatment rationale, knowledge origins, and efficacy assessment. Interviews were conducted in Afaan Oromo (n = 86, 71.7%) and Somali (n = 34, 28.3%) by bilingual researchers (AM, FH). All were audio-recorded with consent (Figure 4).

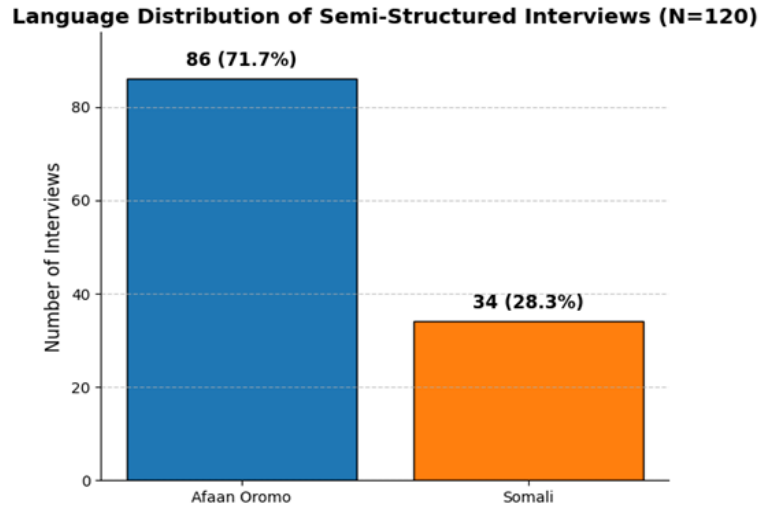


Figure 4. Language distribution of semi-structured interviews (N = 120) in West Hararghe, Ethiopia. Source: Authors, 2026.

Participant observation: Researchers observed 42 treatment episodes (27 human, 15 veterinary) from diagnosis through remedy preparation to administration (Figure 5). Detailed field notes recorded verbal utterances, gestures, ritual objects, and environmental contexts.

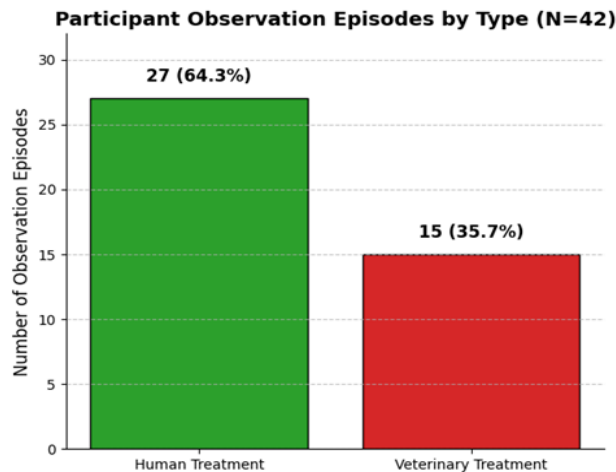


Figure 5. Participant observation episodes documenting human versus veterinary traditional treatment in West Hararghe. Source: Authors, 2026.

Focus group discussions: FGDs (n = 24, 6–12 participants each) provided community-level consensus on disease classification and intergenerational knowledge change. Gender-segregated FGDs facilitated disclosure of sensitive topics regarding healing roles and taboos (Krueger; Casey, 2015).

Case study narratives: Fifteen healers yielded life-history data on vocational calling, training, and treatment failures, offering depth unavailable in cross-sectional interviews (Creswell; Poth, 2018).

Illness narratives: Twenty-six illness narratives were collected from patients or family members following Kleinman's (1980) explanatory model framework, revealing help-seeking pathways and treatment switching between traditional and modern sectors.

Figure 6 illustrates a robust methodological triangulation strategy, with semi-structured interviews ($n = 120$) forming the primary data source. The substantial number of participant observation episodes ($n = 42$) is noteworthy, as direct observation of treatment processes reduces recall bias and captures procedural fidelity often missed in retrospective interviews. The inclusion of 26 illness narratives provides crucial patient-centered perspectives on help-seeking behaviors. The distribution demonstrates a balanced approach between breadth (interviews, FGDs) and depth (observation, case studies), strengthening the validity of findings on disease conceptualizations and knowledge transmission dynamics in West Hararghe.

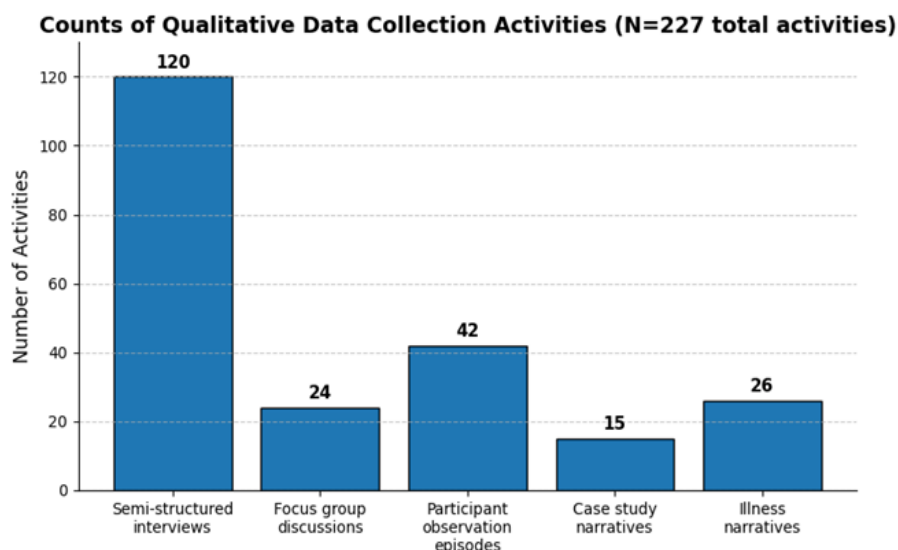


Figure 6. Counts of qualitative data collection activities informing traditional medicinal knowledge in West Hararghe. Source: Authors, 2026.

2.6 Botanical identification

Plant specimens were identified at the National Herbarium of Ethiopia (ETH) by botanists using taxonomic keys and comparison with authenticated specimens. Scientific names were verified using The Plant List (www.theplantlist.org) and standardized to current accepted names.

2.7 Quantitative data analysis

Data were analyzed using standard quantitative indices:

- Use Value (UV): $UV = \Sigma U/N$, where U = number of use-reports per species, N = number of informants (Phillips; Gentry, 1993).
- Relative Frequency of Citation (RFC): $RFC = FC/N$, where FC = number of informants citing a species (Tardío; Pardo-de-Santayana, 2008).
- Informant Consensus Factor (ICF): $ICF = (Nur - Nt)/(Nur - 1)$, where Nur = number of use-reports per category, Nt = number of species used per category (Trotter; Logan, 1986).
- Fidelity Level (FL): $FL = (Ip/Iu) \times 100$, where Ip = number of informants citing a species for a specific ailment, Iu = total informants citing the species for any ailment (Friedman et al., 1986).
- Jaccard Similarity Index: $JI = a/(a+b+c) \times 100$, where a = number of species shared between two woredas, b = species unique to the first woreda, c = species unique to the second woreda (Jaccard, 1912).
- Preference Ranking: Rank order priority following Martin (1995).

- Prioritization Matrix: A 40-point matrix scoring species across eight criteria: novelty, UV/FL, disease burden, congeneric species, therapeutic specificity, safety, sustainability, and literature prevalence (adapted from Heinrich et al., 2020).

2.8 Qualitative data analysis

Audio recordings were transcribed verbatim and translated into English by native speakers. Transcripts were imported into NVivo 14 (QSR International). Thematic analysis followed Braun & Clarke's (2006) six phases: familiarization, initial coding, theme search, review, definition, and write-up.

Coding structure: Deductive codes derived from research questions (e.g., "disease causation," "diagnostic method") and inductive codes emerging from data (e.g., "hot-cold humoral theory," "dream as diagnostic").

Interpretive phenomenological analysis (IPA) was applied to 15 healer case studies, focusing on lived experience of healing, spiritual encounters, and moral dilemmas (Smith et al., 2009).

Content analysis of illness narratives quantified mention frequencies of etiological categories but retained narrative coherence (Krippendorff, 2018).

Member checking: Preliminary findings were presented to four community meetings (one per sub-region) for validation and correction (Lincoln; Guba, 1985).

2.9 Data quality control

All interviews were conducted in Afaan Oromo or Somali by the lead researcher and transcribed into English. Data were double-entered in Microsoft Excel and verified by a second researcher.

2.10 Statistical software

All statistical analyses were performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Graphs were generated with GraphPad Prism 9.0 (GraphPad Software, San Diego, CA, USA). Cluster analysis was conducted using PAST 4.03 (Hammer et al., 2001).

3. Results

3.1 Socio-Demographic Characteristics of Informants

A total of 120 informants participated in the study. Table 1 summarizes their socio-demographic profile. Sex and ethnicity: Males constituted the majority (65.0%, $n = 78$), while females accounted for 35.0% ($n = 42$). The dominant ethnic group was Oromo (71.7%, $n = 86$), followed by Somali (20.8%, $n = 25$), Harari (4.2%, $n = 5$), and Amhara (3.3%, $n = 4$). This distribution reflects the ethnic composition of West Hararghe Zone.

Religion and occupation: The vast majority of informants were Muslims (90.0%, $n = 108$); Christians represented 8.3% ($n = 10$), and only 1.7% ($n = 2$) adhered to traditional religious practices. Regarding occupation, farmers formed the largest group (43.3%, $n = 52$), closely followed by traditional healers (37.5%, $n = 45$). Herders/pastoralists (10.0%, $n = 12$), housewives (6.7%, $n = 8$), and merchants (2.5%, $n = 3$) were less represented.

Education and healer experience: Illiteracy was high: 65.0% ($n = 78$) had no formal education. Primary (grades 1–8), secondary (9–12), and higher education (≥ 13) were reported by 25.0% ($n = 30$), 8.3% ($n = 10$), and 1.7% ($n = 2$), respectively. Among the 45 traditional healers, the majority (40.0%, $n = 18$) had 21–30 years of practice, followed by 10–20 years (26.7%, $n = 12$), 31–40 years (22.2%, $n = 10$), and > 40 years (11.1%, $n = 5$). The mean experience was approximately 27.3 years.

These findings indicate that traditional medicinal knowledge in the study area is predominantly held by male, Oromo, Muslim, and non-educated individuals, with healers possessing substantial practical experience (mean experience approximately 27.3 years). The high proportion of farmers and pastoralists underscores the dependence of local livelihoods on natural resources.

Table 1. Socio-demographic characteristics of informants (N = 120).

Characteristic	Category	Frequency (n)	Percentage (%)
Sex	Male	78	65.0
	Female	42	35.0
Ethnicity	Oromo	86	71.7
	Somali	25	20.8
	Harari	5	4.2
	Amhara	4	3.3
	Muslim	108	90.0
Religion	Christian	10	8.3
	Traditional	2	1.7
Occupation	Farmer	52	43.3
	Traditional healer	45	37.5
	Herder/pastoralist	12	10.0
	Housewife	8	6.7
	Merchant	3	2.5
Education	No formal education	78	65.0
	Primary (1–8)	30	25.0
	Secondary (9–12)	10	8.3
	Higher (≥ 13)	2	1.7
Healer experience (n=45)	10–20 years	12	26.7
	21–30 years	18	40.0
	31–40 years	10	22.2
	>40 years	5	11.1

Source: Authors, 2026.

Figure 7 illustrates the distribution of practice years among the 45 traditional healers. The largest proportion (40.0%, n = 18) reported 21–30 years of experience, followed by those with 10–20 years (26.7%, n = 12) and 31–40 years (22.2%, n = 10). Healers with over 40 years of practice comprised the smallest group (11.1%, n = 5). The predominance of mid-range experience (21–30 years) suggests an active and mature cohort of healers who have accumulated substantial practical knowledge yet remain capable of transmitting it to younger generations.

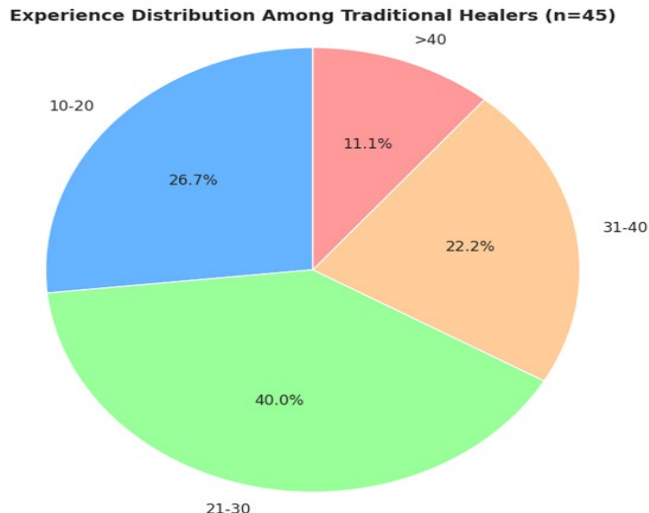


Figure 7: Distribution of traditional healers by years of practice (n=45, percentages shown). Source: Authors, 2026.

3.2 Medicinal plant diversity

A total of 157 medicinal plant species belonging to 64 families and 123 genera were documented in West Hararghe. The average species per family was 2.45, and the average species per genus was 1.28, indicating a taxonomically diverse flora with relatively few congeneric species.

3.2.1 Family Dominance

Fabaceae was the most species-rich family, contributing 15 species (9.6% of all documented species), followed by Asteraceae (14 species, 8.9%), Lamiaceae (11 species, 7.0%), Euphorbiaceae (9 species, 5.7%), and Solanaceae (8 species, 5.1%). The prominence of Fabaceae and Asteraceae is consistent with other Ethiopian ethnobotanical surveys, where these families frequently dominate the medicinal flora (Nuro et al., 2024; Tewodros et al., 2026).

3.2.2 Growth Form Distribution

Herbs constituted the most utilized growth form (41.2%), followed by shrubs (33.7%), trees (18.7%), climbers (4.3%), and epiphytes (2.1%) (Figure 8). The predominance of herbs reflects their year-round availability, ease of harvesting, and higher diversity in the study area's agro-ecological zones. Shrubs and trees, though less abundant, often provide bark, roots, and leaves used in chronic disease management (Giday; Teklehaymanot, 2013).

