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RESEARCH

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Ethnobotanical study of medicinal plants used to treat human and livestock ailments in Addi Arkay district, northwest Ethiopia

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Abstract

Background Ethiopia harbors a wealth of plant biodiversity, diverse ecological zones, rich cultural heritage, and long-standing traditional knowledge and medical practices. Despite documentation of this knowledge in few regions, information remains limited for the Addi Arkay district of northwestern Ethiopia. Therefore, this study aimed to document the indigenous and local knowledge on the use of human and livestock medicinal plants.

Methodology Ethnobotanical data were collected between October and December 2024 through semi-structured interviews, guided field observations, focus group discussions, and ranking exercises conducted with 385 informants. Stratified sampling, random, and purposive sampling techniques were employed. A mixed-methods approach (both qualitative and quantitative) was used for data analysis. Quantitative analyses included preference ranking, Direct Matrix Ranking (DMR), Informant Consensus Factor (ICF), fidelity level (FL), Jaccard Similarity Index (JSI), and Rahman's Similarity Index (RSI). T tests and one-way ANOVA were employed to compare mean levels of indigenous and local knowledge across different socio-demographic and socio-economic factors.

Results This study documented 112 medicinal plant species (105 genera, 58 families, including four endemic and one nearly endemic) were used for human and livestock remedies in the Addi Arkay district, northwestern Ethiopia. Fabaceae was the dominant family (7.14%). The majority of plant species (75.89%) were used to treat human ailments, while a smaller proportion (5.36%) were used for livestock, and 18.75%) were used for both human and livestock ailments. The most frequently used plant parts were leaves (34.6%) followed by roots (27.9%), and grinding was the most common method of preparation (30.4%). The preference ranking exercise revealed *Opuntia ficus-indica* as the top choice for treating human hemorrhoids and *Phytolacca dodecandra* as the preferred treatment for rabies in livestock. DMR revealed *Cordia africana*, *Olea europaea* subsp. *cuspidata*, and *Terminalia leiocarpa* as the most threatened multipurpose medicinal plants. Informant Consensus Factor values ranged from 0.63 to 0.93. Fidelity level analysis revealed that *Phytolacca dodecandra* was most effective against rabies, followed by *Rubia cordifolia* for cough and *Plumbago zeylanica* for swelling. Agricultural expansion posed the most significant threat, followed by overgrazing and fuel (charcoal and fuel wood). The highest levels of indigenous and local medicinal plant knowledge were predominantly transmitted orally through family lines, with paternal contributions often playing a significant role. Compared to other studies conducted in Ethiopia, the Jaccard Similarity Index (JSI%) for human medicinal plants ranged in value from 6.9% to 68.92% and for veterinary plants from 10.91% to 27.91%, whereas the Rahman's Similarity

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Index (RSI) ranged from 0.98% to 15.63%. Ten novel medicinal plant uses, not previously documented in Ethiopia or elsewhere, were identified.

Conclusion This pioneering study in Addi Arkay district, northwestern Ethiopia, documented 112 medicinal plants for the treatment of human and livestock ailments, revealing the significant array of plant resources utilized for local primary healthcare services. However, threats from agricultural expansion, overgrazing, and fuel (charcoal and fuel wood) use necessitate in situ and ex situ conservation actions. Implementing sustainable harvesting practices and community-based conservation initiatives is recommended to protect the rich medicinal plants wealth of the district for continual use across generations besides ensuring preservation of valuable ethnomedicinal knowledge.

Background

Ethiopia is a renowned center for ethnomedicinal research, owing to its exceptional plant biodiversity, diverse ecological zones, rich cultural heritage, and deep-rooted traditional knowledge and ancient medical practices [1, 2]. As one of the twelve Vavilov Centers of Origin, Ethiopia's flora encompasses 6,027 higher plant species, of which 647 (10.74%) are endemic [1, 3]. From this wealth of plant genetic resources, approximately 800 species are actively employed within the traditional healthcare system to treat nearly 300 distinct physical and mental health disorders [4]. This reliance on traditional medicine is substantial, with an estimated 80% of the Ethiopian human population and 90% of livestock depending on it, and 95% of traditional medical preparations derived from plant sources [5, 6]. However, the transmission of this invaluable knowledge, primarily through oral tradition, is increasingly threatened [7]. Globalization, modern education, and acculturation, coupled with persistent stereotypes of herbalists (often labeled with terms like "wizard," "magician," "tenquay," and "debetera"), contribute to the erosion of traditional practices [2, 8, 9]. Moreover, a range of anthropogenic factors, including habitat destruction, urbanization, agricultural expansion, deforestation, firewood collection, and broader environmental degradation, significantly impacts both the availability of medicinal plants and the transmission of associated knowledge, particularly in culturally rich regions of Ethiopia [10, 11].

Ethiopia's modern healthcare services and institutions are often inadequate, inaccessible, and unaffordable for a large segment of the population [12]. Limited health centers, coupled with shortages of medicines and healthcare personnel, disproportionately impact low-income communities and rural populations, often compelling them to seek healthcare from traditional practitioners [12, 13]. This is particularly evident in areas like Addi Arkay district, where reliance on plant-based traditional medicine is high. Community trust in the efficacy of traditional remedies and the relative affordability of these plant-based treatments further contribute to their widespread use [14]. The Addi Arkay district, a dryland region characterized by *Combretum-Terminalia* vegetation [15], is home to the Waldeba Monastery, one of the most sacred sites in Ethiopia. Similar to other lowland regions of the country, this area is often subject to misconceptions, labeled as a "waterless area" and perceived as "resource-poor and challenging for development [16]." As a result, Addi Arkay has been marginalized and neglected in terms of research and management interventions. However, with appropriate management strategies, the area has the potential to serve as a vital resource for herbal medicine, climate change adaptation and mitigation, as well as a buffer against erosion and desertification.

Therefore, given the unique cultural and ecological context of Addi Arkay and the urgent need to document and preserve its traditional medicinal plant knowledge, this study aimed to: (i) document the medicinal plants with the associated indigenous and local knowledge employed by local communities to treat human and livestock ailments; (ii) analyze the influence of socio-demographic and socio-economic factors on traditional medicinal knowledge; and (iii) assess the major threats challenging these vital plant resources.

Materials and methods

Description of the study area

The study was conducted in the Addi Arkay district, situated within the North Gondar Zone of the Amhara Region in northwestern Ethiopia, approximately 837 km northwest from the capital city, Addis Ababa. The Addi Arkay district spans an area of 1,720 km^2, with elevations ranging from 858.195 to 4411.78 m above sea level (m.a.s.l) and found between 12°50′0"and 13°30′0"N latitude and 37°40′0"—38°20′0"E longitude (Fig. 1). The topographical features of the district were analyzed using Digital Elevation Models (DEMs) obtained from the United States Geological Survey (USGS). The results indicated that the district is predominantly characterized by flat terrain, which constitutes 73% of the total area. In contrast, hilly terrain makes up 5.4% of the landscape, mountainous regions account for 7.2%, and valleys represent 14.4%.

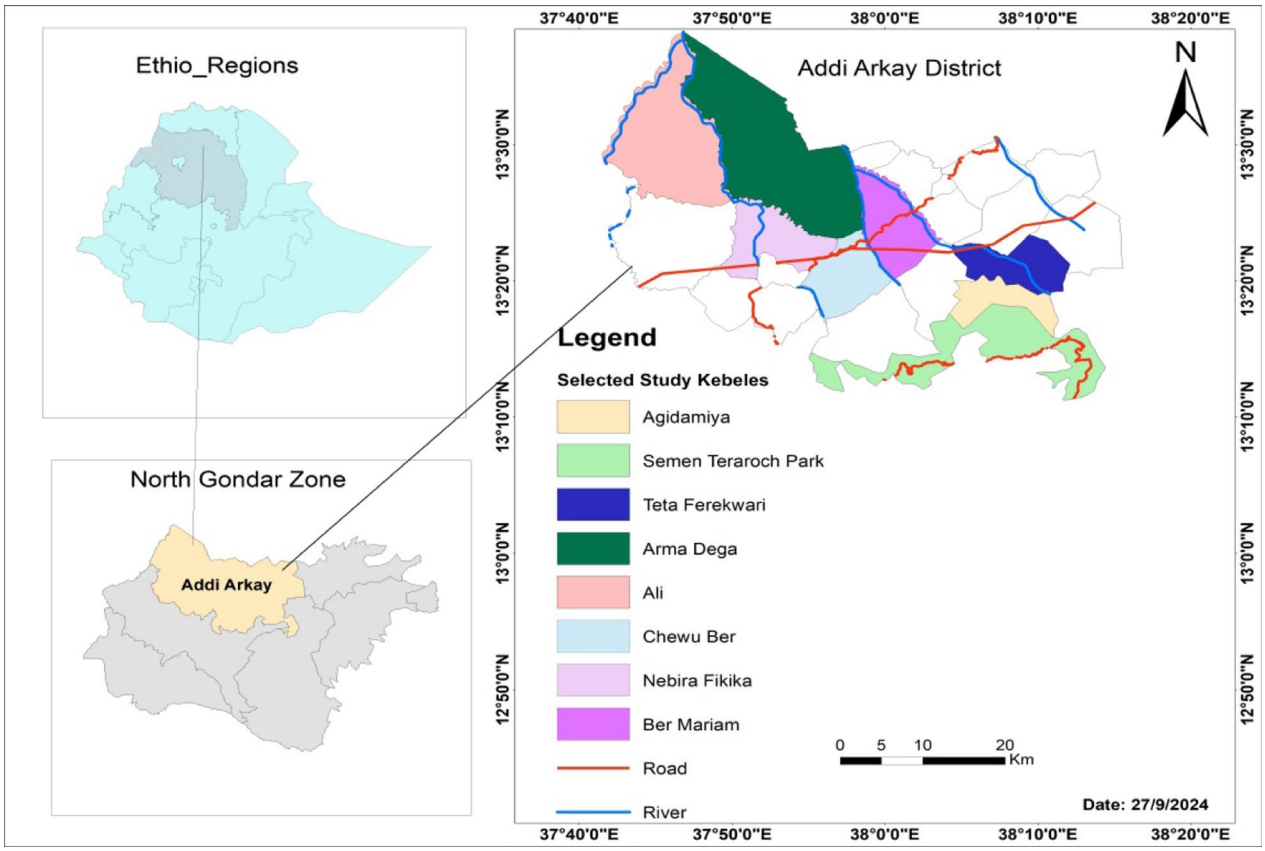

Fig. 1 Map of Ethiopia showing Amhara region and the study district

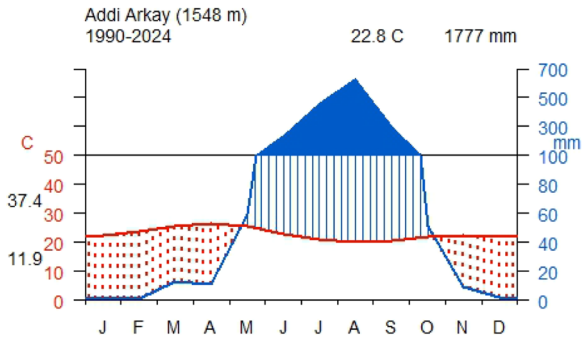

Fig. 2 Climate diagram for Addi Arkay town (Amhara Meteorological Service, 2024)

The district exhibits a uni-modal rainfall pattern (Fig. 2), with a mean annual rainfall of 1,777 mm. The wet season spans from May to October, while the dry season lasts from November to April. The mean annual temperature was 22.8 °C, with minimum and maximum temperatures of 11.9 °C and 37.4 °C, respectively (Amhara Meteorological Service Center, 2024). Following Ethiopia's traditional agroecological zone classification [17], the district comprises 67.46% Kolla (lowland, 500–1500 m.a.s.l.), 23.43% Woyina Dega (midland, 1500–2500 m.a.s.l.), 7.42% Dega (highland, 2500–3200 m.a.s.l.), and 1.99% Wurch (highland and alpine, > 3500 m.a.s.l.).