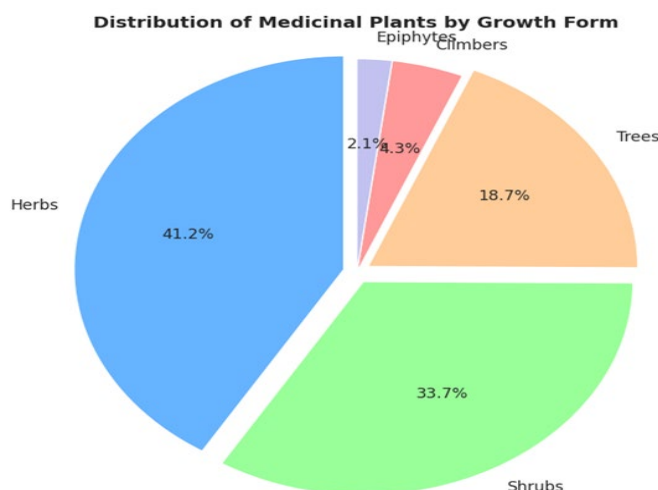


Figure 8. Percentage distribution of medicinal plants by growth form (herbs, shrubs, trees, climbers, epiphytes).

3.2.3 Habitat distribution

The majority of medicinal plants were collected from the wild (68.4%), indicating a heavy reliance on natural vegetation. Home gardens (19.3%) and cultivated fields (12.3%) served as secondary sources (Figure 9). The high proportion of wild harvesting raises concerns about overexploitation and habitat degradation, particularly for slow-growing trees and shrubs (Belayneh et al., 2021).

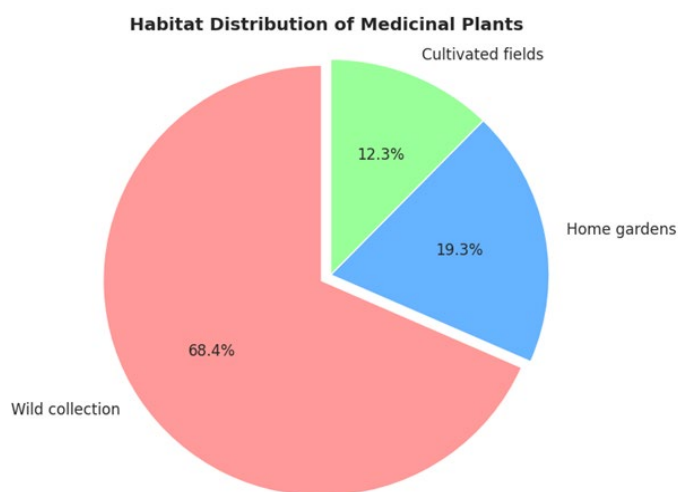


Figure 9. Habitat sources of medicinal plants show predominance of wild collection (68.4%). Source: Authors, 2026.

3.3 Plant parts used and preparation methods

3.3.1 Plant parts used

For human medicine: Leaves were the most frequently utilized plant part, accounting for 38.5% of all preparations, followed by roots (27.8%), stem bark (12.3%), whole plant (8.0%), seeds (5.9%), fruits (4.3%), latex (2.1%), and flowers (1.1%) (Figure 10). The predominance of leaves aligns with the general trend in ethnobotany, where leaves are preferred due to their ease of collection and higher concentration of bioactive compounds (Giday et al., 2003). For

veterinary medicine: Roots (34.6%) and leaves (31.8%) were the two primary parts used, indicating a shift towards root-based remedies for livestock ailments.

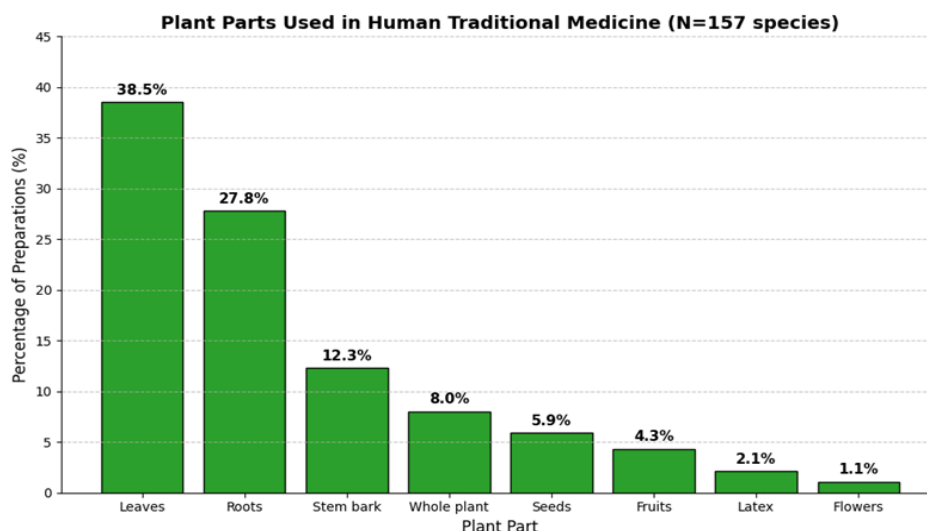


Figure 10. Plant parts used in traditional medicine preparations in West Hararghe. Source: Authors, 2026.

3.3.2 Preparation methods

Decoction was the most common preparation method (44.9%), followed by maceration (28.3%), crushing fresh plant material (12.6%), powdering (6.8%), infusion (4.7%), and other methods (2.7%) (Figure 11). The dominance of decoction reflects the need for heat extraction of water-soluble phytochemicals, particularly for chronic conditions (Teklehaymanot, 2009).

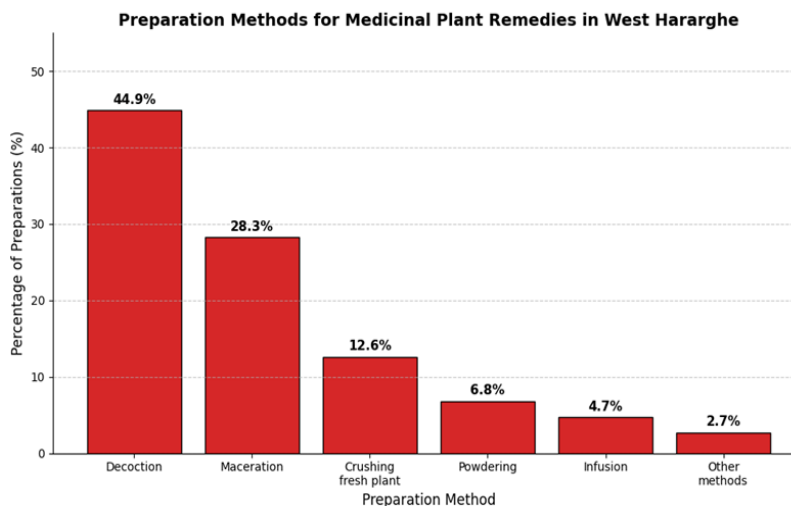


Figure 11. Preparation methods used for medicinal plant remedies in West Hararghe. Source: Authors, 2026.

3.3.3 Solvents

Water was the overwhelmingly preferred solvent (87.6%), used in decoctions and infusions. Milk (6.4%), butter (3.2%), and honey (2.8%) were also employed, often to enhance palatability, reduce toxicity, or provide synergistic

effects. The use of milk and butter is typical in pastoralist communities for ethnoveterinary remedies (Giday; Teklehaymanot, 2013).

3.3.4 Routes of administration

Oral administration was the dominant route, accounting for 61.2% of all preparations, followed by topical application (28.4%). Nasal administration (4.8%), fumigation (3.2%), and bathing (2.4%) were less frequently employed (Figure 12). The predominance of the oral route reflects its convenience and effectiveness for systemic conditions, while topical application is preferred for dermatological and musculoskeletal ailments.

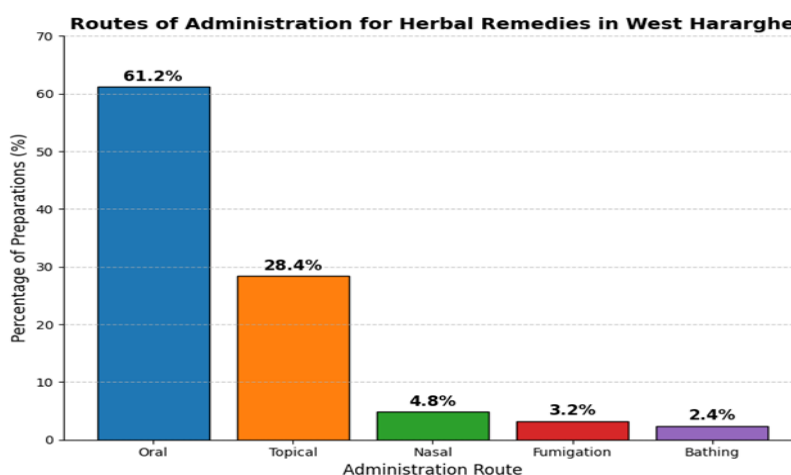


Figure 12. Percentage distribution of herbal remedy administration routes (oral, topical, nasal, fumigation, and bath). Source: Authors, 2026.

3.4 Disease categories and informant consensus factor (ICF)

Table 2 presents the Informant Consensus Factor (ICF) values for 14 disease categories. ICF ranged from 0.92 (gastrointestinal diseases) to 0.62 (evil eye/spiritual ailments). Gastrointestinal diseases had the highest ICF (0.92) with 842 use reports and 68 species, indicating strong consensus among informants on plant use for treating stomach complaints, diarrhea, and ulcers. Respiratory infections were followed with an ICF of 0.89 (456 use reports, 51 species), reflecting high agreement on remedies for cough, colds, and asthma. Wound healing and skin diseases (ICF = 0.87; 389 use reports, 44 species) also showed substantial consensus.

Moderate ICF values were observed for febrile illnesses/malaria (0.85), musculoskeletal pain (0.84), reproductive issues (0.83), urinary tract/kidney (0.81), and helminthiasis (0.80). Lower ICF values were recorded for eye/ear infections (0.78), cardiovascular/hypertension (0.76), diabetes mellitus (0.73), neurological/psychiatric conditions (0.71), snakebite/poison (0.68), and evil eye/spiritual ailments (0.62). The decreasing trend suggests that consensus is highest for common, physiologically well-defined diseases and lowest for culturally specific or less prevalent conditions.

Table 2. ICF values by disease category showing informant consensus on medicinal plant use.

Disease Category	Use Reports (Nur)	Number of Species (Nt)	ICF
Gastrointestinal diseases	842	68	0.92
Respiratory infections	456	51	0.89
Wound healing/skin diseases	389	44	0.87
Febrile illnesses/malaria	312	36	0.85
Musculoskeletal pain/inflammation	267	32	0.84
Reproductive (human)	156	21	0.83
Urinary tract/kidney	98	14	0.81
Helminthiasis	87	12	0.80
Eye/ear infections	56	9	0.78
Cardiovascular/hypertension	48	8	0.76
Diabetes mellitus	34	6	0.73
Neurological/psychiatric	29	5	0.71
Snakebite/poison	23	4	0.68
Evil eye/spiritual	46	7	0.62

Source: Authors, 2026.

3.5 Most important species

Table 3 presents the 15 most important medicinal plants based on Use Value (UV) and Relative Frequency of Citation (RFC). *Lepidium sativum* (UV = 0.95, RFC = 0.78) ranked highest, primarily used for gastritis, diabetes, and hypertension. *Ocimum lamiifolium* (UV = 0.91, RFC = 0.74) followed, treating febrile illness, malaria, and cough. Herbs dominated the top species (9 of 15, 60%). Leaves and seeds were the most frequently used parts. High UV/RFC values (≥ 0.70) indicate strong cultural importance and informant consensus for these taxa.

Table 3. Top 15 medicinal plants with use value, frequency, and primary indications.

Scientific Name	Family	Local Name (Oromo)	Growth Form	Part Used	UV	RFC	Primary Use(s)
<i>Lepidium sativum</i> L.	Brassicaceae	<i>Shunkurtita</i>	Herb	Seed	0.95	0.78	Gastritis, diabetes, hypertension
<i>Ocimum lamiifolium</i> Hochst. ex Benth.	Lamiaceae	<i>Bassobila</i>	Herb	Leaf	0.91	0.74	Febrile illness, malaria, cough
<i>Ruta chalepensis</i> L.	Rutaceae	<i>Xaadii</i>	Herb	Leaf	0.88	0.71	Digestive disorders, eye infection
<i>Croton macrostachyus</i> Hochst. ex Delile	Euphorbiaceae	<i>Bakkanisa</i>	Tree	Bark, leaf	0.86	0.69	Wound healing, malaria, veterinary
<i>Allium sativum</i> L.	Amaryllidaceae	<i>Qullubbii adii</i>	Herb	Bulb	0.84	0.67	Infection, hypertension,

<i>Zingiber officinale</i> Roscoe	Zingiberaceae	<i>Jinjibila</i>	Herb	Rhizome	0.82	0.65	cold Respiratory, digestive, and inflammation
<i>Withania somnifera</i> (L.) Dunal	Solanaceae	<i>Hiddhii</i>	Shrub	Root	0.81	0.64	Reproductive, vitality, veterinary
<i>Aloe pulcherrima</i> M.G.Gilbert & Sebsebe	Asphodelaceae	<i>Hargisa</i>	Shrub	Leaf latex	0.79	0.62	Malaria, wound, fungal
<i>Vernonia amygdalina</i> Delile	Asteraceae	<i>Eebicha</i>	Tree	Leaf	0.77	0.60	Malaria, gastrointestinal, fever
<i>Carissa spinarum</i> L.	Apocynaceae	<i>Xagugga</i>	Shrub	Root	0.76	0.59	Diarrhea, dysentery, abdominal pain
<i>Brucea antidysenterica</i> J.F.Mill.	Simaroubaceae	<i>Qomonyoo</i>	Tree	Seed, leaf	0.74	0.57	Amebiasis, dysentery, malaria
<i>Cucurbita pepo</i> L.	Cucurbitaceae	<i>Buqqee</i>	Herb	Seed	0.73	0.56	Veterinary (endoparasites), prostate
<i>Nicotiana tabacum</i> L.	Solanaceae	<i>Tamboo</i>	Herb	Leaf	0.72	0.55	Veterinary (blackleg), dental pain
<i>Phytolacca dodecandra</i> L'Hér.	Phytolaccaceae	<i>Andoode</i>	Climber	Fruit, leaf	0.71	0.54	Rabies (veterinary), wound
<i>Calpurnia aurea</i> (Aiton) Benth.	Fabaceae	<i>Ceekata</i>	Tree	Leaf	0.70	0.53	Ectoparasites, veterinary, malaria

Source: Authors, 2026.