Demographic characteristics of the Addi Arkay district were ascertained from data provided by the North Gondar Zone Plan Commission (2025) projected population size of the Census (CSA, 2007). The total population of the district in 2024 was 125,908, comprising 63,865 men and 62,043 women. A predominantly rural population (103,756) was observed, with a smaller urban population of 22,151. Religious affiliation was primarily Ethiopian Orthodox Christianity (89.5%) and Muslims accounting 10.5%. The district's ethnic composition was predominantly Amhara (97.63%) and Tigre (2.1%), with other ethnic groups constituting a small proportion (0.27%) of the population. Linguistic data indicated Amharic as the primary language (98.02%), followed by Tigrinya (1.8%), with other languages spoken by the remaining 0.18% of the population.

According to Addi Arkay District Agriculture Office (2024), food insecurity was a significant challenge in the Addi Arkay district, with 18 of its 22 Kebeles reliant

on food aid. The district's diverse agricultural system includes the cultivation of cereals (*Eragrostis teff*, *Hordeum vulgare*, *Zea mays*, *Sorghum bicolor*, *Eleusine corocana*, and *Triticum aestivum*), legumes (*Phaseolus vulgaris*, *Pisum sativum*, *Cicer arietinum*, *Glycine max*, *Lens culinaris*, and *Lathyrus sativus*), oil crops (*Guizotia abyssinica*, *Linum usitatissimum*, *Helianthus annuus*, and *Sesamum indicum*), fiber crop (*Gossypium herbaceum*). Mixed crop-livestock farming represents the predominant agricultural practice (80.8%), followed by exclusive crop cultivation (17%) and exclusive livestock rearing (2.2%).

Sampling and data collection methods

Reconnaissance survey and site selection

This research was conducted with ethical approval obtained from the University of Gondar, College of Natural and Computational Science, Department of Biology (clearance number 419/2024). Subsequent to acquiring permission from the Addi Arkay District Administration Office, a reconnaissance survey was undertaken within the district from July 5th to July 30 th, 2024. Based on the insights gained during the reconnaissance survey and in consultation with district leaders and local community elders, eight Kebeles were selected through stratified random sampling. The selected sample Kebeles represented 36.36% of the total 22 Kebeles in the Addi Arkay district. The selection process considered the presence of traditional healers/herbalists and agroecological variations within the district. These criteria were strategically chosen to ensure representative samples across the district's diverse ecological and sociocultural contexts, ensuring a comprehensive investigation of indigenous and local knowledge related to traditional medicine.

Sample size determination and informant selection

The sample size was determined using Cochran's formula: $n = N/1 + N (e^2)$, as cited by [18], where n is the sample size, N is the total number of households in the district, and e is the margin of error $(0.05)^2$ at a 95% confidence level. The sample size for each Kebele was subsequently calculated based on the proportion of households in that Kebele relative to the total number of households across the selected Kebeles. Thus, informants from each kebele = (number of households in one kebele/total number of households in all kebeles) x total sample size. A total of 385 informants participated in the study, comprising of 355 general informants and 30 key informants, with a gender distribution of 229 men and 156 women (see additional file 1). General informants were selected through stratified random sampling technique, while key informants were chosen via purposive sampling technique based on the recommendations from local leaders and the community [1].

Data collection and voucher specimen identification

Ethnobotanical data were collected following established protocols [19–23] using semi-structured interviews, focus group discussions, and guided field walks. Semi-structured interviews were central to data collection, providing a flexible framework for in-depth exploration of specific topics while allowing informants to share personal experiences and nuanced understandings of traditional healing practices in a conversational setting. Interviews were conducted with a diverse range of informants for detailed qualitative data on various aspects of medicinal plants, including the local plant names, parts used, treated ailments, dosage, additives, preparation/administration methods, perceived efficacy, and threats, as well as qualitative data for ranking exercises. The interviews were primarily conducted in Amharic language, common language of the study area. Subsequently, all the documented data were translated into English.

Focus group discussions (FGDs) complemented the individual interviews by providing a platform for collective knowledge sharing and community dialog. This method encouraged the sharing of ideas and experiences related to medicinal plant use, revealing both community consensus and diverse viewpoints on specific medicinal plants and their applications. FGDs also served to verify and expand upon data collected during the interviews, adding depth to the subsequent analysis. A total of 12 informants (6 men and 6 women) participated in the FGDs. To encourage open communication and address potential gender-specific perspectives, such as communication styles, emotional expression, shyness, and fear of judgment, FGDs were segregated by gender, with separate sessions held for men and women participants [24]. These sessions were conducted at a convenient location within the community, facilitated by the researcher, and meticulously documented through detailed note-taking for subsequent analysis. To ensure the validity and reliability of ethnobotanical data, a triangulation technique was employed, incorporating multiple data collection methods and diverse informant perspectives to cross-validate findings, mitigate bias, and enhance the robustness of the study's conclusions.

Fieldwork, including guided walks with informants, was conducted from October to December 2024, providing a crucial experiential dimension to the study. Field equipment included a GPS, plant press, data sheets, secateurs, camera, and hand lens. Researchers accompanied informants into the field to directly observe

medicinal plants in their natural habitats and collect voucher specimens. During these walks, informants shared their intimate knowledge of plant identification, local names, growth patterns, ecological preferences, morphology of plants assisted for identification, and traditional harvesting practices. During the guided field walk exercise, each specimen was collected numbered, pressed, and dried. Identification was performed using the Flora of Ethiopia and Eritrea [25–31], with support from experts at the University of Gondar and Ethiopian Biodiversity Institute. Finally, the pressed specimens were deposited at the University of Gondar mini Herbarium. The recent scientific name updates for a plant species were verified using the world flora online [32] and Plants of the World Online (https://powo.science.kew.org/). Additionally, the endemic plants and conservation status of the identified species were cross-referenced and validated against the comprehensive works of [33–37] and the IUCN Red List of Threatened Species online database (https://www.iucnredlist.org/), which provides authoritative information on the endemic flora and conservation status of plants.

Data analysis

This study employed a mixed-methods approach using both qualitative and quantitative data [19, 20]. Quantitative ethnobotanical data, managed in Microsoft Excel 2010, were analyzed using Informant Consensus Factor (ICF), Preference Ranking, Direct Matrix Ranking, Index of Fidelity (FL), Jaccard's Similarity Index (JSI), and Rahman's Similarity Index (RSI). Results were presented in tables. Data regarding growth form, parts used, preparation, and administration methods were also analyzed and were presented in graphs and tables. T tests and one-way ANOVA (SPSS v.25) were employed to compare traditional medicinal plant knowledge across various socio-demographic and socio-economic factors. Specifically, a two-tailed independent samples t test was utilized to discern differences between two categorical parameters, while one-way ANOVA assessed variances among three or more categorical variables. To further elucidate specific group differences within variables featuring more than two categorical levels, post hoc analyses, including Tukey's Honest Significant Difference (HSD) and Least Significant Difference (LSD) tests, were conducted. Qualitative data provided narrative context and insights for the discussion.

Preference ranking

Preference ranking, following [19], was used to identify the five most important medicinal plants for treating human hemorrhoids and the five most important plants for treating rabies in livestock. Ten randomly selected informants ranked the pre-selected plants based on personal preference and perceived community importance, assigning a value of 5 to the most preferred and 1 to the least. Total scores for each plant were summed to determine the overall ranking.

Direct Matrix Ranking (DMR)

DMR, following [19, 20], was used to identify multipurpose medicinal plants under the greatest pressure and their respective threats. Fifteen key informants evaluated ten multipurpose medicinal plants across seven use categories (agriculture tools, building, medicine, fodder, food, fuel and furniture). Informants assigned use values (5 = best, 4 = very good, 3 = good, 2 = less used, 1 = least used, 0 = not used). Subsequently, average use values were calculated for each species, which were then ranked accordingly.

Informant Consensus Factor

Reported human and livestock ailments were categorized according to World Health Organization's International Classification of Diseases 11 th Revision (ICD-11) [38] with some modifications. The Informant Consensus Factor (ICF) was calculated for each disease category to assess informant agreement and determine the most important diseases categories and potentially effective medicinal plants in the respective disease category [39]. The ICF ranges from 0 to 1, where higher values reflect greater consensus among informants regarding the use of specific medicinal plants for treating particular ailments. An ICF value of 0 indicates no agreement, suggesting that informants have diverse opinions or knowledge about the medicinal properties of plants for a given disease [40]. Conversely, values closer to 1 imply a strong consensus, highlighting the importance of certain plants within traditional medicine for both human and livestock health. The formula used was:

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

where nur = number of use citation in each category and nt = number of species used [19].

Index of fidelity FL

Index of fidelity (FL) was used to determine relative healing potential of medicinal plants using the formula:

$$\mathrm{FL} = \frac{\mathrm{IP}}{\mathrm{IU}} \times 100$$

where IP = the number of informants who independently cited the importance of a species for treating a particular

disease, and IU = the total number of informants who reported the plant for any given diseases [41].

Jaccard's Similarity Index

Jaccard's Similarity Index (JSI%) was employed to assess the similarity of human and veterinary medicinal plants utilized in this study compared to previous research in Ethiopia. When utilizing the Jaccard index to compare plant use, plant species that were used in both human and livestock remedies were counted in both the human medicinal plant dataset and the livestock medicinal plant dataset separately. This was done to ensure that the full usage of the plant was accounted for in the similarity index calculations. The calculation for Jaccard's Similarity Index was following [42, 43].

$$\mathrm{JSI}(\%) = \left(\frac{c}{a+b-c}\right) \times 100$$

where a = no species only in current study, b = no species only in previous study, and c = no of common species in current study and previous studies.

Rahman's Similarity Index (RSI)

Rahman's Similarity Index (RSI%) serves as a crucial metric for assessing the cultural similarities of indigenous knowledge across diverse communities and areas [44]. RSI facilitates a deeper understanding of how communities interact with their natural environment and the cultural significance they attach to these plants. The RSI in percent is calculated using the formula:

$$\mathrm{RSI}(\%) = \frac{\mathrm{Nd}}{\mathrm{Na}+\mathrm{Nb}+\mathrm{Nc}-\mathrm{Nd}} \times 100$$

where "Na" is the number of unique species in area A, "Nb" is the number of species unique in area B, "Nc" is the number of common species in both areas A and B, and "Nd" is the number of common species used for similar ailments in both areas A and B. Additionally, "Nc" and "Nd" must be greater than or equal to zero, which allows for a meaningful comparison of shared knowledge regarding plant uses for medicinal purposes.