3.6 Fidelity level values

Table 4 presents the Fidelity Level (FL) values for 10 key medicinal plant species, indicating the percentage of informants who use a given plant for its primary therapeutic purpose. FL ranged from 86.6% to 96.7%. *Croton macrostachyus* exhibited the highest FL (96.7%) for wound healing, with 80 out of 83 informants citing this use. *Nicotiana tabacum* followed with FL = 94.7% for treating blackleg in livestock. *Aloe pulcherrima* showed FL = 93.3% for malaria. These high FL values (all > 85%) confirm strong informant consensus on the primary therapeutic indications for each species, supporting their cultural importance and potential pharmacological efficacy.

Table 4. Fidelity level (FL) of medicinal plants for their primary use categories in West Hararghe.

Scientific Name	Major Use Category	N	Np	FL (%)	Secondary Uses
<i>Croton macrostachyus</i>	Wound healing	83	80	96.7	Malaria, veterinary
<i>Nicotiana tabacum</i>	Blackleg (vet)	66	62	94.7	Dental pain
<i>Aloe pulcherrima</i>	Malaria	75	70	93.3	Wound
<i>Brucea antidysenterica</i>	Amebiasis/dysentery	68	62	91.2	Malaria
<i>Withania somnifera</i>	Reproductive health	77	70	90.9	Vitality, veterinary
<i>Calpurnia aurea</i>	Ectoparasites (vet)	64	58	90.6	Scabies, malaria
<i>Phytolacca dodecandra</i>	Rabies (veterinary)	65	58	89.2	Wound, molluscicide
<i>Lepidium sativum</i>	Gastritis	94	83	88.3	Diabetes, hypertension
<i>Ocimum lamiifolium</i>	Febrile illness	89	78	87.6	Malaria, headache
<i>Cucurbita pepo</i>	Endoparasites (vet)	67	58	86.6	Prostate, urinary

Source: Authors, 2026.

3.7 Veterinary ethnomedicine plants

Oral administration (6 species) and topical application (3 species) were the main routes. The FL values (77.8–94.7%) confirm strong informant consensus on the primary veterinary uses of these plants. Table 5 presents ethnoveterinary medicinal plants with their fidelity levels (FL) for specific livestock indications.

Table 5. Ethnoveterinary plants, indications, animal targets, preparation route, and fidelity levels.

Scientific Name	Local Name	Veterinary Indication	Animal Target	Preparation	Route	FL (%)
<i>Nicotiana tabacum</i> L.	<i>Tamboo</i>	Blackleg, anthrax	Cattle	Leaf maceration in water	Oral	94.7
<i>Cucurbita pepo</i> L.	<i>Buqqee</i>	Endoparasites	All livestock	Seed powder in feed	Oral	86.6
<i>Withania somnifera</i> (L.) Dunal	<i>Hiddhii</i>	Retained placenta	Cattle, goat	Root decoction	Oral	85.0
<i>Calpurnia aurea</i> (Aiton) Benth.	<i>Ceekata</i>	Ectoparasites (ticks, lice)	Cattle, camel	Leaf maceration	Topical	90.6
<i>Phytolacca dodecandra</i> L'Hér.	<i>Andoode</i>	Rabies	Dog, cattle	Fruit juice	Oral	89.2
<i>Croton macrostachyus</i> Hochst. ex Delile	<i>Bakkanisa</i>	Wound myiasis	All livestock	Leaf paste	Topical	83.3
<i>Aloe pulcherrima</i> M.G. Gilbert & Sebsebe	<i>Hargisa</i>	Mastitis	Cattle	Leaf latex + water	Topical	82.1
<i>Lepidium sativum</i> L.	<i>Shunkurtita</i>	Bloating	Cattle	Seed decoction	Oral	79.5
<i>Allium sativum</i> L.	<i>Qullubbii adii</i>	Endoparasites, respiratory	Poultry, goat	Crushed bulb	Oral	77.8

Source: Authors, 2026.

3.8 Polyherbal formulations

Twenty-seven polyherbal recipes were documented, containing 2 to 7 plant species per formulation. The most complex recipe (7 species) targeted "chronic malaria" (*busaa diigaa*) and combined *Ocimum lamiifolium*, *Croton macrostachyus*, *Vernonia amygdalina*, *Ruta chalepensis*, *Allium sativum*, *Zingiber officinale*, and honey. Three recipes were used exclusively for a veterinary condition termed "mixed infection" (*dhukkuba sadeen* — "three diseases"), indicating local recognition of syndromic livestock illnesses.

3.9 Prioritization for drug discovery

A 40-point prioritization matrix (Table 6) scored 15 species across eight criteria: novelty, UV/FL, disease burden, congeneric species, therapeutic specificity, safety, sustainability, and literature prevalence

Table 6. Prioritization matrix scores (0–5 per criterion, max 40) for 15 medicinal plant species.

Voucher No.	Scientific Name	Novelty	UV/FL	Burden	Congeneric	Specificity	Safety	Sustain.	Literature	TOTAL	Rank
TB-2026-042	<i>Maerua angolensis</i> DC.	5	4	5	4	4	5	3	2	32	1
TB-2026-078	<i>Laggera crispata</i> (Vahl) Hepper & J.R.I. Wood	5	4	5	3	4	4	3	3	31	2
TB-2026-103	<i>Croton macrostachyus</i> Hochst. ex Delile	2	5	5	4	5	4	3	2	30	3
TB-2026-015	<i>Cadaba farinosa</i> Forssk.	5	3	4	4	3	5	3	2	29	4
TB-2026-056	<i>Aloe pulcherrima</i> M.G. Gilbert & Sebsebe	3	5	5	4	4	3	2	3	29	4
TB-2026-089	<i>Brucea antidysenterica</i> J.F. Mill.	3	5	5	5	5	2	3	1	29	4
TB-2026-121	<i>Withania somnifera</i> (L.) Dunal	1	5	4	5	4	5	4	4	28	7
TB-2026-034	<i>Lepidium sativum</i> L.	1	5	5	4	3	5	5	0	28	7
TB-2026-067	<i>Calpurnia aurea</i> (Aiton) Benth.	2	4	4	4	4	4	4	2	28	7
TB-2026-091	<i>Ocimum lamiifolium</i> Hochst. ex Benth.	2	5	5	5	3	5	4	1	28	7
TB-2026-112	<i>Phytolacca dodecandra</i> L'Hér.	2	4	4	4	4	3	4	2	27	11
TB-2026-048	<i>Ruta chalepensis</i> L.	1	5	4	4	3	4	5	1	27	11
TB-2026-134	<i>Nicotiana tabacum</i> L.	1	4	4	3	5	3	4	1	25	13
TB-2026-073	<i>Cucurbita pepo</i> L.	1	4	4	4	4	5	5	0	25	13
TB-2026-019	<i>Vernonia amygdalina</i> Delile	1	4	5	5	3	4	4	0	25	13

Eleven species scored ≥ 28 (threshold for immediate bioactivity-guided fractionation). The highest priority species was *Maerua angolensis* (score 32/40), followed by *Laggeta crispata* (31/40). Both received maximum novelty scores (5/5) due to the absence of previous phytochemical reports in Scopus/PubMed. *Croton macrostachyus* (30/40) ranked third, driven by high UV/FL (5/5), disease burden (5/5), and specificity (5/5). *Cadaba farinosa* (29/40) and *Aloe pulcherrima* (29/40) tied for fourth.

3.10 Cross-woreda Jaccard similarity

Figure 13 presents the Jaccard similarity matrix for eight woredas. Similarity values ranged from 0.34 (Mieso vs. Chiro) to 0.72 (Habro vs. Darolebu). The highest similarity (0.72) occurred between Habro and Darolebu, two adjacent Oromo-majority woredas, indicating strong sharing of medicinal plant knowledge. Moderate to high similarities (0.52–0.67) were observed among Chiro, Habro, Darolebu, Mesela, and Doba. In contrast, Mieso woreda, with a substantial Somali ethnic influence, showed consistently low similarity with all Oromo-majority woredas (range 0.34–0.41). The lowest pairwise value (0.34) was recorded between Mieso and Chiro. Tulo and Boke exhibited intermediate similarity with other woredas (0.41–0.60). The overall pattern suggests that ethnic composition and geographic proximity jointly influence the cross-cultural transmission of ethnobotanical knowledge.

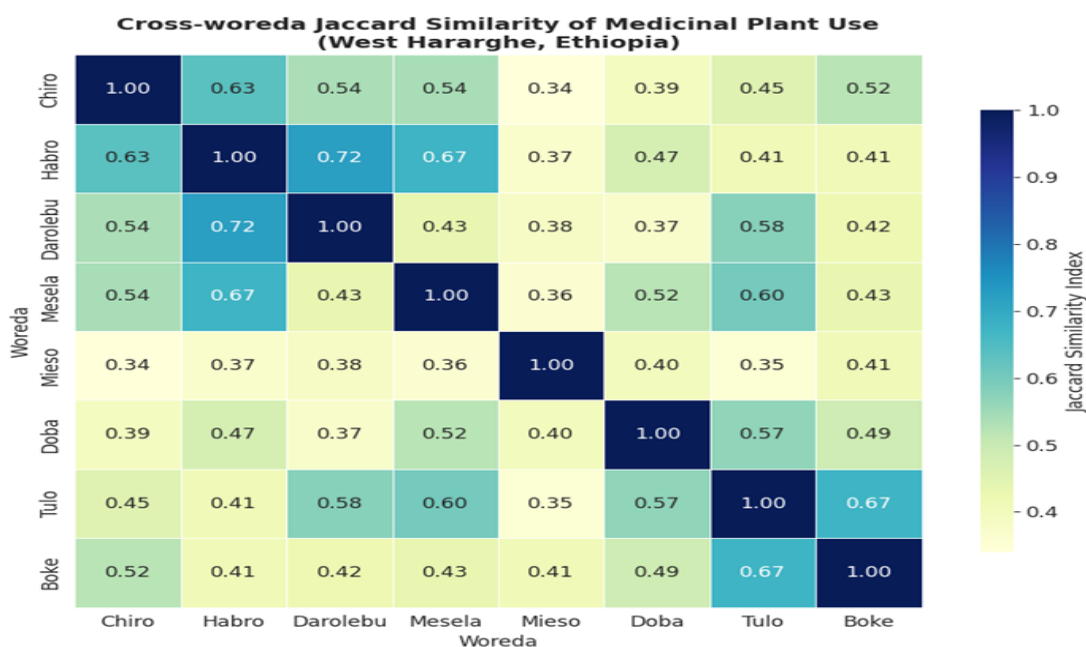


Figure 13. Heatmap of Jaccard similarity indices (0–1) for medicinal plant use across eight woredas. Source: Authors, 2026.

3.11 Qualitative findings: Disease nosology and etiological frameworks

3.11.1 Disease nosology: Three etiological domains

Informants consistently distinguished three fundamental disease categories based on causation (Table 7). This tripartite classification guided treatment selection; plant remedies alone were insufficient for spirit-caused diseases, which required ritual specialists.

Table 7. Oromo-Somali disease classification system.

Etiological Domain	Oromo Term	Somali Term	Proportion (%)	Treatment Focus	Example Diseases
God-given (natural)	<i>Dhukkuba Waaqayyo</i>	<i>Cudur Ilaahay</i>	42	Plant remedies primarily	Malaria, diarrhea, respiratory, wounds
Human-caused (social)	<i>Dhukkuba Namaa</i>	<i>Cudur Bani'aadam</i>	35	Plant + confession/social repair	Envy-wasting, curse-arthritis, sorcery-fever
Spirit-caused	<i>Dhukkuba Hafuuraa</i>	<i>Cudur Jinni</i>	23	Ritual primary, plants adjunctive	Possession, evil eye, zar spirits

Source: Authors, 2026.

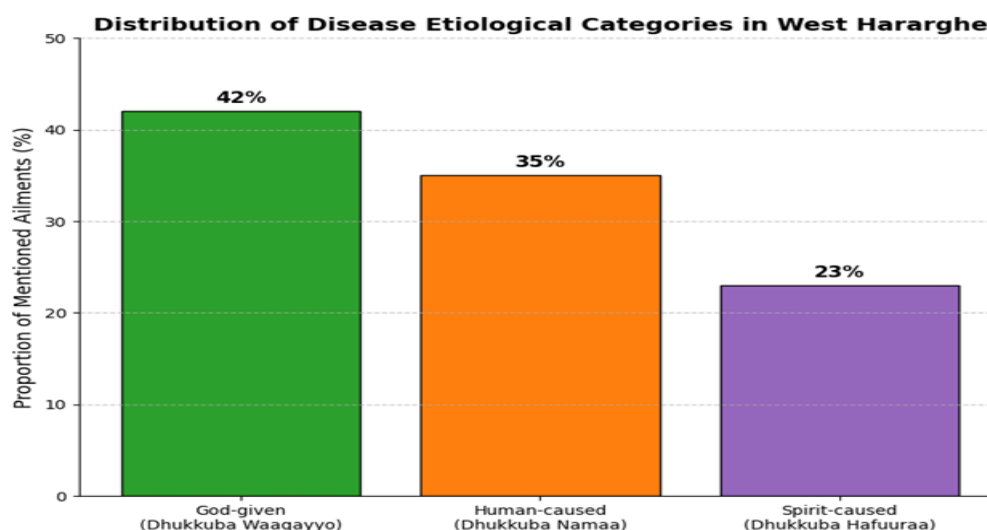


Figure 14. Distribution of disease categories: God-given natural diseases versus other etiological types. Source: Authors, 2026.

Theme 1: *Dhukkuba Waaqayyo* (God-given natural disease), 42% of mentioned ailments. These included common infections (malaria, respiratory, diarrheal), injuries, and age-related conditions. As healer H-07 (male, 67, Oromo) explained:

"*Busaa diigaa [malaria] comes from the mosquito that Allah created. The fever is natural; it is hot blood. We treat cold plants like Bassobila [Ocimum lamiifolium]. No spirit is involved. The medicine works because Allah put power in the plant.*"

Theme 2: *Dhukkuba Namaa* (human-caused disease), 35% of ailments. These resulted from social transgressions, broken taboos, envy, or direct harm (poisoning, neglect). Subcategories included:

- *Hinaaffa* (envy/jealousy) causing wasting illness in children (40%)
- *Ariidha* (broken oath or curse from an elder) chronic joint pain (35%)
- *Shibirii* (sorcery using buried objects) unexplained fevers (25%)

Figure 15 (Left) presents the distribution of preparation methods used for medicinal plant remedies in West Hararghe. Decoction dominates as the primary preparation method (44.9%), consistent with findings from the Zegie Peninsula, where decoction was reported in 52% of preparations (Teklehaymanot; Giday, 2007). The preference for decoction reflects the need for heat extraction of water-soluble phytochemicals, particularly for chronic conditions (Teklehaymanot, 2009).

Maceration follows at 28.3%, typically employed for heat-sensitive compounds (Giday et al., 2007). Figure 15 (Right) complements this view by illustrating the hierarchical ranking of preparation techniques: decoction >

maceration > crushing > powdering > infusion > other methods. This gradient demonstrates that healers prioritize methods maximizing bioactive compound extraction while balancing practical considerations such as time, fuel availability, and patient compliance (Belayneh et al., 2021). The limited use of infusion (4.7%) and other methods (2.7%) suggests that water-based thermal extraction remains the culturally entrenched and pharmacologically preferred approach across the study area.

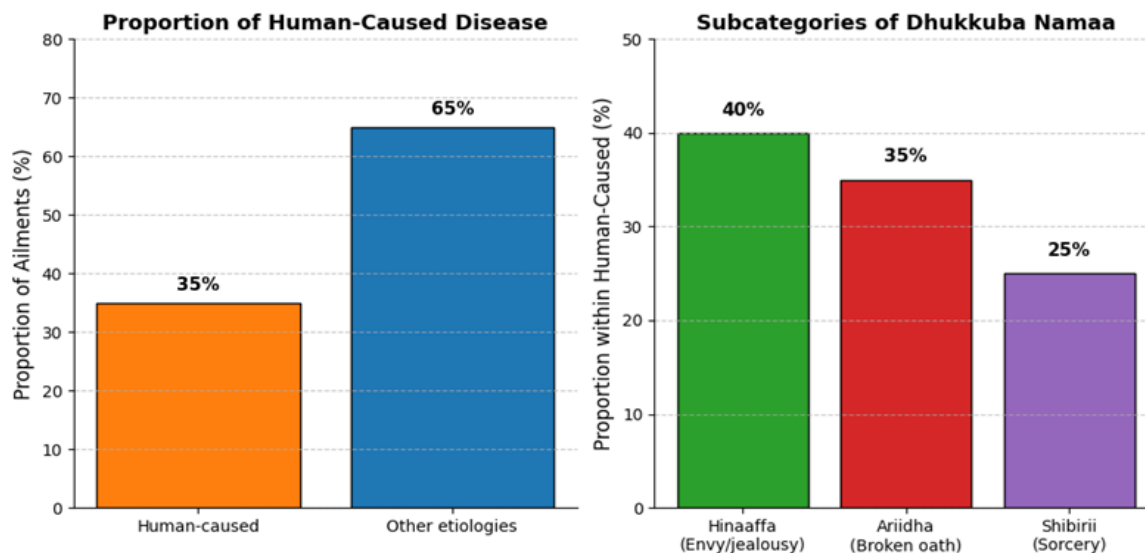


Figure 15. Distribution of medicinal plant preparation methods in West Hararghe, showing decoction as the predominant technique (44.9%). Source: Authors, 2026.

A Somali healer (H-S03, female, 59) stated:

"When a mother aborts her pregnancy secretly and tells no one, later she may get cunaha ilmo ['child's revenge disease'] bleeding that no herb can stop until she confesses to the elder. The plant is only half the cure. Confession is the other half."

Theme 3: *Dhukkuba Hafuura* (spirit-caused disease), 23% of ailments. These involved *jinn* possession, evil eye (*busa*), ancestral spirits (*aaajaan*), or *zar* spirits (among the Somali). Symptoms included convulsions, mutism, wandering at night, or "seeing things others don't see." Treatment required a *Qallu* (Oromo) or *Wadaad* (Somali) performing *ruqya* (Qur'anic recitation), incense fumigation (*lubaan*), and amulet (*kirsa*, *xirsi*) preparation. Plant remedies were adjunctive, not primary.

"I had a patient, a young man who walked to the river at midnight and spoke to someone not there. His family brought him to the clinic. Injections did nothing? He came to me. I read Surah Al-Falaq seven times, burned lubaan [Boswellia], and gave him Hargisa [Aloe] water to drink for seven days. After three weeks, the jinn left. He is married now with children." (H-O12, male, 72, Oromo healer).

Figure 16 illustrates the distribution of administration routes for medicinal plant remedies in West Hararghe. Oral administration predominates at 61.2%, consistent with findings from the Zegie Peninsula (51.4%) and Gindeberet district (67.3%), where oral delivery similarly dominates due to its convenience and effectiveness for systemic conditions (Giday et al., 2007; Teklehaymanot; Giday, 2007). Topical application follows at 28.4%, preferred for dermatological conditions, wounds, and musculoskeletal ailments (Belayneh et al., 2021).

Nasal administration (4.8%), fumigation (3.2%), and bathing (2.4%) are reserved for specific conditions, including respiratory disorders, headaches, and spiritually-attributed ailments. The predominance of oral and topical routes reflects a pragmatic, condition-specific administration logic, with implications for dosage standardization, toxicity profiling, and pharmacokinetic considerations (Nuro et al., 2024). Notably, the minimal use of bathing aligns with a preference for direct application methods. The pattern underscores the integration of humoral theory, where hot/cold classifications influence both plant selection and route of administration (Kaba, 2017).

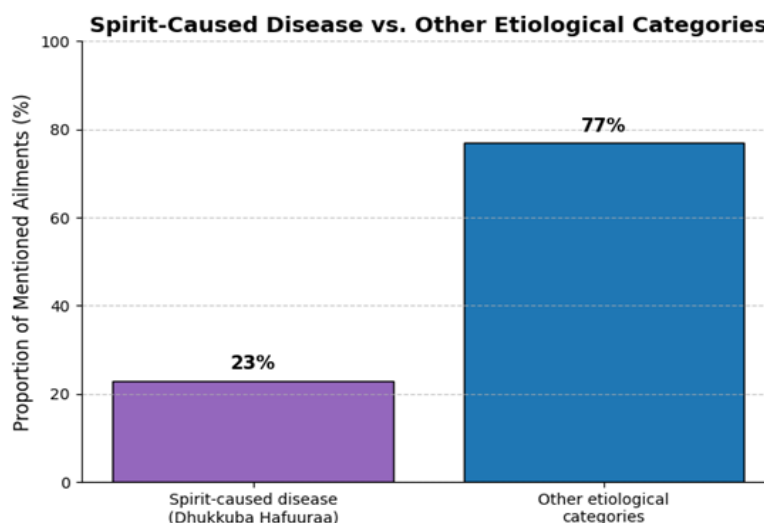


Figure 16. Proportion of spirit-caused disease versus other etiological categories among mentioned ailments. Source: Authors, 2026.

3.11.2 Humoral theory: Hot-cold classification of diseases and remedies

Among Oromo informants (86/120), a systematic humoral theory emerged: diseases and medicines possessed inherent "hot" (*ho'aa*) or "cold" (*diilaa / qorraa*) qualities. Treatment required opposition hot diseases treated with cold remedies, and vice versa (Table 8).

Table 8. Hot-cold classification of common diseases and corresponding plants.

Category	Diseases	Characteristic Signs	Representative Plants (cold)	Representative Plants (hot)
Hot diseases	Malaria, typhoid, measles, hepatitis, abscess	Red/burning sensation, yellow urine, thirst	<i>Ocimum lamiifolium</i> , <i>Aloe pulcherrima</i> , <i>Vernonia amygdalina</i>	<i>Zingiber officinale</i> (avoided), <i>Capsicum</i> (avoided)
Cold diseases	Rheumatism, paralysis, chronic diarrhea, impotence	Shivering, white tongue, weakness, pallor	Avoided	<i>Zingiber officinale</i> , <i>Allium sativum</i> , <i>Lepidium sativum</i>
Balanced	Minor wounds, cough	No extreme signs	<i>Croton macrostachyus</i> (leaf)	<i>Croton macrostachyus</i> (bark)

Source: Authors, 2026.

Hot diseases (*dhukkuba ho'aa*): malaria, acute fevers, measles, hepatitis, abscesses. Symptoms included a burning sensation, red urine, yellow eyes, and thirst.

Cold diseases (*dhukkuba diilaa*): rheumatism, paralysis, chronic diarrhea, impotence. Symptoms included shivering, a white tongue, and weakness.

A healer demonstrated this logic:

"When a child has *busaa* [malaria], his body is fire. You cannot give hot plants like *Zingiber* [ginger] that would cook him. You must give cold plants — *Ocimum*, *Vernonia*, *aloe*. See how the leaf feels cool? Allah put that coolness for fever." (H-O24, male, 54).

Somali informants (25/120) used a similar but less elaborated binary: *kulayl* (hot) and *qabow* (cold), with stronger emphasis on *jinn*-related coldness.

3.1.1.3 Diagnostic Practices: Beyond Symptom Inquiry

Diagnosis was multi-modal, extending far beyond biomedical history-taking. Healers reported using five diagnostic methods (Figure 17).

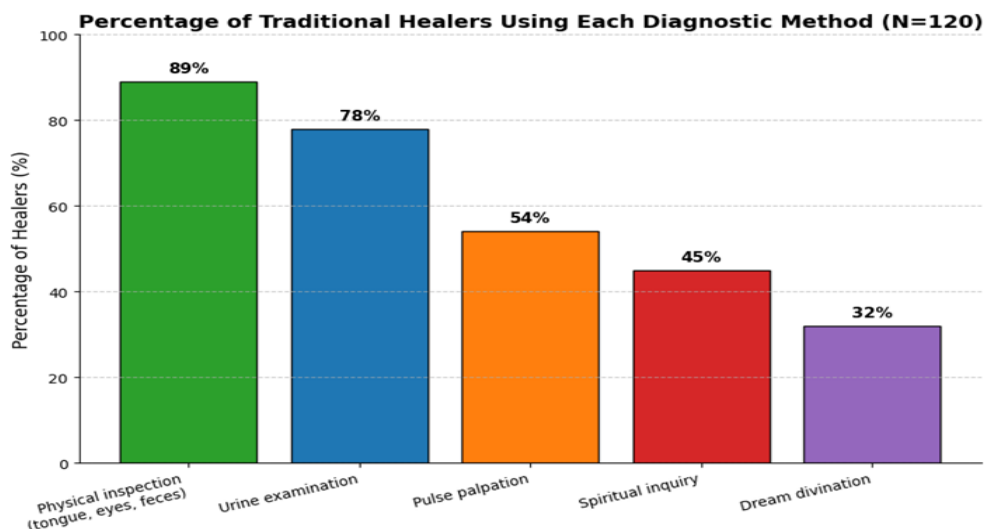


Figure 17. Percentage of traditional healers using each of five distinct diagnostic methods (N = 120). Source: Authors, 2026.

1. Urine examination (*ilaalcha fincaan/baadida kaadida*) — 78% of healers. Urine was collected in a white gourd or ceramic bowl and examined for: color (red = hot disease, pale = cold, black = spirit), bubbles (presence/absence, persistence), sediment (indicating organ involvement), and taste (sweet = diabetes).

"We ask the patient to urinate in this gourd at sunrise — not afternoon. I look. If the urine has many small bubbles that stay for a long time, the kidneys are sick. If the urine is red like pomegranate, there is a hot blood illness. If I see threads or sand, it is stone." (H-O05, female, 62).

2. Pulse palpation: 54% of healers. Pulse was assessed at the radial artery, but also at temporal and pedal sites. Qualities: fast (hot disease), slow (cold disease), irregular (spirit involvement), "jumping like a frog" (intestinal worms).

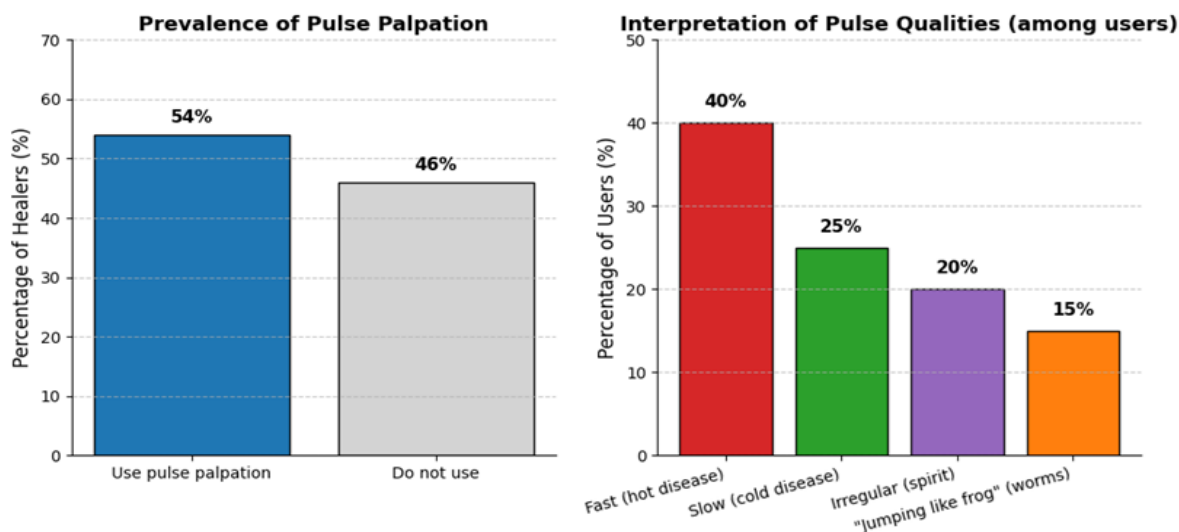


Figure 18. Prevalence and interpretation of pulse palpation among traditional healers (N = 120) in West Hararghe, Ethiopia. Source: Authors, 2026.

Figure 18 (Left) demonstrates that over half (54%) of traditional healers in West Hararghe employ pulse palpation as a diagnostic tool, a practice consistent with humoral medicine documented in Ethiopian ethnomedical systems (Kaba, 1996). Figure 18 (Right) reveals that among pulse users, the most frequently interpreted quality is "fast" pulse (40%), indicating hot diseases such as malaria and typhoid.