Results

Socio-demographic and socio-economic characteristics of the informants

This study investigated the influence of socio-demographic and socio-economic factors on medicinal plant knowledge within the Addi Arkay district. Results indicated significant variations in knowledge scores across demographic groups (Table 1). Key informants ($n = 30$), possessing specialized knowledge, demonstrated a substantially higher mean score (20.93 ± 5.25) compared to general informants ($n = 355$) (9.06 ± 5.04, $p = 0.000$). Gender also played a significant role, with men exhibiting greater knowledge (11.45 ± 6.56) than women (7.84 ± 4.16, $p = 0.000$). Age correlated positively with knowledge, with individuals aged 60 and above scoring significantly higher (15.55 ± 5.46) than younger age groups (20–39 years: 6.82 ± 4.54; 40–59 years: 9.78 ± 4.72, $p = 0.000$). Interestingly, illiterate individuals demonstrated greater knowledge (10.80 ± 6.03) than literate individuals (5.47 ± 2.84, $p = 0.000$), with a further decline in knowledge observed among those with higher education levels (e.g., >12 years: 3.33 ± 0.71, $p = 0.000$). Marital status also influenced knowledge scores, with married individuals exhibiting higher scores (10.66 ± 5.99) compared to other marital statuses ($p = 0.002$). Ethnicity and religion also demonstrated significant associations with medicinal plant knowledge (Amhara: 10.27 ± 6.00; Tigray: 5.00 ± 1.85; Agew: 4.20 ± 0.84, $p = 0.000$; Orthodox: 10.36 ± 6.01; Muslim: 5.29 ± 2.68, $p = 0.000$).

Socio-economic factors also significantly impacted medicinal plant knowledge. Occupation influenced knowledge retention, with ascetics (11.05 ± 5.92) and farmers (10.35 ± 6.03) exhibiting substantially higher mean knowledge scores compared to multiple occupations (8.00 ± 3.23), merchants (5.82 ± 1.78), and formally employed individuals (3.65 ± 0.70). Access to transportation showed a negative correlation with knowledge, with individuals lacking transport access scoring higher (11.61 ± 6.08) than those with transport access (5.67 ± 2.58, $p = 0.000$). Income level also correlated inversely with knowledge, with poor individuals (10.96 ± 6.455) exhibiting greater knowledge than rich individuals (5.85 ± 2.541, $p = 0.000$). Finally, distance from town exhibited a positive correlation with medicinal plant knowledge, as individuals residing more than 8 km away recorded significantly higher scores (10.96 ± 6.25) compared to those living within 3 km (4.97 ± 1.94, $p = 0.000$).

Diversity of medicinal plants for human and livestock ailments

A floristic survey of human and livestock medicinal plants in the Addi Arkay district recorded 112 species distributed across 105 genera and 58 families (Table 2). This comprehensive inventory showed the region's significant ethnomedicinal potential. The Fabaceae family was the most represented, comprising 8 species (7.14%) of the total, followed by Lamiaceae and Solanaceae, each contributing 6 species (8.04%) of the total. Four medicinal plant species endemic to Ethiopia namely: *Echinops kebericho* (NT), *Kalanchoe petitiana* (LC), *Millettia ferruginea* (LC), *Urtica simensis* (LC), and one nearly endemic medicinal plant, *Thymus schimperi* (NE), were

Table 1 Medicinal plant knowledge of the informants in Addi Arkay district ($n = 385$)

Parameter	Informant categories	Number of informants (n)	Mean ± SD	F-statistic	*p* value
Socio-demographic parameters					
Healing experience	Key Informants	30	20.93 ± 5.25	152.318	0.000*
	General Informants	355	9.06 ± 5.04		
Gender	Men	229	11.45 ± 6.56	37.077	0.000*
	Women	156	7.84 ± 4.16		
Age (Years)	20–39	166	6.82 ± 4.54^{c}	100.688	0.000*
	40–59	120	9.78 ± 4.72^{b}		
	> = 60	99	15.55 ± 5.46^{a}		
Education status	Illiterate (unable to read and write)	326	10.80 ± 6.03	44.243	0.000*
	Literate (able to read and write)	59	5.47 ± 2.84		
Education level	1–6	26	7.12 ± 3.51^{a}	10.493	0.000*
	7–12	24	4.67 ± 1.05^{b}		
	> 12	9	3.33 ±0.71^{c}		
Marital status	Single	92	8.25 ± 5.77^{ab}	5.161	0.002*
	Married	283	10.66 ± 5.99^{c}		
	Widowed	7	7.86 ± 1.95^{ab}		
	Divorced	3	4.33 ±0.58^{b}		
Ethnic background	Amhara	365	10.27 ± 6.00^{a}	8.291	0.000*
	Tigray	15	5.00 ±1.85^{b}		
	Agew	5	4.20 ±0.84^{c}		
Religion	Orthodox	357	10.36 ±6.01	19.612	0.000*
	Muslim	28	5.29 ±2.68		
Socio-economic parameters					
Occupation	Farmer	295	10.35 ±6.03^{a}	7.467	0.000*
	Merchant	11	5.82 ±1.78^{b}		
	Employed (in a formal job)	17	3.65 ±0.70^{b}		
	Ascetics (Monk/nun)	56	11.045 ±5.92^{a}		
	Multiple occupations	6	8.00 ±3.23^{ab}		
Transport access	Accessible (road and car)	105	5.67 ±2.58	93.776	0.000*
	Not accessible (nor road and car)	280	11.61 ±6.08		
Income level	Poor (estimated annual income less than $1000)	270	10.96 ±6.46^{a}	14.472	0.000*
	Medium (estimated annual income than $1000-$10,000)	89	8.26 ±3.94^{b}		
	Rich (estimated annual income greater than $10,000)	26	5.85 ±2.54^{c}		
Distance from town (km)	Less than 3 km	37	4.97 ±1.94^{c}	13.806	0.000*
	3–5 km	25	7.68 ±5.27^{b}		
	6–8 km	45	9.38 ±4.06^{ab}		
	More than 8 km	278	10.96 ±6.25^{a}		

* Shows a significant difference for the parameters at $p < 0.05$

documented within the study area. The analysis of therapeutic applications revealed a strong focus on human health, with 85 species (75.89%) utilized to address distinct human ailments, while a smaller proportion of species, 6 (5.36%), was employed for livestock ailments, and 21 species (18.75%) served both human and livestock health needs (Table 2).

The habitat analysis demonstrated a strong reliance on natural forests as a source of medicinal plants, with 81 species (72.32%) collected from these areas followed by relatively smaller contributions from home gardens (16 species, 14.29%) and arable land (15 species, 13.39%) The distribution of medicinal plant species across various growth forms revealed that shrubs were the most prevalent, accounting for 42 species (37.50%), followed by herbs (41, 36.61%), trees (19, 16.96%), and climbers (10, 8.93%) (Fig. 3).

Plant parts, preparation, and additives used for remedies

The findings from the interviews revealed significant insights into the utilization of plant parts in traditional medicinal practices. Notably, leaves emerged as the predominant component, constituting 34.6% of the reported medicinal plants (Fig. 4). This was closely followed by

Table 2 List of medicinal plant used to treat human and livestock ailments in Addi Arkay district, Northwestern Ethiopia

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU	Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
Acanthaceae	*Justicia schimperiana* (Hochst. ex Nees) T.Anderson Simiza (Am)	13°18'39"N 37°55'54"E 1353 m	LI	S	NF	L	F	Hu	Rheumatism	Heat the leaf in fire and apply the overheated leaf to the painful area	T	[5, 6, 45-53]	WM029/25
Amaranthaceae	*Achyranthes aspera* L. Telenji (Am)	13°25'05"N 37°55'08"E 1326 m	LI	H	NF	R/L	F	Hu	Menorrhagia (over menstruation)	Crush the leaves and root, then drink with tea	O	[5, 40, 45, 47, 49, 50, 52, 54-57]	WM046/25
						R	F	Hu	Stabbing pain (wugat)	Grind it with root of *Rumex crispus* (tult) and *Urtica simensis* (sama), mix with butter and then smear painful body	T		
	Chenopodium murale L. Amedmado (Am)	13°28'28"N 37°51'28"E 1234 m	LI	H	NF	F	F	Hu	Wound	Grind the leaf into a paste and apply it directly to the wound	T	[45, 47, 54]	WM050/25
Amaryllidaceae	*Allium cepa* L. Qeyi-shinkurt (Am)	13°24'42"N 37°51'12"E 1256 m	LI	H	AL	Bu	F	Hu	Increase sexual desire	Eat the fresh bulb until sexual desire is improved	O	[46, 50, 58, 59]	WM013/25
	Allium sativum L. Nechi-shinkurt (Am)	13°21'41"N 38°10'42"E 2148 m	MI	H	AL	Bu	F/D	Hu	Cough	Boil with water, then drink the infusion	O	[1, 5, 6, 45-54, 57-61]	WM098/25
						Bu	F	Hu	Common cold	Sniff the fresh bulb	N		
						Bu	F	Hu	Malaria	Eat the fresh bulb	O		
						Bu	F	Hu	Abdominal pain	Boil the bulb with the leaves of *Citrus lemon* in water, allow it to cool, mix with honey, and then drink after three days.	O		
	Crinum abyssinicum Hochst. ex A.Rich. Yejib shinkusrt (Am)	13°19'17"N 38°07'07"E 2540 m	HI	H	NF	Bu	F	Hu	Swelling	Grind and mix with butter and smear, or grind with the root *of Kalanchoe petitiana*, heat the mixture, and burn the swell part	T	[51, 62]	WM072/25
Apiaceae	*Coriandrum sativum* L. Dinbilal (Am)	13°17'29"N 38°04'33"E 2094 m	MI	H	AL	S	D	Hu	Cough	Boil the seeds with butter and water, and then drink the mixture.	O	[5, 51]	WM071/25
	Foeniculum vulgare Mill. Ensilal (Am)	13°18'52"N 38°10'30"E 2067 m	MI	H	NF	L	F	Hu	Kidney stone	Socked in water then allow them to drink in the morning	O	[1, 46, 47, 49, 50, 55, 60, 62]	WM077/25

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU	Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
Apocynaceae	*Calotropis procera* (Aiton) Dryand. Tobia (Am), Ghindae (Tg)	13°19′58″N 37°55′01″E 1328 m	LI	S	NF	R	D	Hu	Scabies (itch)	Dry and grind the root, then mix it with butter to create a cream and smear on the body	T	[1, 47, 48, 55, 57, 59, 62]	WM024/25
						La	F	Hu	Hemorrhoid	Extract the latex and then smear the fluid on the affected area	T		
						La	F	Li	Wound	Squeeze the latex, mix it with latex from *Euphorbia tirucalli* and *Euphorbia abyssinica*, then let it cream for 3 days before use	T		
	Carissa spinarum L. Agam (Am)	13°19′19″N 37°55′38″E 1454 m	LI	S	NF	L	F	Li	Eye disease	Squeeze the leaf to extract the juice, then apply a few drops to the eyes	Op	[1, 5, 6, 45, 46, 49, 59, 62]	WM025/25
						R	D	Hu	Evil spirit	Burn the root and use the resulting smoke for fumigation	N		
	Stephanotis rubicunda (K. Schum.) S.Reuss, Liede & Meve Quandira-hareg (Am)	13°27′08″N 37°58′32″E 1258 m	LI	C	NF	R	F	Li	Rabies	Crush the root, soak with milk, and let the puppy drink	O	[63]	WM045/25
Asparagaceae	*Asparagus africanus* Lam. Yeset-kesit (Am)	13°25′02″N 37°58′51″E 1236 m	LI	S	NF	R/L	F	Hu	Hemorrhoid	Grind the leaf and root, mix with Calotropis procera latex, then paste on it	T	[43, 44, 48, 59]	WM039/25
Asphodelaceae	*Aloe vera* (L.) Burm.f. Eret (Am)	13°27′55″N 37°45′32″E 1298 m	LI	S	HG	La	F	Hu	Fibril illness	Squeeze a quarter cup of the gel and mix it with coffee to drink	O	[53, 54, 60]	WM001/25