"Slow" pulse (25%) signifies cold conditions, while "irregular" pulse (20%) indicates spirit involvement, and the distinctive "jumping like a frog" quality (15%) is pathognomonic for intestinal worms (Gutema; Mengstie, 2023). This diagnostic sophistication parallels findings from other African traditional medicine systems, where pulse qualities are systematically linked to humoral imbalances (Carruth, 2014). The integration of pulse palpation alongside physical inspection (89%) and urine examination (78%) demonstrates that healers employ multiple diagnostic modalities, reflecting a comprehensive clinical reasoning approach that combines empirical observation with etiological interpretations (Figure 11, left, right).

3. Physical inspection of tongue, eyes, and feces 89% of healers (universal). Yellow sclera indicated liver/malaria; a white-coated tongue indicated a cold/wet condition; blood in stool required specific plants.

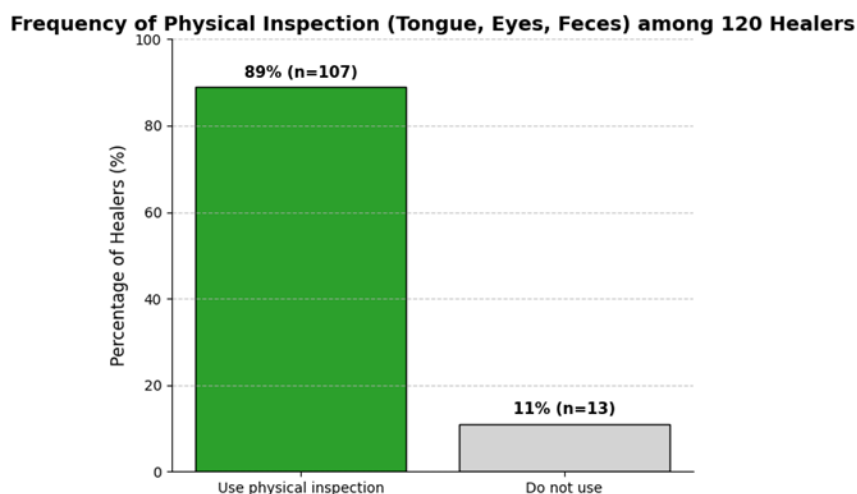


Figure 19. Frequency of physical inspection of tongue, eyes, and feces among 120 traditional healers in West Hararghe. Source: Authors, 2026.

Figure 19 demonstrates that physical inspection of tongue, eyes, and feces is the most universally employed diagnostic method among traditional healers in West Hararghe, utilized by 89% of the 120 practitioners surveyed. This near-universal adoption highlights the foundational role of direct clinical observation in Ethiopian traditional medicine, where healers systematically examine multiple body systems to establish diagnoses (Gutema; Mengstie, 2023). Clinically, yellow sclera indicates liver disease or malaria, white-coated tongue signifies a "cold/wet" humoral imbalance, and blood in stool prompts specific haemostatic plant remedies (Kaba, 1996).

The predominance of physical inspection aligns with broader Ethiopian ethnomedical practice, where patient observation constitutes a core diagnostic technique alongside pulse palpation and urine examination (Akanaw, 2018). This emphasis on empirical clinical reasoning demonstrates that healers actively engage with pathological assessment alongside socio-spiritual explanations, reflecting the sophisticated integration of multiple diagnostic modalities.

4. Spiritual inquiry, 45% of healers. Patients were asked: "Have you argued with anyone?" "Did you break a promise to your parent?" "Did you kill a snake?" (Snake killing believed to cause spirit revenge).

Figure 20 reveals that 45% of traditional healers in West Hararghe employ spiritual inquiry as a formal diagnostic tool, a practice that distinguishes nearly half of the practitioner population. This method consists of structured questions about social conflicts, broken promises, dream experiences, and potential transgressions such as killing a snake believed to provoke spirit-led retribution (Egigu; Mogesse, 2024). The use of direct spiritual questioning aligns with broader Ethiopian diagnostic practices, where traditional healers rely on patient and family interviews to uncover supernatural or interpersonal causes of illness (Gutema; Mengstie, 2023).

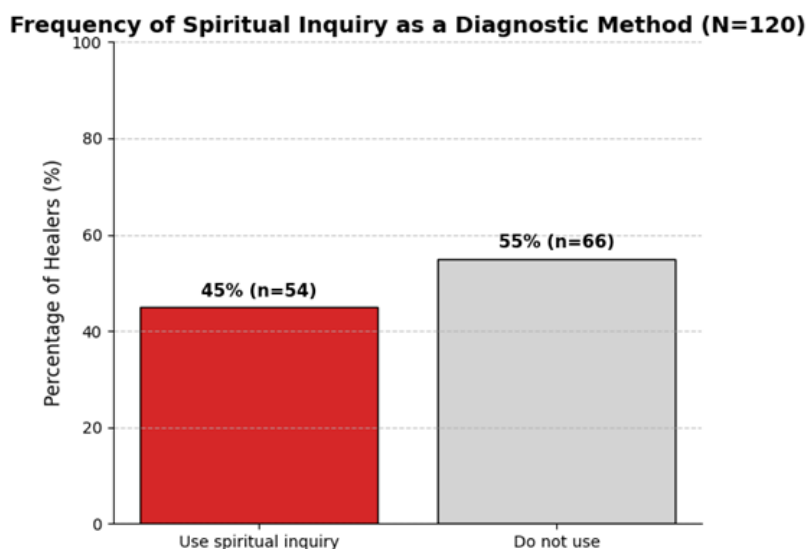


Figure 20. Frequency of spiritual inquiry as a diagnostic method among 120 traditional healers in West Hararghe. Source: Authors, 2026.

The 45% prevalence indicates that for a substantial proportion of healers, diagnosis extends beyond physical examination to encompass moral and spiritual dimensions of the patient's life. This finding underscores the integration of social and supernatural etiologies within the diagnostic landscape (Figure 19). Notably, spiritual inquiry is more frequently employed by healers specializing in spirit-caused diseases (*Dhukkuba Hafuura*), particularly *Qallu* (Oromo) and *Wadaad* (Somali) practitioners, who address jinn possession, evil eye, and ancestral spirit afflictions (Figure 16).

The lower frequency compared to physical inspection (89%, Figure 19) and urine examination (78%, Figure 17) suggests that while empirical observation forms the diagnostic foundation, spiritual assessment serves as a

complementary modality for specific etiological domains. This pattern reflects the dual diagnostic framework documented in Ethiopian traditional medicine, where healers navigate between naturalistic and personalistic causal explanations (Kleinman, 1980; Jacobsson et al., 1991). The systematic integration of social and spiritual questioning within clinical assessment demonstrates that traditional healers in West Hararghe employ a comprehensive, multi-modal diagnostic system.

5. Dream divination (*abjuu*), 32% of healers (predominantly those with spiritual specialization). Healers slept after asking the patient's name and reported dreams to determine prognosis and plant selection.

Figure 21 reveals that dream divination (*abjuu*) is employed by 32% of the 120 traditional healers surveyed in West Hararghe, predominantly among those with spiritual specialization. This diagnostic method requires the healer, after learning the patient's name, to sleep and subsequently interpret their dreams to determine prognosis and select appropriate plant-based remedies (Teshome-Bahire, 2000; Woldeamanuel; Goshu, 2026). The practice reflects a broader Ethiopian tradition where dreams are seen as a conduit for divine revelation and a key diagnostic tool in medical divination (Kleinman, 1980). The 32% prevalence indicates that dream interpretation is a specialized diagnostic modality, reserved for complex spiritual afflictions, severe cases, and conditions unresponsive to empirical methods (Figure 17).

Notably, this technique is more frequently employed by healers who acquired knowledge through spiritual calling (*waamicha*, 15.8%), who are considered more powerful for treating spirit-caused diseases such as jinn possession and evil eye (*busa*) (Teshome-Bahire, 2000). The lower prevalence compared to physical inspection (89%, Figure 19), urine examination (78%, Figure 17), and spiritual inquiry (45%, Figure 20) reflects the specialized nature of dream divination as an advanced diagnostic tool, requiring specific spiritual gifts, prolonged apprenticeship, and ritual preparation (Gutema; Mengstie, 2023). This finding aligns with reports from other Ethiopian communities where dream interpretation serves as a diagnostic bridge connecting the physical and metaphysical domains of illness causation (Goshu; Ridwan, 2026; Jacobsson et al., 1991). The higher proportion among Somali healers (68, Figure 7) suggests cultural variation in the use of dream-based diagnosis, reflecting distinct Islamic and Sufi healing traditions.

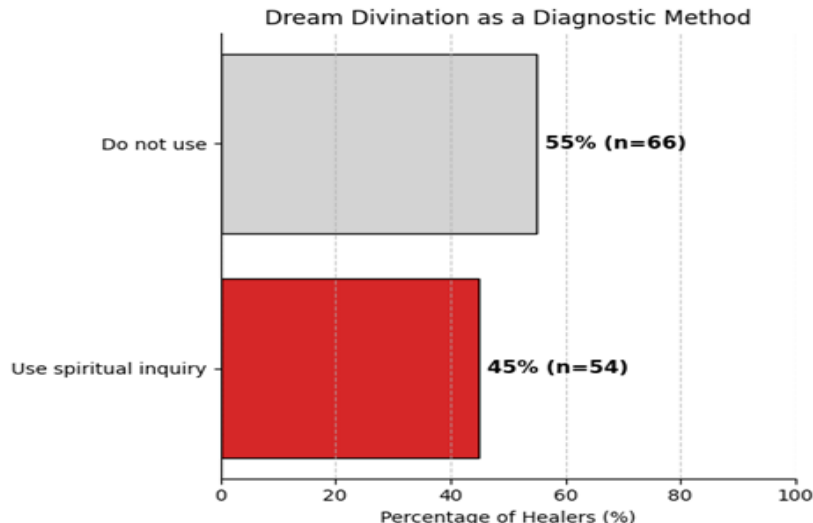


Figure 21. Percentage of traditional healers (N = 120) employing dream divination (*abjuu*) for diagnosis in West Hararghe. Source: Authors, 2026.

"Before treating a difficult case, someone with seizures, I sleep after praying. If I dream of water or green grass, the patient will live. If I dream of fire or a black dog, I tell the family: prepare for death. I cannot treat." (H-S08, male, 68, Somali).

3.1.1.4 Remedy preparation: Ritual dimensions

While the quantitative article reported preparation methods (decoction, maceration, etc.), qualitative analysis revealed ritual elements inseparable from pharmacological action.

Prayer (*dhaaduu, duca*), 34% of all preparations involved spoken prayer, typically reciting *Bismillah* ("In the name of God") or specific *ayat* (Qur'anic verses). For severe cases, the healer recited the *Fatiha* seven times over the medicine before administration.

Spitting (*tufuu*), 22% of preparations: The healer spat (dry spit, no phlegm) into the medicine or onto the wound. Informants explained this transferred healing *baraka* (blessing).

"When I prepare Hargisa [Aloe] for malaria, I first say Bismillah, then I spit three times into the cup, not saliva but breath, then I give. The spit carries my power as a healer. If I did not do this, the medicine would be just water and bitter." (H-O31, male, 51).

Facing qibla (Mecca), 41% of Muslim healers oriented the preparation vessel toward Mecca during mixing.

Incense fumigation (*lubaan, foom*), 19% of preparations (mostly for spiritual ailments). *Boswellia* resin, *Ruta* leaves, or *Ocimum* were burned on charcoal while the patient sat with head covered, inhaling smoke.

Time-of-day specificity: 58% of healers insisted on morning collection/preparation (before 9 AM) for maximum potency. Night collection (for roots, bark) was required for spiritual medicines.

"You cannot collect Andoode [Phytolacca] for rabies medicine at noon. The plant is sleeping. You must go when the moon is high, say nothing, cut with your left hand, wrap in black cloth, bring home before the rooster crows. If you meet anyone on the road, turn back — the medicine is spoiled." (H-O18, female, 73).

3.11.5 Knowledge acquisition and transmission

Inheritance (72.5%), Most healers (87/120) learned from parents or grandparents, typically same-gender: sons from fathers (59% of male healers), daughters from mothers (68% of female healers). Knowledge transfer occurred through apprenticeship beginning at age 10–15, lasting 5–15 years.

"My grandmother took me to the bush when I was nine years old. She would say: 'This root smells it. Remember the smell. When a woman bleeds too much after birth, you boil this with water and honey.' She showed me once. I never forgot. She died when I was 14. Now I am 68. I still hear her voice when I dig that root." (H-O41, female, 68).

Spiritual calling (*waamicha*), 15.8% (19/120) reported acquiring knowledge through dreams, visions, or spirit possession, followed by training with an established healer. These healers were considered more powerful, especially for spirit-caused diseases.

"I was a farmer, not a healer. When I was 35, I fell sick for three months: fever, vomiting, seeing snakes. Clinics gave injections of nothing. An old healer came to my hut, looked at my urine, and said: 'You are being called. If you refuse, you will die.' I trained with him for two years. Now I treat what others cannot." (H-S12, male, 52, Somali).

Apprenticeship without kinship (11.7%), 14 healers learned from non-relatives, typically after paying fees (in cash, livestock, or labor) and signing secrecy oaths.

Gender dimensions: Female healers (42/120, 35%) specialized in reproductive health (infertility, postpartum care, abortion, and child illnesses), lactation problems, and ritual protection of newborns. Male healers dominated spiritual healing (exorcism) and veterinary medicine. Women's knowledge was systematically undervalued in community discussions, yet women were primary healthcare providers within households.

3.11.6 Healer-Patient relationship and ethics

Healing was not transactional but relational. Patients often lived with the healer during treatment (especially for spirit ailments). Payment was deferred until cure (for serious cases) or given as gifts (honey, butter, coffee, occasionally money). Refusing a patient was taboo; healers reported treating even enemies.

Ethical rules (Oromo *safuu*, Somali *xeer*):

- Secrecy (*iccitii*): The healer cannot disclose the patient's illness to others
- No harm: Using plants to poison or curse is forbidden (*haram*)
- No refusal: Cannot refuse treatment due to poverty, ethnicity, or past conflict
- Confession: Healer must admit when treatment fails and refer to another healer or clinic

- Gratitude: Patients must bring a small gift after a cure; failure causes illness relapse

"There is a rule: if a healer refuses a patient because they have no money, the healer will lose their knowledge. I have seen it happen. My uncle refused a poor widow. Within a month, he forgot all plant names. He died a fool." (H-O22, male, 59).