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU		Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
Asteraceae	*Artemisia abyssinica* Sch. Bip. ex A.Rich. Chikugh (Am)	13°18'05"N 38°04'33"E 2343 m	HI	H	HG	L	D		Hu	Common cold	Sniff the leaf	N	[45, 50, 53-55, 59]	WM062/25
	Bidens pilosa L. Yekahinkim/Yeseyitan-merife (Am)	13°34'02"N 37°47'16"E 1084 m	LI	H	NF	R	F	Hu		Nasal bleed	Grind the root, mix it with October honey, and consume the mixture	O	[46, 62]	WM0488/25
						R	F	Hu		Snake bite	Grind the root, squeeze, and drink juice	O		
	Echinops kebericho Mesfin [NT] Kebericho (Am)	13°22'00"N 38°11'00"E 2387 m	HI	H	NF	R	D	Hu		Fibril illness	Burn the root and fumigate the house with the smoke	Ot	[6, 46, 53, 59, 61, 62]	WM101/25
						R	D	Hu		Snake repellents	Burn the root and fumigate house; the smoke repels snake	Ot		
	Laggera crispata (Vahl) Hepper & J.R.I.Wood Yedega tila (Am)	13°20'32"N 38°11'50?"E 2415 m	HI	H	NF	L	F	Hu		Bleeding	Squeeze the leaf and apply to stop bleeding	T	[6, 57, 64]	WM105/25
	Vernonia amygdalina Delile Girawa (Am)	13°24'14"N 37°51'55"E 1215 m	LI	S	NF	L	F	Hu		Spider poison	Squeeze to extract the fluid, then smear it	T	[6, 46, 53, 57, 60, 64, 65]	WM023/25
						L	F	Hu		Gastritis	Squeeze the leaves to extract the fluid, then mix it with water and drink one cup	O		
						L	F	Hu		Intestinal parasite	Squeeze the leaves of *Vernonia amygdalina* and *Zehneria scabra* to extract the fluid. Mix the extracts, dilute with water, and drink one cup before meals	O		

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU		Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
Bignoniaceae	*Stereospermum kunthianum* Cham. Zana (Am)	13°26'18"N 37°53'39"E 1344 m	LI	T	NF	SB	F	Hu		Laceration (skin cut)	Wrap the inner layer of the bark around the injured area	T	[54, 66-68]	WM055/25
						SB	F	Hu		Luxation (bone dislocation)	Wrap the inner layer of the bark around the injured bone	T		
						SB	F	Hu		Back pain	Grind the bark and mix it with honey, then consume the mixture.	O		
	Cordia africana Lam. Wanza (Am)	13°28'06"N 37°58'19"E 1318 m	LI	T	NF	F	F	Hu		Gastritis	Consume the fruit directly	O	[1, 45-47, 52, 54, 59, 68, 69]	WM041/25
						R	F	Hu		Scorpion bite	Chewing the root and swallow	O		
						SB	D	Hu		Hemorrhoid	Grind the stem bark of it with the root bark *of Rydingia integrifolia*, mix with honey or butter, and smear	T		
						F	F	Hu		Tape worm	Swallow the fruit	O		
	Cynoglossum lanceolatum Forssk. Chigogot (Am)	13°18'45"N 38°09'41"E 2162 m	MI	H	NF	R	F	Hu		Diarrhea	Grind the root and drink with yoghurt	O	[45, 58, 70]	WM075/25
Brassicaceae	*Lepidium sativum* L. Feto (Am)	13°28'13"N 37°47'08"E 1378 m	LI	H	AL	S	D	Hu		Hemorrhoid	Burn the stem, apply the flame topically	T	[1, 46, 52, 53, 59]	WM006/25
						S	D	Hu		Gastrointestinal parasite	Grind seeds, mix with water to create a paste, and combine with chopped injera to eat	O		
						S	D	Hu		Gastritis	Soak the seed in water, then drink the jelly-like fluid	O		
Cactaceae	*Opuntia ficus-indica* (L.) Mill. Qulqual (Am), Beles (Tg)	13°20'15"N 38°06'32"E 2055 m	MI	S	NF	Fl	F	Hu		Hemorrhoid	Mix the flower with honey and apply it gently around the anus	T	[1]	WM082/25

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU		Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
Capparaceae	*Boscia integrifolia* J.St.-Hil. Keremed	13°26′22″N 37°52′16″E 1145 m	LI	T	NF	R	D	Hu		Evil eye	Grind the root and then inhale or sniff the powder	N	[47, 54, 71]	WM049/25
						St	D	Hu		Evil sprite	Cut the stem to make cross and tie it around the neck	Ne		
	Capparis tomentosa Lam. Gimero (Am)	13°28′36?N 37°54′54″E 1680 m	MI	C	NF	R	F	Hu		Toothache	Chew the root along with *Zingiber officinale* and hold it on the teeth for a few minutes	O	[1, 6, 54, 56, 59]	WM014/25
						R	F	Hu		Cough	Grind it with the root of *Rosa abyssinica*, then burn the mixture and inhale the smoke	N		
						R	D	Hu		Evil sprite	Burn the root and use the smoke to fumigate the house	Ot		
Caryophyllaceae	*Silene macrosolen* Steud. ex A.Rich. Wegert (Am)	13°20′26″N 37°57′17″E 1830 m	MI	H	NF	R	D	Li		Fibril illness	Burn with fire, then fumigate the smoke	N	[51, 72, 73]	WM087/25
Celastraceae	*Catha edulis* (Vahl) Endl. Khat (Am)	13°26′06′N′38°00′05″E 1505 m	MI	S	HG	L	F	Hu		Asthma	Boil with the leaf of *Coffee arabica* and mix with *Meliponula bocandei* honey, then drink	O	[1, 6, 46, 52, 61, 68]	WM040/25
Combretaceae	*Terminalia leiocarpa* (DC.) Baill. Kirkira (Am)	13°24′54″N 37°56′56″E 1453 m	LI	T	NF	SB	F	Hu		Stomachache	Chew the stem bark and swallow the liquid	O	[74]	WM047/25
						SB	F	Hu		Malaria	Boil the stem bark with water, then drink the infusion	O		
						SB	F	Hu		Uvula descending	Chew the stem bark and swallow the fluid	O		
						L	F	Li		Eye diseases	Squeeze the leaf and drop the liquid into the eye	Op		
						L	F	Li		Eye diseases	Squeeze the leaf and drop the liquid into the eye	Op		
Crassulaceae	*Kalanchoe petitiana* A.Rich. [LC] Andahula (Am)	13°20′50″N 38°11′23″E 2518 m	HI	S	NF	L	F	Hu		Swelling	Heat the leaf in fire and apply the overheated leaf to the painful area	T	[1, 6, 61]	WM104/25
						L	F	Hu		Finger amputation (Lufe)	Grind the leaf and wrap around the affected area	T		

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU		Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
Combretaceae	*Terminalia brownii* Fresen. Weiba (Tg)	13°28'02"N 37°51'34"E 1280 m	LI	T	NF	SB	F	Hu		Hepatitis	Boil with *Vicia faba*, drink the decoction, and eat the boiled *Vicia faba*	O	[54, 75, 76]	WM057/25
Cucurbitaceae	*Cucumis ficifolius* A.Rich. Yemidir enbuay (Am)	13°19'14"N 38°07'56"E 2071 m	MI	H	NF	R	F	Hu		Colic and dyspepsia (dasesa)	The mother chews the root and swallows the juice; the newborn baby gets through breastfeeding	O	[1, 6, 45-47, 50, 52, 54, 57, 68]	WM074/25
						F	F	Hu		Hemorrhoid	Grind it with *Aloe vera* seed, heat the mixture and paste on it	T		
						R	F	Li		Calf scour (qumenga)	Crush the roots and mix them with water to extract the juice, serve the juice using fresh *Lagenaria siceraria* (bottle gourd) to drink	O		
	Cucurbita pepo L. Duba (Am)	13°19'42"N 37°55'55"E 1399 m	LI	H	HG	S	D	Hu		Tape worm	Eat the seed in the morning before meal	O	[1, 5, 46, 54, 59, 68]	MW026/25
						S	D	Hu		Headache	Grind the seed, paste it on the head, and wrap it	T		
	Zehneria scabra Sond. Hareg-resa (Am)	13°17'34"N 38°04'50"E 2181 m	MI	C	NF	L	F	Hu		Fibril illness	Boil the leaf in water, then use the steam for fumigation, drink one cup of the fluid, and wash the body in the morning	O	[5, 47, 57]	WM092/25
						L	F	Hu		Common cold	Boil in water to generate steam, then use the steam for fumigation	N		
Cupressaceae	*Juniperus procera* Hochst. ex Endl. Yehabesha tsde (Am)	13°20'15"N 38°11'07"E 2468 m	HI	T	NF	Re	D	Hu		Diarrhea	Munch the resin and swallow it	O	[5, 49, 50]	WM112/25
						Re	D	Hu		Toothache	Grind with the *Rosa hybrida* fruit, *Euphorbia abyssinica* latex, *Myrica salicifolia* root, and *Lobelia rhyncopetalum* root, then make a paste to apply on the teeth	O		
						R	F	Hu		Gum bleeding	Grind the roots of *Rosa hybrida* and Calpurnia aurea, then make a paste to apply on the teeth	O		
Cyperaceae	*Cyperus dichrostachyus* Hochst. ex A.Rich. Giramita (Am)	13°21'19"N 38°11'17"E 2552 m	HI	H	HG	St	D	Hu		Mumps	Tie the stem around the neck	Ot	[55]	WM099/25

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU	Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
Ebenaceae	*Diospyros mespiliformis* Hochst. ex A.DC. Serkin (Am), Aye (Tg)	13°33′54″N 37°47′33″E 1113 m	LI	T	NF	F	F	Hu	Ringworm	Paint the affected area with the fruit	T	[68, 77]	WM053/25
Euphorbiaceae	*Croton macrostachyus* Hochst. ex Delile Bisana (Am)	13°19′26″N 38°07′49″E 2043 m	MI	T	NF	L	F	Hu	Hepatitis	Boil the leaf and drink the infusion or cook the leaf into a stew and eat	O	[45-47, 57, 60, 61, 69]	WM073/25
						L	F	Hu	Ringworm	Rubbing with the leaf involves using it to gently clean or massage the skin	T		
						L	F	Hu	Finger amputation (Lufe)	Grind the leaf and mix it with butter to create a cream and wrap it with plastic	T		
						R	F	Hu	Dysuria (shintemat)	Grind the root, mix it with tella, and drink the decoction	O		
						SB	F	Hu	STDs	Grind the bark with the leaf of *Phytolacca dodecandra*, mix with water, and drink	O		
						SB	F	Hu	Yellow fever	Grind the stem bark and drink it with tella	O		
						SB	F	Li	Rabies	Grind the bark with the leaf of *Phytolacca dodecandra*, mix with water, and drink	O		
	Euphorbia abyssinica J.F.Gmel. Qulqual (Am)	13°18′17″N 37°56′09″E 1513 m	MI	T	NF	La	F	Hu	Wound (Chinkuŕ)	Squeeze the latex, then cream it	T	[45, 46, 68]	WM027/25
	Euphorbia tirucalli L. Kinchib (Am)	13°24′10″N 37°59′46″E 1503 m	MI	T	HG	La	F	Hu	Hemorrhoid	Squeeze the latex, then cream it	T	[46]	WM042/25
	Ricinus communis L. Bulka (gulo)	13°29′36″N 37°48′03″E 1326 m	LI	S	HG	L	F	Hu	Ear disease	Squeeze and then dropping in to the ear	A	[46, 47, 69]	WM008/25
						L	F	Li	Eye diseases	Heat the leaf in fire then squeeze the fluid and then drop to their eye	Op		
						L	F	Hu	Ear parasite (moth)	Squeeze the leaf and add some droplet to the ear	A		
	Tragia brevipes Pax Alebilabit (Am)	13°24′38″N 37°51′50″E 1236 m	LI	C	NF	R	F	Hu	Impotency	Crush the root*half of the first finger size*and dilute with local beer and drink	O	[1, 61, 78]	WM022/25
						R	F	Hu	Love potion (mestefakir)	Crush the root and cream with raw butter and smear the body	T		
						R	F	Hu	Brain enlightenment	Chopped the root into seven pieces and swallow with white honey	O		

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU	Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
Fabaceae	*Vachellia abyssinica* (Hochst. ex Benth.) Kyal. & Boatwr. Habesha girar (Am)	13°18′52″N 38°05′59″E 2615 m	MI	T	NF	L	F	Hu	Toothache	Chew the leaf and hold it on the teeth	O	[6, 45, 46, 50, 53, 59]	WM097/25
	Calpurnia aurea (Aiton) Benth. Digita (Am)	13°19′29″N 38°06′64″E 2040 m	MI	S	NF	L	D	Hu	Wound	Pound the leaves into a fine powder, then mix the powder with Vaseline and smear the wound	T	[1, 5, 46, 49, 59, 68]	WM065/25
						L	F	Hu	Eczema (Chife)	Grind it *with Plantago lanceolata*, mix with butter, and smear	T		
						F	F	Hu	Gum bleeding	Grind and past on gum	O		
						L	D	Li	Ectoparasite of hen	Burn the leaf and use the smoke for a fumigation	T		
	Lupinus albus L. Gibto (Am)	13°17′47″N 38°04′34″E 2087 m	MI	H	AL	S	D	Hu	Hypertension	Boil the seeds and drink the resulting watery fluid	O	[79]	WM096/25
	Millettia ferruginea (Hochst.) Hochst. ex Baker [LC] Birbira (Am)	13°18′37″N 38°05′57″E 2648 m	HI	T	NF	L	F	Li	Leech	Crush the leaves and add them to water for drinking	O	[1, 46, 49, 61, 68]	WM078/25
	Senna singueana (Delile) Lock Bisbisha/gufa (Am)	13°19′33″N 38°06′50″E 1988	MI	S	NF	R	F	Hu	Snake bite	Chew the root and swallow the liquid	O	[80, 81]	WM086/25
	Tamarindus indica L. Humer (Tg)	13°35′37″N 37°48′10″E 1007 m	LI	T	NF	F	F	Hu	Cough	Eat the fruit	O	[48, 62, 68]	WM056/25
						F	F	Hu	Internal parasite	Soak the fruit in water and then drink the juice	O		
						F	F	Hu	Diarrhea	Eat the fruit	O		
						F	F	Hu	Hypertension	Soak the fruit in water, then mix it with chopped teff bread and eat	O		
	Trigonella foenum-graecum L. Abish (Am)	13°17′45″N 38°04′28″E 2103 m	MI	H	AL	S	D	Hu	Gastritis	Grind and soak them in water for a day. Then, drink the juice before meals in the morning	O	[6, 45, 53]	WM090/25
	Vicia faba L. Bakela (Am)	13°19′25″N 38°11′10″E 2674 m	HI	H	AL	S	D	Hu	Boil (bugungi)	Chew the seed, then apply the paste directly onto the boil	T	[45, 60, 68]	WM111/25
Francoaceae	*Bersama abyssinica* Fresen. Azamir (Am)	13°20′33″N 38°06′04″E 2031 m	MI	S	NF	L	F	Hu	Ascariasis	Squeeze the leaf, mix the juice with water, and then drink	O	[46, 60, 61]	WM063/25

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU	Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
Lamiaceae	*Rotheca myricoides* var. discolor (Klotzsch) Verdc. Misrich (Am)	13°18'48"N 38°08'05"E 2281 m	MI	S	NF	R	F Hu		Evil eye	Crush the root with the root of *Cucumis ficifolius*, *Carissa spinarum*, and *Capparis tomentosa* and tie it around the neck	Ne	[45, 59, 77]	WM070/25
	Leonotis nepetifolia (L.) R.Br. Ras kimir (Am)	13°29'16"N 37°49'59"E 1320 m	LI	S	NF	R	F Hu		Anthrax	Chew the root and swallow the liquid	O	[54, 60]	WM011/25
	Ocimum lamiifolium Hochst. ex Benth. Damakese (Am)	13°20'29"N 38°11'06"E 2372 m	HI	S	NF	L	F Hu		Common cold	Squeeze the leaves and mix the juice with tea or boil the leaves for a steam bath	O	[1, 5, 46, 53, 59, 60]	WM108/25
						L	F Hu		Fibril illness	Squeeze the leaves and mix the juice with tea or boil the leaves for a steam bath	O		
						L	F Hu		Hypertension	Boil the leaves with tea, then drink the mixture	O		
						L	F Hu		Ear parasite (moth)	Grind it with the leaves of *Cucumis ficifolius* and *Zehneria scabra*, squeeze, and add some droplets	A		
						L	F Li		Fibril illness	Squeeze and mix the leaf extracts of *Ocimum lamiifolium and Croton macrostachyus*, then let a glass of it for drenching	O		
	Rydingia integrifolia (Benth.) Scheen & V.A.Albert Tinjut (Am)	13°20'11"N 38°05'54"E 2071 m	MI	S	NF	L	F Hu		Abdominal pain	Squeezing the leaves, then drink in small amount	O	[45, 47, 62]	WM081/25
						R	D Hu		RH factor (Shotelay)	Tied the root around waist until delivery	Ne		
						L	D Hu		Fleas	Smoke and fumigate the house	Ot		
	Premna schimperi Engl. Checho (Am)	13°19'35"N 38°07'01"E 2038 m	MI	S	NF	L	F Li		Eye diseases	Chew the leaf and then spit it into the eye	Op	[40, 46, 56]	WM083/25
	Thymus schimperi Ronniger[NE] Tosign (Am)	13°16'13"N 38°10'10"E 3526 m	Ala	H	NF	L	D Hu		Cough	Grind the leaf and drink them mixed with water	O	[45, 46, 53]	WM035/25

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU	Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
Linaceae	*Linum usitatissimum* L. Teleba (Am)	13°17'54"N 38°04'19"E 2162 m	HI	H	AL	S	D Hu		Retained placenta	Boil the seeds in water, let the mixture cool, and then drink the liquid	O	[1, 46, 52-54, 60]	WM094/25
						S	D Hu		Gastritis	Soak the seed in water, then drink the jelly-like fluid	O		
Malvaceae	*Corchorus olitorius* L Melekuya (Am)	13°31'08"N 37°49'41"E 1073 m	LI	H	HG	L	F Hu		Back pain	Collect the young leaves and eat the fresh leaf or cook and eat	O	[62, 68, 82]	WM052/25
	Grewia ferruginea Hochst. ex A.Rich. Lenkuata (Am)	13°18'59"N 37°58'02"E 2018 m	MI	S	NF	SB	F Hu		Retained placenta	Soak the stem bark in water, then drink the jelly-like fluid	O	[1, 46, 52, 54, 56, 68]	WM028/25
						SB	F Hu		Dandruff	Wash the head with its soft bark	T		
						SB	F Li		Retained placenta	Soak the stem bark in water, then drink the jelly-like fluid	O		
						L	F Li		Gastritis	Crush the leaves, mix with salt, then allow them to drink	O		
	Sida rhombifolia L. Chifirig (Am), Dekidaro (Tg)	13°20'23"N 37°57'12"E 1833 m	MI	S	NF	L	F Hu		Finger amputation (Lufe)	Grind the leaves into a paste, then wrap the paste around the affected area	T	[46, 68]	WM034/25
Meliaceae	*Melia azedarach* L. Mimi (Am)	13°21'15"N 37°57'44"E 1517 m	MI	T	HG	L	F Hu		Tonsillitis	Chew the leaves and then swallow the liquid.	O	[46, 56, 59, 68]	WM030/25
						L	F Li		Hen disease (coccidiosis)	Squeeze the leaves, mix the juice with water, and let it to be drink	O		
Menispermaceae	*Stephania abyssinica* (Quart.-Dill. & A.Rich.) Walp. Yeayit hareg (Am)	13°18'41"N 38°09'42"E 2168 m	HI	C	NF	L	F Hu		Diarrhea	Squeeze the leaf and allow children to drink the extracted liquid	O	[1, 5, 56, 62]	WM088/25
Molluginaceae	*Glinus lotoides* L. Meterie/Amkinit (Am)	13°23'29"N 37°52'20"E 1268 m	LI	H	AL	S	F Hu		Tape worm	Crush the seeds and mix them with honey, then swallow	O	[83, 84]	WM017/25

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU	Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
Moraceae	*Ficus carica* L. Beles (Tg)	13°24′18″N 37°51′55″E 1206 m	LI	S	NF	L	F	Hu	Ear pus	Squeeze the young leaf and place a few drops into the ear	A	[1, 59, 62]	WM004/25
	Ficus sycomorus L. Bamba (Am)	13°24′19″N 37°51′47″E 1236 m	LI	T	NF	SB	F	Hu	Scorpion bite	Chew and swallow the liquid	O	[62, 68] [62, 68]	WM016/25
						La	F	Hu	Impotency	Smear the latex on the surface of the penis	T		
						L	F	Hu	Hepatitis	Squeeze the leaf, then drink it with honey or buttermilk	O		
Moringaceae	*Moringa stenopetala* (Baker f.) Cufod. Shiferaw (Am)	13°22′20″N 37°59′27″E 1445 m	LI	T	HG	L	F/D	Hu	Hypertension	Dry the leaves, grind them into a fine powder, drink with tea	O	[53, 56, 61, 68]	WM043/25
						L	D	Hu	Headache	Dry the leaves, grind them into a fine powder, drink with tea	O		
						L	F	Hu	Gastritis	Cook the leaves as a stew, then eat	O		
Myricaceae	*Myrica salicifolia* Hochst. ex A.Rich. Sinchi/Shinet (Am)	13°19′29″N 38°11′10″E 2749 m	HI	T	NF	SB	D	Hu	Wound	Grind the inner part of the stem bark into a fine powder, then dust it directly onto the wound	T	[45, 68]	WM106/25
						SB	D	Hu	Brain abscess (neqerisa)	Grind the inner part of the stem bark into a fine powder, inhale using nose	N		
Myrtaceae	*Eucalyptus globulus* Labill. Nech-bahirzaf (Am)	13°21′11″N 38°11′07″E 2307 m	HI	T	AL	L	F	Hu	Common cold	Burn and fumigate the smoke	N	[5, 47, 57, 60-62, 68]	WM102/25
	Myrtus communis L. Adese (Am)	13°20′36″N 38°10′37″E 2182 m	HI	S	HG	L	F/D	Hu	Dandruff	Grind the leaves into a powder, mix with butter, and then smear the cream	T	[1, 46, 50, 59]	WM107/25