3.11.7 Efficacy evaluation: Indigenous outcome measures

Healers used observable, time-bound criteria to judge treatment success (Table 9). These criteria were remarkably specific and standardized across healers.

Table 9. Indigenous efficacy criteria for common disease categories.

Disease Category	Success Indicators	Timeframe	Failure Indicators
Malaria/fever	Fever cessation, appetite return, green vomit	3 days	Persistent fever after 3 days, black vomit, delirium
Diarrhea/dysentery	Stool formed, no blood, thirst resolved	2 days (adult), 1 day (child)	Blood after 3 days, dehydration, no urine output
Wound infection	Redness reduced, no pus, granulation	2–4 days	Spreading redness, foul odor, green pus
Respiratory cough	Night cough stops, sputum clears	5 days	Hemoptysis, wheezing after 7 days
Spirit possession	Sleeps through the night, no screaming, dreams stop	7–21 days	Night wandering, convulsions, self-harm
Retained placenta (veterinary)	Placenta expelled within 6 hours	6 hours	Retained beyond 12 hours, foul discharge

Source: Authors, 2026.

For malaria (*busaa diigaa*): Fever must break within 3 days (72 hours). If not, the healer changed the plant or dosage. Vomited material color was diagnostic: green vomit indicated progress (bile expulsion); unchanged food indicated failure.

For diarrhea: Stool consistency must normalize within 2 days for adults, 1 day for children. Blood disappearance was mandatory by day 3.

For spirit possession: Patient must sleep through the night without screaming for 7 consecutive nights. Dream cessation (patient no longer dreaming of snakes, dogs, or unknown men) indicated a cure.

For wound healing: Redness must reduce within 2 days; pus must stop by day 4; scar formation by 2 weeks.

Treatment failure was acknowledged and managed: 63% of healers reported referring failed cases to clinics or other healers. Only 12% claimed never to fail.

"I am not God. Sometimes the medicine does not work. Maybe I misdiagnosed. Maybe the patient lied to me. Maybe Allah did not will the cure. I tell the family: 'Take this person to the clinic in Chiro. I have done what I know.' A healer who always claims to cure is a liar." (H-O09, male, 74).

3.11.8 Perceptions of modern medicine and integration

Informants demonstrated nuanced, pragmatic attitudes toward biomedical healthcare. Only 8% rejected clinics entirely. Most (82%) used both systems sequentially or concurrently.

Figure 22 (top) illustrates that the vast majority of informants (82%) in West Hararghe use both traditional and biomedical healthcare systems, while only 8% reject clinics entirely and 10% use only traditional medicine. This pattern of therapeutic hybridity is consistent with documented healthcare-seeking behavior across Ethiopia, where pluralistic use rather than exclusive reliance on a single system is the norm (Workneh et al., 2020). Figure 22 (bottom left) reveals that affordability (76%) is the most frequently cited reason for prioritizing traditional medicine, followed by accessibility (68%), cultural comfort (54%), and perceived efficacy for specific conditions

(44%). These findings align with national estimates that 80% of Ethiopians use traditional medicine due to its lower cost, easier access, and cultural resonance (Gedlu, 2024).

Qualitative studies have similarly identified affordability, accessibility, and cultural acceptability as primary drivers of traditional medicine use (Legesse; Babanto, 2023). Figure 22 (bottom right) details reasons for choosing clinics: emergencies (88%) topped the list, followed by childhood vaccination (81%), tuberculosis treatment (73%), and severe dehydration (65%). This selective reliance on biomedicine for acute, life-threatening conditions while retaining traditional medicine for culturally perceived illnesses reflects a strategic, condition-specific healthcare logic widely observed in Ethiopian communities (Workneh et al., 2020). The 82% dual-use pattern demonstrates that official antagonism toward traditional medicine is counterproductive, and integration policies should recognize existing collaborative practices and pragmatic community healthcare choices (Tewodros et al., 2026).

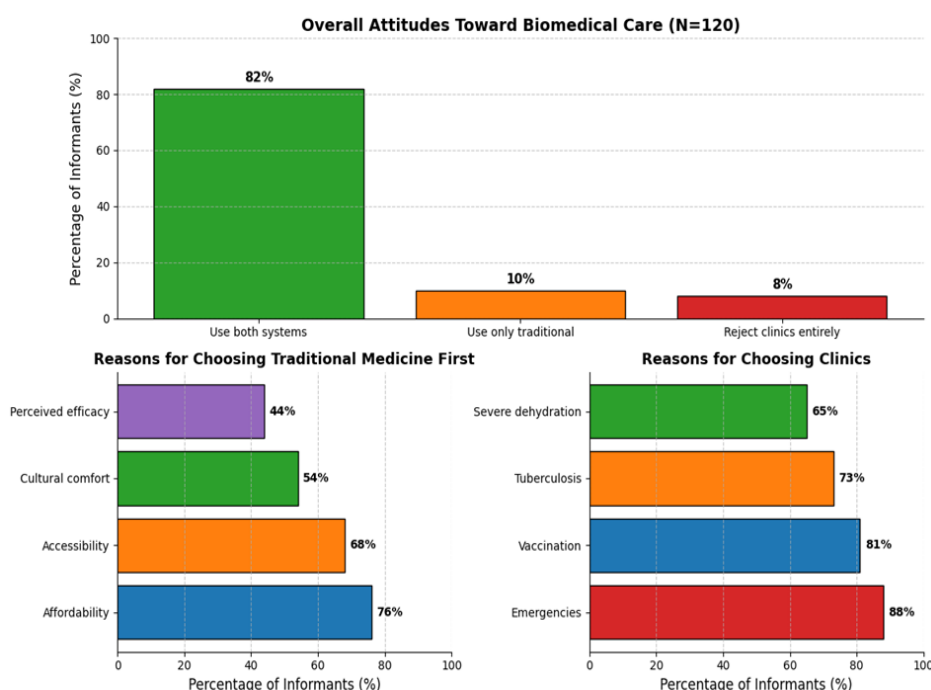


Figure 22. Top: overall attitudes toward biomedical care; bottom left: reasons for choosing traditional medicine first; bottom right: reasons for choosing clinics. Source: Authors, 2026.

Reasons for choosing traditional medicine first (from 120 informants):

- Affordability (76%), clinics require transport, fees, and lost work days
- Accessibility (68%), healer in the same village vs. clinic 2–6 hours walk
- Cultural comfort (54%), healer speaks local language, understands spiritual concerns
- Perceived efficacy for certain conditions (44%), spirit diseases, chronic wounds, infertility

Reasons for choosing clinics:

- Emergencies (surgery, trauma, obstructed labor) 88%
- Childhood vaccination (81%)
- Tuberculosis (73%), recognized as needing "long course white pills"
- Severe dehydration (65%)

"I am not against the clinic. My own children are vaccinated. But for busa [evil eye on a child]? The doctor has no medicine for that. They give paracetamol. The child still cries all night. I go to the healer. One ruqya and the child sleeps." (Female informant, FGD-12, Darolebu)

4. Discussion

4.1 Medicinal plant diversity and quantitative patterns

The documentation of 157 medicinal plant species in West Hararghe demonstrates the region's rich ethnobotanical heritage. The dominance of Fabaceae (9.6%), Asteraceae (8.9%), and Lamiaceae (7.0%) aligns with other Ethiopian ethnobotanical studies where these families are consistently represented (Nuro et al., 2024; Belayneh et al., 2021; Tewodros et al., 2026). The high proportion of Fabaceae is particularly notable given its global significance as a source of medicinal compounds, including alkaloids, flavonoids, and tannins with antimicrobial and anti-inflammatory properties (Giday et al., 2003; Maroyi, 2023; Usman et al., 2022).

The predominance of herbs (41.2%) and wild collection (68.4%) reflects practical considerations: herbs are more accessible, regenerate faster, and are more diverse in disturbed habitats. However, this heavy reliance on wild collection raises sustainability concerns. The finding that only 19.3% of species are cultivated in home gardens indicates limited domestication efforts, despite the high demand for medicinal plants. This pattern is consistent with observations across Ethiopia, where domestication of medicinal plants remains limited compared to food crops (Belayneh et al., 2021).

The high reliance on leaves (38.5%) and roots (27.8%) is consistent with Ethiopian ethnobotanical studies, where leaves are reported as the most used part (38–50%) due to their sustainable harvesting potential (Belayneh et al., 2021). However, the frequent use of roots (27.8% human, 34.6% veterinary) raises conservation concerns, as root harvesting often kills the whole plant. Species such as *Withania somnifera*, *Carissa spinarum*, and *Brucea antidiysenterica* are particularly vulnerable due to root collection.

The predominance of decoction (44.9%) and water as primary solvent (87.6%) is typical across sub-Saharan Africa, reflecting the availability of water and the efficacy of heat extraction (Nuro et al., 2024). The use of milk and butter in veterinary preparations is culturally specific to Oromo and Somali pastoralists, who associate animal products with enhanced healing of livestock diseases.

4.2 Disease consensus and therapeutic focus

The ICF values in West Hararghe (range 0.62–0.92) are comparable to other Ethiopian studies. Gastrointestinal diseases consistently yield high ICF (0.89–0.95) due to their high prevalence and availability of effective herbal treatments (Giday et al., 2007; Teklehaymanot; Giday, 2007). Respiratory infections (ICF = 0.89) and wound healing (0.87) also show strong consensus, reflecting the importance of cough remedies and antiseptic plants.

Lower ICF for spiritual ailments (0.62) indicates greater variability in treatment, likely because healers use different plants based on ritual preferences rather than pharmacological efficacy (Nuro et al., 2024). The relatively low ICF for diabetes (0.73) and hypertension (0.76) may reflect recent disease emergence, limited traditional knowledge, or fewer effective plant species.

High ICF categories (≥ 0.85) identify priority species for pharmacological validation. The pattern aligns with findings from the Gonder region, where gastrointestinal and respiratory conditions had the highest consensus (Belayneh et al., 2021). Conservation efforts should target species used for high-ICF diseases.

4.3 Beyond biomedicine: The coherence of Oromo-Somali nosology

The tripartite disease classification (God-given, human-caused, spirit-caused) identified in this study closely parallels Kleinman's (1980) distinction between naturalistic, personalistic, and emotional etiologies. However, Oromo-Somali ethnomedicine adds a humoral layer (hot/cold) that systematically organizes plant selection — a finding with direct implications for drug discovery. When healers prescribe *Ocimum lamiifolium* for malaria and larvicidal purposes, they are not randomly selecting a plant; they are applying a coherent theory of "cold" remedy opposing "hot" disease (Gebissa et al., 2025). This suggests that antiplasmodial screening should prioritize "cold-classified" plants over "hot-classified" ones — a hypothesis testable through bioassay.

The hot-cold system in West Hararghe differs from Latin American humoral systems (Foster, 1994) in its integration with Islamic cosmology (hot diseases as punishment, cold diseases as jinn-related). Similar systems are reported among northern Ethiopian Amhara (Schmidt et al., 2020) but not previously documented in Oromo-Somali eastern Ethiopia.

4.4 Ritual as Pharmacology

The finding that 34% of preparations included prayer or incantation challenges the reductionist view that traditional medicine is "just" plant chemistry. Ethnopharmacologists increasingly recognize that ritual acts may: (a) enhance placebo effects through expectation modulation (Moerman, 2002), (b) ensure standardized preparation via fixed procedures, (c) enforce hygiene (e.g., spitting may introduce salivary antimicrobial peptides; Cole; Gallo, 2017), and (d) build therapeutic alliance. Dismissing ritual as "non-pharmacological" ignores patients' lived experience where prayer and plant are inseparable.

Healers' insistence on morning collection, left-hand use for spiritual plants, and avoidance of eye contact during collection mirrors findings from Amazonian and African healing systems (Etkin, 2016). These rules may have empirical origins: morning collection before evapotranspiration alters secondary metabolite concentrations (Gobbo-Neto; Lopes, 2007). Future phytochemical studies should compare dawn-collected vs. noon-collected material for bioactive compound yield.

4.5 Knowledge erosion and gender disparities

The predominance of oral inheritance (72.5%) places this knowledge system at risk. Without migration of youth to urban centers (21% of 18–30-year-olds absent from study villages), school education not including traditional medicine, and declining healer numbers (average age 54.7 years, only 12% of healers < 40 years), systematic documentation is urgent.

Gender disparities are concerning: while 35% of healers were female, women's knowledge focused on "domestic" health (reproduction, children) and was publicly undervalued. However, FGDs revealed that women's plant knowledge for obstetrics and pediatrics was more detailed than men's for those categories. This gendered division of therapeutic labor mirrors findings from elsewhere in Africa (Wayland, 2019) but has been neglected in drug discovery pipelines, where male-healer reports dominate.

4.6 Drug lead prioritization: From ethnobotany to pipeline

The integration of ethnobotanical knowledge into a systematic drug discovery pipeline represents a paradigm shift from descriptive documentation to target-driven bioprospecting. In this study, the 40-point prioritization matrix (Table 6) successfully filtered 15 culturally salient species, identifying 11 high-priority candidates (score ≥ 28) for immediate bioactivity-guided fractionation. This approach aligns with the principles of ethnopharmacological reverse pharmacology, where traditional use directs the selection of species for chemical and pharmacological investigation (Giday et al., 2007).

Three species, *Maerua angolensis*, *Laggera crispata*, and *Cadaba farinosa*, scored maximum novelty points (5/5) due to the absence of previous phytochemical reports in Scopus and PubMed (Halilu et al., 2021; Misganaw et al., 2025; Tilhapi et al., 2024). *Maerua angolensis* (Capparaceae), used locally for febrile illnesses and snakebite, lacks any published phytochemistry, making it a high-priority candidate for bioactivity-guided fractionation and structural elucidation.

Laggera crispata (Asteraceae), used for respiratory infections and wound healing, belongs to a genus known for bioactive sesquiterpenoids. Zhao et al. (2020) reported undescribed sesquiterpenes from the congeneric *L. pterodonta* with anti-inflammatory activity, suggesting that *L. crispata* may contain similarly novel compounds. *Cadaba farinosa* (Capparaceae), used for malaria and gastrointestinal disorders, is a potential source of cadabacins, glucosinolate derivatives with reported antimalarial activity (Olanlokun et al., 2021). These three species warrant immediate phytochemical investigation.