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU	Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
Olacaceae	*Ximenia americana* L. Enkoy (Am)	13°27'39"N 37°51'57"E 1306 m	LI	S	NF	SB	D	Hu	Wound	Grind the inner layer of the stem bark and dust it onto the wound	T	[1, 48, 52, 56, 62, 68]	WM058/25
						L	F	Hu	Tonsillitis	Chew seven leaves and then apply the paste to the head	T		
	Jasminum abyssinicum Hochst. ex DC. Tembelel (Am)	13°19'35"N 38°07'01"E 2041 m	HI	C	NF	L	F	Hu	Tooth diseases	Catch hold of the leaf with your teeth	O	[1, 54]	WM066/25
						L	F	Hu	Snake bite	Squeeze the leaves, then drink the fluid	O		
						L	F	Hu	Fleas	Burn straw to fumigate the house	Ot		
	Olea europaea subsp. *cuspidata* (Wall. & G.Don) Cif. Woyira (Am)	13°20'02"N 38°11'18"E 2848 m	HI	T	NF	St	F	Hu	Gastritis	Soak the stem using water and drink the juice	O	[1, 5, 45-47, 50, 52, 54, 56, 59, 60, 68, 69]	WM109/25
						St	F	Hu	Epiphora (eye tearing)	Grind the stem bud of it and Rumex abyssinicus together, then mix them with kohl and smear on eyes	Op		
						L	D	Hu	Flies repellant	Fumigate the house, dry the leaves and branches, then light them to produce smoke	Ot		
Phytolaccaceae	*Phytolacca dodecandra* L'Hér. Mehan-endod (Am)	13°17'34"N 38°04'48"E 2126 m	HI	C	NF	L	F	Hu	Hepatitis	Squeeze the leaves to extract the juice, then drink	O	[1, 5, 45-47, 50, 52, 54, 56, 59, 60, 68, 69]	WM093/25
						R	F	Hu	Anthrax	Grind the root, squeeze, and drink juice half of a spoon	O		
						F	F	Hu	Scabies (itch)	Grind it with the fruit of *Rhamnus Prinoides*, mix with butter and smear, and finally sun or fire heat the body	T		
						R	F	Hu	Meningitis	Chew the root, spit it out, and smear it on your neck	Ne		

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU		Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
						R	F	Li		Stomachache	Crush the leaves, mix them with water, and then drink	O		
						R	F	Li		Rabies	Soak the leaves in water, then drink a small quarter cup of the infusion	O		
						L	F	Li		Wound	Crush the leaves to form a paste for topical application	T		
						L	D	Hu		Kidney disease	Grind the leaf, take one teaspoon of the powder and one teaspoon of honey, dissolve in boiled water, and drink the mixture until recovery	O		
Plantaginaceae	*Plantago lanceolata* L. Gorteb/womberet (Am)	13°23′30″N 37°55′08″E 1309 m	LI	H	NF	L	F	Hu		Wound	Grind the leaf and paste it on the wound	T	[63, 85, 86]	WM020/25
						L	D	Hu		Kidney disease	Grind the leaf, take one teaspoon of the powder and one teaspoon of honey, dissolve in boiled water, and drink the mixture until recovery	O		
Plumbaginaceae	*Plumbago zeylanica* L. Yemegerem/Amira (Am)	13°26′30″N 37°3750′21″E 1239 m	LI	H	NF	R	F	Hu		Incantation	Soak the root in water inside new *Lagenaria siceraria*, and then drink the fluid.	O	[45-47, 54]	WM007/25
						R	F	Hu		Swelling (megerem)	Soak the root in alcohol, then drink the fluid	O		
						R	F	Li		Swelling	Soak the root in alcohol, then drink the fluid	O		
Poaceae	*Oryza sativa* L. Ruz (Am)	13°19′58″N 37°55′52″E 1457 m	LI	H	AL	S	D	Hu		Diarrhea	Boil with milk, drink the decoction	O	[87, 88]	WM031/25

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU	Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
Polygalaceae	*Securidaca longepedunculata* Fresen. Temenahe (Am)	13°27′58″N 37°48′33″E 1135 m	LI	S	NF	R	D	Hu	Fibril illness	Burn and fumigate the smoke	N	[68, 89]	WM010/25
						R	F	Hu	Rabies	The root is crushed, mixed with water, and consumed as a drink	O		
						R	D	Hu	Evil eye	Grind the root with bark of *Croton macrostachyus*, then insert the powder nasally or use it to fumigate the smoke	N		
	Rumex abyssinicus Jacq. Mekmoko (Am)	13°26′46″N 37°46′07″E 1157 m	LI	S	NF	R	D	Hu	Eye diseases	Dry and grind, then drink with tea	O	[1, 47, 50, 52, 54, 60]	WM009/25
						R	F	Hu	Rheumatism (qurtimat)	Boil with Niger oil and sesame oil, then drink before meals	O		
						R	F	Li	Calf ascaris	Crush the root and let it drenching with water	O		
	Rumex crispus L. Tult (Am)	13°19′25″N 37°56′23″E 1454 m	LI	H	NF	R	F	Hu	Rheumatism (qurtimat)	Grind the root of *Rumex crispus* (zirich enbuay) and *Solanum anguivi* together, dilute the mixture with water, and drink a cup of it.	O	[90]	WM032/25
	Rumex nervosus Vahl Embacho (Am)	13°18′16″N 37°56′01″E 1525 m	MI	S	NF	L	D	Hu	Tinea capitis (Quaqucha)	Grind the leaves into a powder and dust it onto head	T	[1, 46, 52, 54, 59]	WM033/25
						L	D	Hu	Wound	Grind the leaves into a powder and dust it onto wound and bind with green algae	T		
Primulaceae	*Maesa lanceolata* Forssk. Shuariya (Am)	13°23′14″N 37°53′24″E 1425 m	LI	S	NF	L	F	Li	Leech	Crush the leaves and add them to water for drinking	O	[47, 54, 56]	WM018/25
						L	F	Li	Fleas	Crush the leaves and dilute in water to wash the body	T		
Ranunculaceae	*Clematis simensis* Fresen. Azo-hareg (Am)	13°19′21″N 38°07′38″E 2090 m	HI	C	NF	L	F	Hu	Wound	Crush and paste on the wound	T	[1, 5, 46, 49, 52]	WM067/25
						L	F	Hu	Hemorrhoid	Squeeze the leaf and apply the juice topically as a cream	T		
						Fl	F	Hu	Tumor	Crush the flower and paste on the tumor	T		
	Nigella sativa L. Tikur azmud (Am)	13°18′58″N 38°07′14″E 2606 m	HI	H	AL	S	D	Hu	Abdominal pain	Grind the seeds, mix them into the bread dough, bake and eat	O	[1, 46, 53, 54, 59, 89]	WM079/25

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU		Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
	Rubia cordifolia L Minchirur (Am)	13°19′02″N 38°08′02″E 2228 m	HI	H	NF	R	F/D	Hu		Migraine	Grind the root and drink with tea	O	[1]	WM069/25
						R	F	Hu		Cough	Grind the root and drink with tea	O		
						R	F/D	Hu		Eye diseases	Grind the root and drink with tea	O		
						R	F/D	Hu		Stomachache	Grind the root and drink with tea	O		
						R	F/D	Hu		Nasal bleed	Grind the root and mix it with butter, then carefully insert it through the nasal passage	N		
						R	D	Hu		Ear parasite (moth)	Grind the dried root into a fine powder, mix it with butter, and then place it in the sun to warm. Drop the mixture into the ear	A		
	Thalictrum rhynchocarpum Quart.-Dill. & A.Rich. Sir-Bizu (Am)	13°19′13″N 38°07′54″E 2047 m	HI	H	NF	L	D	Hu		Wound	Grind the leaf with salt and apply the paste to the wound	T	[1]	WM089/25
						R	F	Hu		Fibril illness	Boil the root and use the steam for a fumigation bath	N		
						R	F	Hu		Hypertension	Grind the root and mix it with honey, then consume it	O		

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU	Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
Rhamnaceae	*Helinus mystacinus* E.Mey. ex Steud. Esat abrid	13°26'53"N 37°53'20"E 1357 m	LI	C	NF	L	F Hu		Fire burn	Crush the leaves and mix them with honey, then past and wrap	T	[91]	WM054/25
	Rhamnus prinoides L'Hér. Gesho (Am)	13°22'48"N 37°54'09"E 1515 m	MI	S	HG	L	F Hu		Uvular descending	Squeeze the juice and drink a small amount	O	[1, 5, 46, 47, 50, 52, 54, 56, 58-60, 68]	WM021/25
						S	F Hu		Scabies (itch)	Grind it with the seed of *Phytolacca dodecandra*, then mix it with butter and smear it on the skin	T		
	Ziziphus mucronata Willd. Abtere (Am)	13°26'10"N 37°53'51"E 1220 m	LI	S	NF	SB	D Hu		Wound	Dry and grind into a powder, and then apply the powder directly onto the wound	T	[92, 93]	WM059/25
						R	F Hu		Snake bite	Heat the root with fire and apply it on the bite area and forehead	T		
	Ziziphus spina-christi (L.) Willd. Gaba	13°34'28"N 37°48'10"E 1201 m	LI	S	NF	L	F Hu		Dandruff	Squeeze the leaves to extract the fluid, then smear it	T	[1, 45, 47, 56, 68]	WM061/25
Rosaceae	*Hagenia abyssinica* (Bruce) J.F.Gmel. Koso	13°20'50"N 38°11'44"E 3021 m	HI	S	NF	F	D Hu		Tape worm	Swallow the seed with honey before breakfast in the morning, and have lunch with hot shirowot at midday	O	[46, 53, 56, 60, 89]	WM103/25
	Rosa abyssinica R.Br. ex Lindl. Kega (Am)	13°19'31"N 38°06'49"E 2016 m	HI	S	NF	R	F Li		Stomachache	Socked in water then allow them to drink	O	[1, 54, 60, 89, 91]	WM084/25
Rubiaceae	*Coffea arabica* L. Buna (Am)	13°26'07"N 37°57'11"E 1321 m	LI	S	HG	S	D Hu		Diarrhea	Grind roasted seed and mix with hone, then let the baby to eat	O	[1, 5, 54, 59, 60, 68, 69]	WM060/25
						S	D Hu		Wound	Grind roasted seed and mix with honey, then paste to wound	T		
Rubiaceae	*Gardenia ternifolia* Schumach. & Thonn. Gambilo (Am)	13°26'51"N 37°46'54"E 1285 m	LI	S	NF	SB	F Hu		Impotency	Grind the ingredients and mix them with Hydromel (honeyed wine), then drink the mixture	O	[68, 94]	WM005/25