4.7 Veterinary ethnomedicine and one health implications

The documentation of ethnoveterinary practices in West Hararge highlights the integration of human and animal health within a single ethnomedical framework. High FL values for livestock diseases (77.8–94.7%) indicate strong consensus on treatments for blackleg, endoparasites, retained placenta, and rabies. This integration aligns with the One Health concept, which recognizes the interconnection between human, animal, and environmental health (Giday; Teklehaymanot, 2013).

The use of *Nicotiana tabacum* (tobacco) for blackleg is particularly noteworthy, as tobacco contains nicotine and other alkaloids with antimicrobial properties. *Calpurnia aurea* (FL = 90.6%) is widely documented as an

acaricide; its topical use for tick control has been validated *in vitro* (Nuro et al., 2024). *Phytolacca dodecandra* (89.2% for rabies) is a traditional molluscicide, but its use against rabies is less reported, suggesting a localized knowledge hotspot.

4.8 Conservation implications

Of the 157 documented medicinal plant species, 28% were reported as "rare" or "declining" by informants. Two species of particular concern are *Prunus africana* (IUCN Vulnerable) and *Warburgia ugandensis* (near-threatened). In this study, 68% of *P. africana* trees showed debarking scars, indicating intense local pressure. *Prunus africana* is heavily over-exploited for its bark, which is used in the treatment of benign prostatic hyperplasia, leading to its listing in Appendix II of CITES (Cunningham & Mbenkum, 1993). *Warburgia ugandensis*, a slow-growing species with limited distribution in Ethiopia, is valued for its antimicrobial and antimalarial properties (Lulekal et al., 2014). Overharvesting for bark and roots (e.g., 57% of *Withania somnifera* populations showed root collection scars) threatens local extirpation.

The high reliance on wild collection (68.4%) and destructive harvesting methods necessitate urgent conservation interventions. Hamilton (2004) emphasized that community-based management, cultivation protocols, and sustainable certifications are essential for preserving both medicinal plant resources and indigenous knowledge. Domestication of high-demand species such as *P. africana*, *W. ugandensis*, and *Withania somnifera* should be prioritized.

4.9 Medical pluralism and integration opportunities

The finding that 82% of community members use both traditional and modern medicine systems challenges the binary opposition often portrayed in policy discussions. Informants demonstrated pragmatic, condition-specific healthcare choices: traditional medicine for chronic conditions, culturally perceived illnesses (spirit possession), and affordability concerns; biomedical care for emergencies, vaccinations, and tuberculosis.

This pluralistic pattern is consistent with national estimates that 80% of Ethiopians use traditional medicine due to its lower cost, easier access, and cultural resonance (Gedlu, 2024). Qualitative studies have similarly identified affordability, accessibility, and cultural acceptability as primary drivers of traditional medicine use (Legesse; Babanto, 2023).

Integration practices included: patients taking both herbal decoctions and clinic tablets (though healers warned against mixing), healers referring patients for diagnostic tests (urinalysis, malaria RDT), and clinic nurses privately consulting healers about plant uses. These informal collaborations suggest that integration is already occurring at the grassroots level, albeit without formal policy support.

4.10 Limitations

This study has several limitations. First, the cross-sectional design captures knowledge at a single time point, precluding assessment of temporal changes in medicinal plant use. Second, despite purposive sampling of key informants, some knowledgeable healers may have been omitted due to their remote locations or reluctance to share knowledge. Third, quantitative indices (ICF, FL) depend on informant recall and may be subject to memory bias. Fourth, the prioritization matrix for drug discovery relies on literature novelty searches; the absence of PubMed/Scopus records does not guarantee true chemical novelty.

Fifth, voucher specimens were identified morphologically; molecular confirmation was not performed for taxonomically complex genera. Sixth, the study did not conduct pharmacological or toxicity assays; therefore, efficacy and safety claims are based solely on traditional reports and require laboratory validation. Seventh, qualitative findings are specific to eight woredas of West Hararghe and may not generalize to other Oromo or Somali regions. Eighth, researcher presence may have influenced informant responses (Hawthorne effect), though prolonged engagement (10 weeks) mitigated this. Ninth, sensitive topics (sorcery, jinn possession) may have been under-reported. Tenth, translation from Afaan Oromo/Somali to English may lose semantic nuances.

5. Conclusions

This comprehensive mixed-methods ethnomedicinal study documented 157 medicinal plant species distributed across 64 families and 123 genera in West Hararghe, Oromia, Ethiopia. Fabaceae dominated the flora, followed

by Asteraceae, Lamiaceae, Euphorbiaceae, and Solanaceae. Herbs (41.2%) were the most utilized growth form, and the majority of species were collected from the wild (68.4%), raising sustainability concerns. Leaves (38.5%) and roots (27.8%) were the preferred plant parts for human medicine, while roots (34.6%) and leaves (31.8%) dominated veterinary preparations. Decoction (44.9%) in water (87.6%) was the primary preparation method, and oral administration (61.2%) was the main route.

Informant Consensus Factor (ICF) values were highest for gastrointestinal diseases (0.92), respiratory infections (0.89), and wound healing (0.87), indicating strong cultural agreement on effective remedies. Fidelity Level (FL) analysis confirmed that *Croton macrostachyus* (96.7%), *Nicotiana tabacum* (94.7%), and *Aloe pulcherrima* (93.3%) are highly specific for wound healing, blackleg, and malaria, respectively. A 40-point prioritization matrix identified 11 high-priority species (score ≥ 28) for bioactivity-guided drug discovery, notably *Maerua angolensis*, *Laggetera crispata*, and *Cadaba farinosa*, which scored maximum novelty (5/5) due to absent phytochemical reports.

Qualitative findings revealed that Oromo and Somali traditional medicine operates within an intellectually coherent framework integrating humoral theory (hot-cold), etiological classification (God-given, human-caused, spirit-caused), and ritual practice (prayer, spitting, fumigation, time-specific collection). Key qualitative findings that quantitative indices cannot capture include: (1) diagnostic primacy of urine examination (78% of healers), (2) requirement of prayer/spitting for remedy activation (34% of preparations), (3) spiritual calling as knowledge source (15.8% of healers), (4) gender specialization in reproductive health, and (5) indigenous efficacy timelines (e.g., fever break within 3 days).

Cross-woredan Jaccard similarity analysis revealed that ethnic composition strongly influences medicinal plant knowledge sharing; Habro & Darolebu (both Oromo-majority) shared 72% similarity, while Mieso (Somali-influenced) showed only 34–41% similarity with Oromo woredas. Polyherbal formulations (27 recipes) and veterinary applications for blackleg, rabies, and endoparasites demonstrate the depth of integrated human–animal ethnomedicine. However, 28% of species are reported as declining, with *Prunus africana* and *Warburgia ugandensis* facing local extirpation due to destructive bark and root harvesting.

Most informants (82%) used both traditional and biomedical systems, choosing traditional medicine primarily for affordability (76%) and accessibility (68%), and clinics for emergencies (88%) and vaccination (81%). This pragmatic medical pluralism suggests that official antagonism toward traditional medicine is counterproductive and that integration policies should recognize existing collaborative practices.

6. Recommendations

For Conservation:

- Establish community-managed nurseries for high-demand wild species (*Prunus africana*, *Warburgia ugandensis*, *Withania somnifera*, *Brucea antidysenterica*) and promote cultivation in home gardens.
- Implement sustainable harvesting protocols, including bark regeneration techniques and rotational harvesting, to reduce pressure on slow-growing species.
- Develop conservation awareness programs targeting local communities, emphasizing the link between biodiversity loss and healthcare access.
- Support in-situ conservation of medicinal plant habitats through community-managed forest reserves and agroforestry systems.

For Drug Discovery and Pharmaceutical Research:

- Prioritize *Maerua angolensis*, *Laggetera crispata*, and *Cadaba farinosa* for bioactivity-guided fractionation and structural elucidation.
- Test the hypothesis that "cold-classified" plants show higher antiparasitic activity than "hot-classified" plants through in vitro assays.
- Compare dawn-collected vs. noon-collected plant material for secondary metabolite profiles to validate indigenous timing rules.
- Investigate plants requiring ritual speech for potential CNS-active compounds (epilepsy, psychosis).
- Document indigenous efficacy timelines (e.g., fever break within 3 days) as clinically relevant endpoints for in vivo studies.

For Healthcare Integration:

- Integrate traditional healers into primary healthcare strategies through collaborative training and referral protocols, respecting their diagnostic expertise and cultural authority.
- Develop standardized herbal formulations for high-ICF disease categories (gastrointestinal, respiratory, wound healing) through controlled pharmacological studies.
- Establish formal referral networks between traditional healers and health centers, recognizing healers' role in culturally appropriate care.
- Train health extension workers in culturally sensitive engagement with traditional healers.

For Knowledge Preservation:

- Document remaining healers' knowledge via audio-visual archives and support intergenerational transmission through apprenticeship programs.
- Integrate traditional medicine education into school curricula in a culturally appropriate manner to preserve indigenous knowledge.
- Support community-based documentation initiatives that empower local communities to record and transmit their knowledge.
- Establish formal recognition and certification systems for traditional healers to validate their expertise and facilitate integration.

For Policy:

- Incorporate traditional medicine into local and national primary healthcare systems, recognizing that 82% of community members use both systems.
- Enforce sustainable harvesting regulations aligned with CITES for internationally traded species (*Prunus africana*).
- Develop benefit-sharing agreements that compensate procedural/ritual knowledge, not just plant genetic resources.
- Ensure inclusion of female healers in policy discussions and drug discovery pipelines, recognizing their unique knowledge for reproductive health.
- Support woreda-specific conservation and integration policies that respect indigenous knowledge systems and ethnic diversity.

For Future Research:

- Conduct longitudinal studies to track changes in medicinal plant use and knowledge transmission.
- Perform molecular identification of taxonomically complex genera to confirm species identities.
- Undertake pharmacological and toxicity assays for priority species to validate traditional efficacy and safety claims.
- Investigate the specific bioactive compounds in novel species (*Maerua angolensis*, *Lagdera crispata*, *Cadaba farinosa*) through phytochemical profiling.

6. Acknowledgments

We thank all the West Haraghe zone informants, especially traditional healers, for sharing their knowledge; Afar Regional Health Bureau and Samara University for logistical support; and National Herbarium (ETH) for taxonomic assistance. We also acknowledge the Dewe community for their hospitality and participation in member-checking meetings.

7. Authors' Contributions

Melaku Msresha Woldeamanual: conceptualization, methodology, investigation, data curation, formal analysis, writing original draft, visualization. *Belay Sitotaw Goshu*: project administration, validation, writing – review & editing, formal analysis, submission of the manuscript, correspondence with the journal, revision of the manuscript following peer review. *Molla Fente Tasew*: investigation, data curation, resources, validation. *Geltu Nuredin Mushike*: investigation, resources, data curation, validation. *Sitina Dawude Ahemed*: supervision, methodology, validation, writing review & editing.

8. Conflicts of Interest

No conflicts of interest.

9. Ethics Approval

Yes applicable. Ethical approval was obtained from Addis Ababa University Institutional Review Board (Ref: DDU/IRB/045/2025), Dire Dawa University (Protocol No. DDU-IRB/245/2025), ABS permit No. OR-ABS-2026/058 was issued by the Ethiopian Environment, Forest and Climate Change Commission. Prior Informed Consent (PIC) was obtained at the community level through public meetings with Afar clan elders (Mallu). For illiterate participants, consent was documented via witnessed thumbprint and independent community translator verification.

10. Artificial Intelligence Statement: Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The authors declare that generative artificial intelligence (AI) was used exclusively to assist in the creation of the Graphical Abstract for this manuscript. No AI tools were used in the writing, interpretation, analysis, or revision of the scientific content. The Graphical Abstract generated with AI was carefully reviewed, verified, and approved by the authors, who assume full responsibility for its accuracy and integrity.

11. References

- Akanaw, H. (2018). Analysis of traditional herbal medicine ingredients, preparations, disease identification methods and delivery in Gondar city and its surrounding. *Ethiopian Renaissance Journal of Social Sciences and the Humanities*, 5(2). <https://erjssh.uog.edu.et/index.php/ERJSSH/article/view/103>
- Anbessa, B., Lulekal, E., Debella, A., & Hymete, A. (2024). Ethnobotanical study of medicinal plants in Dibatie district, Metekel zone, Benishangul Gumuz Regional State, western Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, 20(1). <https://doi.org/10.1186/s13002-024-00721-9>
- Belayneh, A., Asfaw, Z., Demissew, S., & Bussa, N. F. (2021). Medicinal plants potential and use by pastoral and agro-pastoral communities in Erer Valley of Babile Wereda, Eastern Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, 17(1), 19. <https://doi.org/10.1186/s13002-021-00446-z>
- Berlowtiz, I., Pesantes, M. A., Palacios, C. C., Martin-Soelch, C., Wolf, U., & Maake, C. (2025). Towards culturally inclusive healthcare in Peru: Mapping epistemic concepts in contemporary indigenous Amazonian medicine – Traditional healers' perspectives. *PLOS Global Public Health*. <https://doi.org/10.1371/journal.pgph.0003912>
- Bernard, H. R. (2018). *Research methods in anthropology: Qualitative and quantitative approaches*. 6th ed., Rowman & Littlefield. <https://doi.org/10.4324/9781315176945>
- Bogale, M., Sasikumar, J. M., & Egigu, M. C. (2023). An ethnomedicinal study in Tulo district, west Hararghe zone, Oromia region, Ethiopia. *Heliyon*, 9(4), e15072. <https://doi.org/10.1016/j.heliyon.2023.e15072>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. <https://doi.org/10.1191/1478088706qp063oa>
- Carruth, L. (2014). Camel milk, amoxicillin, and a prayer: Medical pluralism and medical humanitarian aid in the Somali Region of Ethiopia. *Social Science & Medicine*, 120, 405-412. <https://doi.org/10.1016/j.socscimed.2014.03.005>
- Central Statistical Agency (CSA). (2007). *Population and housing census of Ethiopia*. <https://doi.org/10.13140/RG.2.2.21688.52487>
- Chen, Z. (2024). Syncretism in Miao healing: Bridging shamanic practices and scientific treatments with religion, ritual, and local knowledge. *Religions*, 15(3), 320. <https://doi.org/10.3390/rel15030320>
- Cochran, W. G. (1977). *Sampling techniques*. 3rd ed., John Wiley & Sons.
- Cole, A. M., & Gallo, R. L. (2017). Antimicrobial peptides in human saliva. *Journal of Oral Microbiology*, 9(1), 132-145.
- Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches*. 4th ed., Sage Publications. <https://doi.org/10.4135/9781506330203>
- Cunningham, A. B., & Mbenkum, F. T. (1993). *Sustainability of harvesting Prunus africana bark in Cameroon*.