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU	Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
Rutaceae	*Citrus aurantiifolia* (Christm.) Swingle Lomi (Am)	13°18'51"N 38°08'46"E 2354 m	HI	S	HG	F	F	Hu	Wound	Extract the lemon juice and apply directly to the wound	T	[1, 49, 53, 89]	WM095/25
						F	F	Hu	Cough	Boil the leaf with *Allium sativum*, then filter the mixture and drink	O		
						L	D	Hu	Cold-induced muscle pain	Leaf burned and fumigate to the smoke	T		
						F	F	Li	Ingestive toxicity	Extract the juice, mix it with egg albumin, and administer to drink	O		
						F	F	Li	Leech	Extract the juice and then administer it through the nasal passage	N		
						F	F	Li	Hen diseases (coccidiosis)	Extract the juice, mix it with water, and allow them to drink	O		
	Clausena anisata (Willd.) Hook.f. Limich (Am)	13°19'25"N 38°08'18"E 2278 m	HI	S	NF	St	F/D	Hu	Teeth diseases	Brush your teeth regularly with the stem stick until recovery	O	[52, 68]	WM068/25
	Ruta chalepensis L. Tenadam (Am)	13°19'04"N 38°06'42"E 2435 m	HI	H	AL	L	F	Hu	Evil eye	Crush and sniff it	N	[1, 5, 45-47, 53, 59, 60, 89, 91]	WM085/25
Salicaceae	*Dovyalis abyssinica* (A.Rich.) Warb. Koshim (Am)	13°21'15"N 38°11'09"E 2342 m	HI	S	NF	L	F	Hu	Boil (bugungi)	Crush the leaf and paste on the boil	T	[45, 46, 52, 53, 59, 89, 91]	WM100/25
Santalaceae	*Osyris lanceolata* Hochst. & Steud. Qeret (Am)	13°18'54"N 38°07'52"E 2162 m	HI	S	NF	L	D	Hu	Leprosy	Burn the leaves of *Osyris quadripartita* and *Hagenia abyssinica*, along with goat horn, to obtain charcoal. Mix this charcoal with water algae, latex from *Ficus carica*, and seed oil from *Ricinus communis*, then smear the mixture onto the body.	T	[1, 57, 68]	WM080/25
Sapindaceae	*Dodonaea viscosa* subsp. *angustifolia* (L.f.) J.G.West Kitkita (Am)	13°18'47"N 38°09'33"E 2216 m	HI	S	NF	S	D	Hu	Finger pain	Mix the seed with butter and swallow	O	[1, 46, 56]	WM076/25
						L	F	Li	Bone luxation	Tie the leaf around the bone	Ot		

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU		Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
Scrophulariaceae	*Verbascum sinaiticum* Benth. Kuttetina(Am), Trina (Tg)	13°20'22"N 37°57'12"E 1857 m	MI	H	NF	R	F	Hu		Fibril illness	Grind and socked with water, then drink one cup of the mixture	O	[1, 45, 46, 53, 54, 89, 91]	WM036/25
						R	F	Hu		Diarrhea	Grind and socked with water, then drink one cup of the mixture	O		
						R	D	Hu		Glossophobia (ayinetila)	Grind the root, burn them to create smoke, then fumigate the smoke every evening for seven days	N		
						R	F	Hu		Rabies	Crush the root with the root of *Phytolacca dodecandra*, prepare the juice using water, and let the puppy drink it	O		
						R	F	Li		Fibril illness	Grind and socked with water, then drink one glass of the mixture	O		
						R	F	Li		Rabies	Crush the root with the root of Phytolacca dodecandra, prepare the juice using milk, and let the puppy drink it	O		
Simaroubaceae	*Brucea antidysenterica* J.F.Mill. Waginose (Am)	13°20'13"N 38°05'05"E 2270 m	HI	S	NF	L	F	Hu		Swelling	Squeeze the leaf, mix the juice with water, and then drink	O	[46, 54, 56, 91]	WM064/25
						F	F	Hu		Eczema (Chife)	Crush the fruit with the leaf of Zehneria scabra, the fruit of *Citrus limon*, and cream with raw butter or baseline and smear the affected area	T		
						S/L	F	Hu		Hemorrhoid	Grind the leaf and seed together, then apply the paste gently to the anus	T		
Solanaceae	*Capsicum annuum* var. *annuum* L. Mitmita (Am)	13°28'17"N 37°47'19"E 1427 m	LI	H	AL	F	F	Hu		Malaria	Eat the fruit with injera	O	[1, 5, 53, 59, 60]	WM002/25
						F	D	Hu		Gastritis	Powder the fruit, mix it with chopped injera (firfir) and eat	O		

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU		Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
Solanaceae	*Datura stramonium* L. Astenagir (Am)	13°25′34″N 37°51′02″E 1219 m	LI	H	NF	S	D	Hu		Toothache	Put the dry seed onto the fire to create smoke for fumigation, or hold the seed with your teeth	O	[1, 45, 46, 52-54, 59, 68, 91]	WM015/25
						L	F	Hu		Tinea capitis (Quaqucha)	Squeeze the leaf and cream it on head	T		
	Nicotiana tabacum L. Timbaho (Am)	13°23′02″N 37°59′54″E 1603 m	MI	H	HG	L	F	Hu		Tonsillitis	Squeeze the leaf, drink the extract to the esophagus	O	[1, 5, 45-47, 49, 50, 53, 60, 91]	WM044/25
						L	F	Li		Leech	Squeeze the leaves, administer the juice through the nasal passage	N		
	Physalis peruviana L. Aute (Am)	13°22′52″N 37°52′50″E 1385 m	LI	H	NF	F	F	Li		Leech	Extract the fruit juice and administer it nasally	N	[56]	WM019/25
	Solanum incanum L. Embuay (Am)	13°28′19″N 37°49′47″E 1073 m	LI	S	NF	R	F	Hu		Scorpion bite	Chewing and swallow the liquid	O	[1, 45, 46, 52-54, 59, 68, 69]	WM012/25
						F	F	Li		Sinusitis (tifna)	Extract the juice, mix it with milk, and then administer it through the nasal passage	N		
	Withania somnifera (L.) Dunal Gizewa (Am)	13°18′59″N 37°55′42″E 1414 m	LI	S	HG	L	F	Hu		Psychosis	Soak leaves in water, then wash the body	T	[1, 45-47, 54, 56, 68, 69, 95]	WM037/25
						R/L	F/D	Hu		Evil eye	Crush and mix them with water to drink	O		
Urticaceae	*Urtica simensis* Hochst. ex A.Rich. [LC] Sama (Am)	13°20′07″N 38°11′09″E 2684 m	HI		NF	L	F	Hu		Gastritis	Boil the leaf and eat it regularly like cabbage, or grind the leaf, squeeze, and drink before meals.	O	[1, 46, 50]	WM110/25
Verbenaceae	*Verbena officinalis* L. Atuch	13°17′37″N 38°04′44″E 2059 m	HI	H	NF	R	F	Hu		Stomachache	Chew the root and swallow the liquid	O	[1, 46, 52, 54]	WM091/25

Table 2 (continued)

Family	Scientific name & Local name	Geographical location of specimen and altitude (m.a.s.l)	AE	H	Ha	PU	CPU	Use	Ailment treated	Methods of Preparation and Application	RA	References	V. No 2025 G.C
Vitaceae	*Cissus petiolata* Hook.f. Alkie (Am)	13°25′05″N 37°57′10″E 1590 m	MI	C	NF	R	F	Hu	Snake bite	Grind the root and soak it in water. After some time, filter the mixture and drink about a quarter cup of the filtrate	O	[54]	WM051/25
						St	F	Li	Swelling	Tied the thin stem on the neck of cattle	Ne		
						L	F	Hu	Back pain	Soak the leaf buds in water inside a fresh *Lagenaria siceraria*, wash the body for seven days	T		
	Cyphostemma adenocaule (Steud. ex A.Rich.) Desc. ex Wild & R.B.Drumm. Aserkush (Am)	13°25′13″N 37°57′27″E 1589 m	MI	H	NF	R	D	Hu	Wound	Dry and grind the root, then apply the powder	T	[1, 47]	WM003/25
						R	D	Hu	Rabies	Dry and grind the root, then mix the powder with milk and drink it	O		
						R	D	Hu	Snake bite	Dry and grind the root, then boil it with honey and drink the mixture	O		
						R	D	Hu	Love potion (mestefakir)	Dry and grind the root, then mix it with *Meliponula bocandei* honey and apply it topically	T		
						R	D	Li	Dog herbal sterilization	Tie the roots of *Cyphostemma denocaule* (Tazima) and *Inula confertiflora* (Weynagift) around the neck of the women	Ne		
Zingiberaceae	*Zingiber officinale* Roscoe Gingibel (Am)	13°20′16″N 37°55′04″E 1384 m	LI	H	AL	St	F	Hu	Stomachache	Chew and then swallow the resulting liquid	O	[1, 45-47, 52, 53, 57, 59, 60]	WM038/25
						St	F	Hu	Common cold	Grind and boil, then drink one glass as tea	O		

[Local name: Amhara = A, Tigray = T, Agew = Ag, Agroecology: AE (Ll = Lowland, MI = Midland, Hl = Highland, Hla = Highland and alpine), Habit = H (Tree = T, Shrub = S, Climber = C, Herb = H), Habitat = Ha (HG = Home Garden, AL = Arable Land, NF = Natural Forest), Use (Human= Hu, Livestock = Li), Part used = PU (Bulb = Bu, Flower = Fl, Fruit = F, Latex = La, Resin = Re, Leaf = L, Root = R, Root bark = RB, Seed = S, Stem = St, Stem bark = SB, Tuber = Tu), Condition of Part Used = CPU (Fresh = F, Dry = D, Fresh/Dry = F/D), Route of Administration = RA (Auricular = A, Nasal = N, Oral = O, Optical = Op, Topical = T, Ne= Neck, Ot = Other), V. No = Voucher Number, Red color = endemic plants, endemic medicinal plants = bold subscripts (NT = Near Threatened, LC = Least Concern, NE = Not Evaluated), Am = Amharic, Tg = Tigrigna].