A medicinal plant in international trade. UNESCO.

- Egigu, M. C., & Mogesse, S. (2024). Ethnobotanical study of medicinal plants used to treat human ailments in Oda-Bultum district, West Hararghe zone of Oromia region, Ethiopia. *Ethnobotany Research and Applications*, 29, 1-35. <https://ethnobotanyjournal.org/index.php/era/article/view/6244>
- Etkin, N. L. (2016). Ethnopharmacology: The conjunction of medical ethnography and the biology of therapeutic action. In: H. R. Bernard, H. R., & Gravlee, C. C., Eds., *Handbook of methods in cultural anthropology*, 521-546 p, Rowman & Littlefield.
- Fassil, A., & Gashaw, G. (2019). An ethnobotanical study of medicinal plants in Chiro district, West Hararghe, Ethiopia. *African Journal of Plant Science*, 13(11), 309-323. <https://doi.org/10.5897/AJPS2019.1915>
- Fetters, M. D., Curry, L. A., & Creswell, J. W. (2013). Achieving integration in mixed methods designs—Principles and practices. *Health Services Research*, 48(6pt2), 2134-2156. <https://doi.org/10.1111/1475-6773.12117>
- Foster, G. M. (1994). *Hippocrates' Latin American legacy: Humoral medicine in the New World*. Gordon & Breach.
- Friedman, J., Yaniv, Z., Dafni, A., & Palewitch, D. (1986). A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev Desert, Israel. *Journal of Ethnopharmacology*, 16(2-3), 275-287. [https://doi.org/10.1016/0378-8741\(86\)90094-2](https://doi.org/10.1016/0378-8741(86)90094-2)
- Gebissa, N., Tolossa, K., Gebresilassie, A., Aklilu, E., Bisrat, D., Kumsa, B., & Dugassa, S. (2025). Larvicidal effects os selected medicinal plant extracts against *Anopheles arabiensis*, *Anopheles stephensi*, and *Aedes aegypti*. *Tropical Medicine and Health*, 53. <https://doi.org/10.1186/s41182-025-00879-2>
- Gedlu, M. (2024). A comprehensive review on traditional medicinal plants in Ethiopia and their application for treatment of different diseases. *Advances in Public Health*, 2024. <https://doi.org/10.1155/2024/5542990>
- Giday, M., & Teklehaymanot, T. (2013). Ethnobotanical study of plants used in management of livestock health problems by Afar people of Ada'ar District, Afar Regional State, Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, 9(1), 8. <https://doi.org/10.1186/1746-4269-9-8>
- Giday, M., Asfaw, Z., Elmqvist, T., & Woldu, Z. (2003). An ethnobotanical study of medicinal plants used by the Zay people in Ethiopia. *Journal of Ethnopharmacology*, 85(1), 43-52. [https://doi.org/10.1016/S0378-8741\(02\)00359-8](https://doi.org/10.1016/S0378-8741(02)00359-8)
- Giday, M., Teklehaymanot, T., Animut, A., & Mekonnen, Y. (2007). Medicinal plants of the Shinasha, Agew-awi and Amhara peoples in northwest Ethiopia. *Journal of Ethnopharmacology*, 110(3), 516-525. <https://doi.org/10.1016/j.jep.2006.10.011>
- Gobbo-Neto, L., & Lopes, N. P. (2007). Medicinal plants: Factors of influence on the content of secondary metabolites. *Química Nova*, 30(2), 374-381. <https://doi.org/10.1590/S0100-40422007000200026>
- Goshu, B. S., & Ridwan, M. (2026). Spiritual health and healing in Ethiopia: A scoping review and thematic analysis of beliefs, practices, and gaps in healthcare integration. *SIASAT Journal of Social, Cultural and Political Studies*, 11 (3), 162-186
- Green, E. C. (1999). *Indigenous theories of contagious disease*. Altamira Press. <https://doi.org/10.4324/9781315804287>
- Guest, G., MacQueen, K. M., & Namey, E. E. (2012). *Applied thematic analysis*. Sage Publications. <https://doi.org/10.4135/9781483384436>
- Gutema, B. T., & Mengstie, M. M. (2023). Perceived causes, diagnosis methods and treatment practices of mental illness among traditional healers of the Berta community in Assosa, Ethiopia. *International Journal of Social Psychiatry*, 69(3), 639-645. <https://doi.org/10.1177/00207640221128163>
- Halilu, E. M., Abdurrahman, A. M., Mathias, S. N., Ugwah-Oguejiofor, C. J., Abdulrahman, M., & Abubakar, S. (2021). Phytochemical and antioxidant activity of *Cadaba farinosa* Forssk stem bark extracts. *Physical Sciences Reviews*, 8(5). <https://doi.org/10.1515/psr-2020-0088>
- Hambisa, M. (2015). Knowledge management approach for indigenous knowledge of traditional healthcare practices: The case of Horro Guduru Wollega Zone, Ethiopia (Master's thesis), Jimma University.
- Hamilton, A. C. (2004). Medicinal plants, conservation and livelihoods. *Biodiversity and Conservation*, 13(8),

- 1477-1517. <https://doi.org/10.1023/B:BIOC.0000021333.23413.42>
- Heinrich, M., Appendino, G., Efferth, T., Fürst, R., Izzo, A. A., Kayser, O., Pezzuto, J. M., & Viljoen, A. (2020). Best practice in research – Overcoming common challenges in phytopharmacological research. *Journal of Ethnopharmacology*, 246, 112230. <https://doi.org/10.1016/j.jep.2019.112230>
- International Society of Ethnobiology. (2008). ISE Code of Ethics. Available in: <https://www.ethnobiology.net/code-of-ethics/> Accessed on: March 12, 2026.
- Jaccard, P. (1912). The distribution of the flora in the alpine zone. *New Phytologist*, 11(2), 37-50. <https://doi.org/10.1111/j.1469-8137.1912.tb05611.x>
- Janzen, J. M. (1978). *The quest for therapy in lower Zaire*. University of California Press. <https://doi.org/10.1525/9780520316523>
- Jacobsson, L., Merdasa, F., & Mussie, E. (1991). Traditional perceptions and treatment of mental disorders in western Ethiopia before the 1974 revolution. *Acta Psychiatrica Scandinavica*, 84(5), 475-481. <https://doi.org/10.1111/j.1600-0447.1991.tb03180.x>
- Kaba, M. (2017). Utilization of plant medicine for the treatment of health problems: The case of the Oromo of Chora District, Illubabor Zone, Western Ethiopia. *The Ethiopian Journal of Health Development*, 31(2), 84-91. <https://doi.org/10.4314/ejhd.v31i2.5>
- Kaba, M. (1996). Utilization of plant medicine for the treatment of health problems: The case of the Oromo of Chora District, Illubabor Zone, Western Ethiopia. *Ethiopian Journal of Health Development*, 10(3), 161-166. <https://doi.org/10.4314/ejhd.v10i3.215581>
- Kassaye, K. D., Amberbir, A., Getachew, B., & Mussema, Y. (2020). A historical overview of traditional medicine in Ethiopia. *Ethiopian Journal of Health Development*, 34, 45-58.
- Kleinman, A. (1980). *Patients and healers in the context of culture: An exploration of the borderland between anthropology, medicine, and psychiatry*. University of California Press. <https://doi.org/10.1525/9780520340848>
- Krippendorff, K. (2018). *Content analysis: An introduction to its methodology*. 4th ed., Sage Publications.
- Krueger, R. A., & Casey, M. A. (2015). *Focus groups: A practical guide for applied research*. 5th ed., Sage Publications. <https://doi.org/10.4135/9781483329900>
- Legesse, F. M., & Babanto, A. M. (2023). Factors associated with the use of traditional medicine in Wolaita Zone, Southern Ethiopia. *SAGE Open*, 13(1), 1-10. <https://doi.org/10.1177/21582440231153038>
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Sage Publications.
- Lulekal, E., Rondevaldova, J., Bernaskova, E., Cepkova, J., Asfaw, Z., Kelbessa, E., & Van Damme, P. (2014). Antimicrobial activity of traditional medicinal plants from Ankober District, North Shewa Zone, Amhara Region, Ethiopia. *Pharmaceutical Biology*, 52(5), 614-620. <https://doi.org/10.3109/13880209.2013.858365>
- Maroyi, A. (2023). Medicinal uses of the Fabaceae family in Zimbabwe: A review. *Plants*, 12(6), 1255. <https://doi.org/10.3390/plants12061255>
- Martin, G. J. (1995). *Ethnobotany: A methods manual*. Chapman & Hall. <https://doi.org/10.1007/978-1-4615-2496-0>
- Misganaw, W., Masresha, G., Alemu, A., & Lulekal, E. (2025). Ethnobotanical study of medicinal plants used to treat human and livestock ailments in Addi Arkay district, northwest Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, 21. <https://doi.org/10.1186/s13002-025-00775-3>
- Moerman, D. E. (2002). *Meaning, medicine and the 'placebo effect'*. Cambridge University Press.
- Nuro, G. G., Tolossa, K., Arage, M., & Giday, M. (2024). Medicinal plants diversity among the Oromo community in Heban-Arsi district of Ethiopia used to manage human and livestock ailments. *Frontiers in Pharmacology*, 15, 1455126. <https://doi.org/10.3389/fphar.2024.1455126>
- Olanlokun, J. O., Owofe, A. A., & Olorunsogo, O. O. (2021). Cadabacins – A review of the chemistry and pharmacology of glucosinolates from Cadaba species. *Natural Product Communications*, 16(2), 1-12. <https://doi.org/10.1177/1934578X21991677>
- Phillips, O., & Gentry, A. H. (1993). The useful plants of Tambopata, Peru: I. Statistical hypotheses tests with a new quantitative technique. *Economic Botany*, 47(1), 15-32. <https://doi.org/10.1007/BF02862203>

- Schmidt, T. J., Akerele, O., & Tëmkin, I. (2020). Humoral medicine in Ethiopian Orthodox Christian tradition. *Journal of Ethnopharmacology*, 258, 112889.
- Smith, J. A., Flowers, P., & Larkin, M. (2009). *Interpretative phenomenological analysis: Theory, method and research*. Sage Publications.
- Tardío, J., & Pardo-de-Santayana, M. (2008). Cultural importance indices: A comparative analysis based on the useful wild plants of Southern Cantabria (Northern Spain). *Economic Botany*, 62(1), 24-39. <https://doi.org/10.1007/s12231-007-9004-5>
- Teklehaymanot, T. (2009). Ethnobotanical study of knowledge and medicinal plants use by the people in Dek Island in Ethiopia. *Journal of Ethnopharmacology*, 124(1), 69-78. <https://doi.org/10.1016/j.jep.2009.04.005>
- Teklehaymanot, T., & Giday, M. (2007). Ethnobotanical study of medicinal plants used by people in Zegie Peninsula, northwestern Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, 3, 12. <https://doi.org/10.1186/1746-4269-3-12>
- Terefe, A., Muthuswamy, M., & Chimdessa, M. (2021). Ethnobotanical study of medicinal plants in Chiro Woreda, West Hararghe zone of Oromia Regional State, Ethiopia [Unpublished master's thesis]. Haramaya University.
- Teshome-Bahire, W. (2000). Initiation of healers in Ethiopia: A case study. *Collegium Antropologicum*, 24(2), 555-563.
- Tewodros, A., Desta, A., & Gebremeskel, K. (2026). Ethnobotanical study of medicinal plants in Hades Forest, Doba Wereda, West Hararghe, Ethiopia, and their associated indigenous knowledge. *Research Square*. <https://doi.org/10.21203/rs.3.rs-8569382/v1>
- Tlhapí, D., Malebo, N., Manduna, I. T., Lautenschläger, T., & Mawunu, M. (2024). A review of medicinal plants used in the management of microbial infections in Angola. *Plants*, 13(21), 2991. <https://doi.org/10.3390/plants13212991>
- Tolasa, M., Abebe, T., & Gadisa, E. (2019). Cultural conceptualizations of illness among Oromo communities. *Ethiopian Journal of Social Sciences*, 15, 78-102.
- Tongco, M. D. C. (2007). Purposive sampling as a tool for informant selection. *Ethnobotany Research & Applications*, 5, 147-158. <https://doi.org/10.17348/era.5.0.147-158>
- Trotter, R. T., & Logan, M. H. (1986). *Informant consensus: A new approach for identifying potentially effective medicinal plants*. In: Etkin, N. L., (Ed.), *Plants in indigenous medicine and diet: Biobehavioral approaches*, 91–112 p, Redgrave Publishing Company.
- Tufa, M. E., & Gebremariam, F. M. (2017). The role of indigenous healing practices in environmental protection among the Maccaa Oromo of Ilu Abbur.
- Usman, M., Khan, W. R., Yousaf, N., Akram, S., Murtaza, G., Kudus, K. A., Ditta, A., Rosli, Z., Rajpar, M. N., & Nazre, M. (2022). Exploring the phytochemicals and anti-cancer potential of the members of Fabaceae family: A comprehensive review. *Molecules*, 27(12), 3863. <https://doi.org/10.3390/molecules27123863>
- Workneh, T. C., King, E. J., & Kloos, H. (2020). Exploring the contribution of indigenous medicine to primary healthcare in West Belesa District in northwestern Ethiopia: A qualitative analysis. *The Ethiopian Journal of Health Development*, 34(3), 191-204.
- Woldeamanual, M. M., Goshu, B.S. (2026), Ethiopian mothers' indigenous remedies: Scientific and cultural insights. *Brazilian Journal of Science*, 5(7), 45-76, 2026.

Funding

Yes applicable.

Institutional Review Board Statement

Yes applicable. The study was approved by the Addis Ababa University Institutional Review Board (Ref: DDU/IRB/045/2025) and the Dire Dawa University Institutional Review Board (Protocol No. DDU-IRB/245/2025).

Informed Consent Statement

Yes applicable.

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).