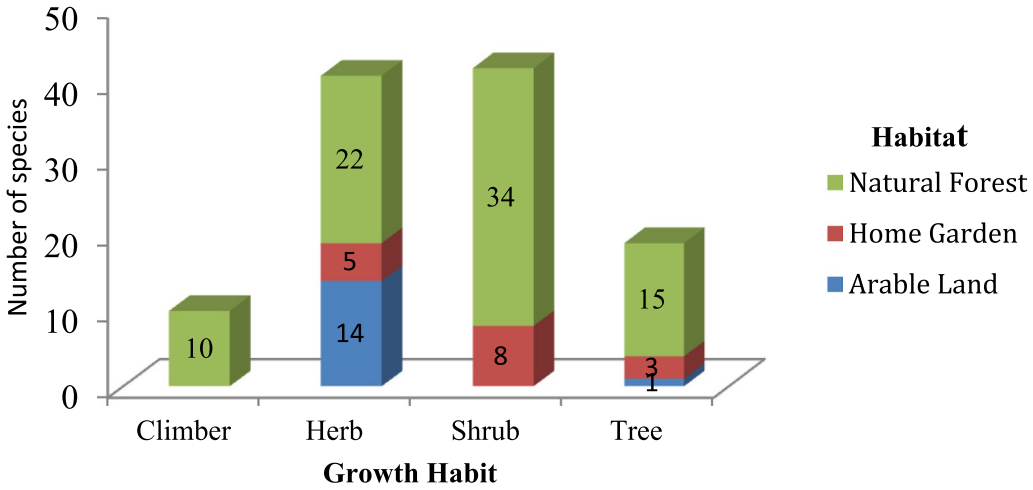

Fig. 3 Growth form and habitat of human and livestock medicinal plants in Addi Arkay district

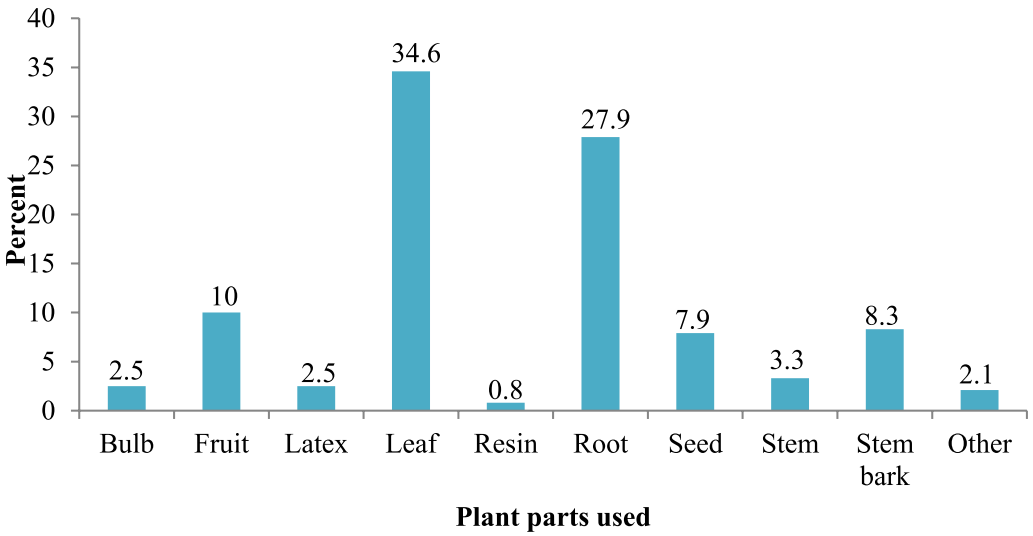

Fig. 4 Plant parts for remedy preparation of human and livestock ailments in the Addi Arkay district (other = flower, root & leaves, seed & leaves)

roots, which accounted for 27.9%, while fruits represented a smaller fraction at 10% (Fig. 4).

In terms of preparation methods, grinding was the most frequently employed technique, utilized in 30.4% of cases, followed by squeezing at 14.2% and crushing at 10.4% (Fig. 5). Fresh plant material was predominantly used in remedy preparation (71.31%), followed by dried plant parts (59%) (Table 2). A variety of additives, including honeys, dairy products, and seed oils, were incorporated to mitigate toxicity or enhance flavor. Water was the most commonly used additive, followed by honey, tea, salt, and butter.

Dosage and route of administration for remedies

Regarding dosage and measurement, practitioners employed various tools such as glass containers, bottle gourds, cups, and teaspoons to ascertain appropriate dosages. Dosage considerations were depend on various factors such as age (children, adults, and the elderly), pregnancy, and breast lactation, body weight, and physiological characteristics. The analysis of routes of administration for traditional remedies in the study area revealed that oral administration was the predominant method, accounting for 54.2% of all instances, followed by topical (27.5%) and nasal administration (7.9%) (Fig. 6).

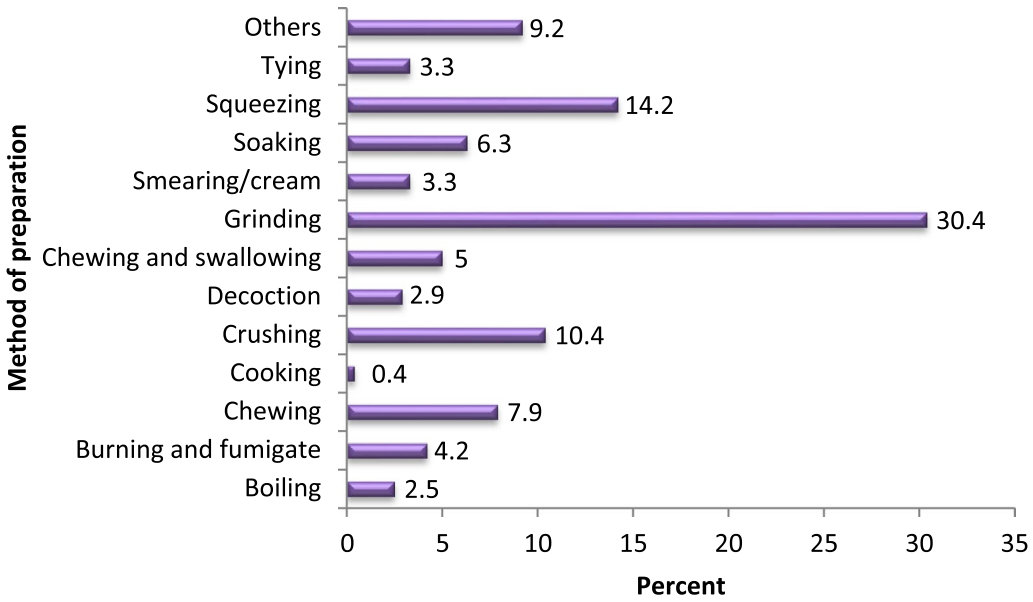

Fig. 5 Method of preparation to treat human and livestock ailments in Addi Arkay district (others include inhaling, pounding, heating, massaging, chopping, and catch hold)

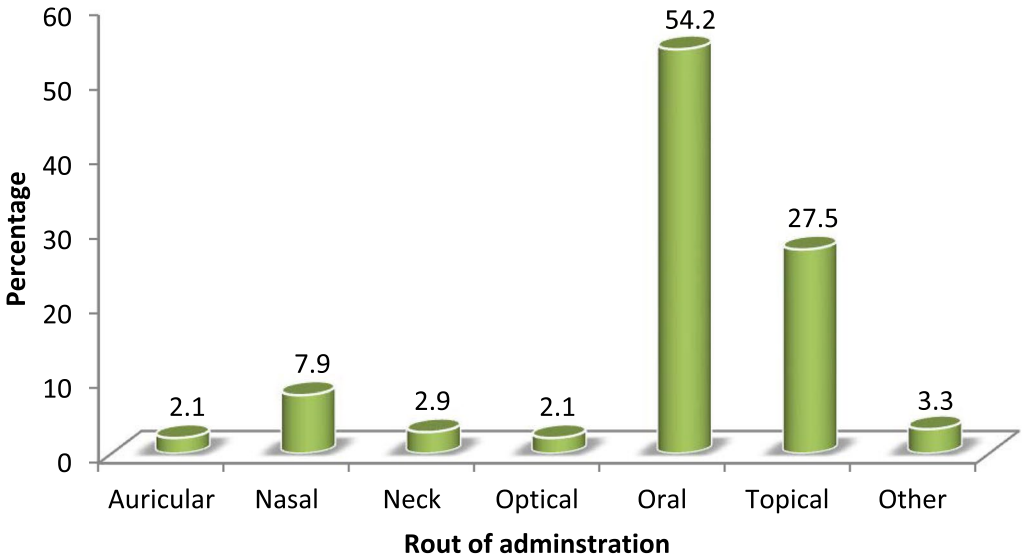

Fig. 6 Route of administration to treat human and livestock ailments in Addi Arkay district (other = fumigate the house, tie around the bone)

Ranking indices of most important human and livestock medicinal plants

Preference ranking

The preference ranking exercise involving five medicinal plants and ten key informants for treating human hemorrhoids indicated that *Opuntia ficus-indica* was the most favored, followed by *Cucumis ficifolius* and *Euphorbia tirucalli* (Table 3). In addition, a similar ranking for medicinal plants used in the treatment of rabies in livestock identified *Phytolacca dodecandra* as the top choice, followed by *Verbascum sinaiticum* and *Cissus petiolata* (Table 4).

Table 3 Preference ranking of commonly used human medicinal plants used to treat hemorrhoid

Plant species	Key informants (K)										Total	Rank
	K-1	K-2	K-3	K-4	K-5	K-6	K-7	K-8	K-9	K-10		
Opuntia ficus-indica (L.) Mill	5	4	5	4	3	1	2	3	4	5	36	1
Cucumis ficifolius A.Rich	3	3	4	5	1	2	2	5	5	3	33	2
Euphorbia tirucalli L	2	5	1	3	5	3	4	4	2	2	31	3
Lepidium sativum L	4	1	2	2	4	5	3	2	1	4	28	4
Cordia africana Lam	1	2	3	1	2	4	2	1	3	1	20	5

Table 4 Preference ranking of commonly used livestock medicinal plants used to treat rabies

Plant species	Key informants (K)										Total	Rank
	K-1	K-2	K-3	K-4	K-5	K-6	K-7	K-8	K-9	K-10		
Phytolacca dodecandra L'Hér	5	4	5	4	3	5	3	5	3	3	40	1
Verbascum sinaiticum Benth	4	5	2	5	1	3	4	2	2	5	33	2
Cissus petiolata Hook.f	3	2	4	1	2	4	1	4	5	4	30	3
Croton macrostachyus Hochst. ex Delile	1	3	3	2	4	1	5	3	1	2	25	4
Marsdenia rubicunda (K.Schum.) N.E.Br	2	1	1	3	5	2	2	1	4	1	22	5

Table 5 Mean value of Direct Matrix Ranking for multipurpose plant species in Addi Arkay district

Plant species	Use categories							Total	Rank
	Agriculture tools	Building	Medicinal	Fodder	Food	Furniture	Fuel		
Cordia africana Lam	1	5	2	4	5	5	5	27	**1**
Olea europaea subsp. *cuspidata* (Wall. & G.Don) Cif	3	5	3	0	0	5	5	21	**2**
Ziziphus spina-christi (L.) Willd	1	1	3	0	5	3	2	15	**7**
Grewia ferruginea Hochst. ex A.Rich	1	1	3	3	3	2	0	13	**9**
Diospyros mespiliformis Hochst. ex A.DC	3	2	2	0	4	4	3	18	**4**
Terminalia leiocarpa (DC.) Baill	3	5	2	0	0	4	5	19	**3**
Ziziphus mucronata Willd	0	1	2	0	3	2	0	8	**10**
Croton macrostachyus Hochst. ex Delile	4	2	3	0	0	4	1	14	**8**
Vachellia abyssinica (Hochst. ex Benth.) Kyal. & Boatwr	3	5	1	2	1	4	1	17	**6**
Ficus sycomorus L	0	3	2	2	3	2	4	16	**5**
Total	**19**	**29**	**23**	**11**	**24**	**36**	**26**		
Rank	**6 th**	**2nd**	**5 th**	**5 th**	**4 th**	**1 st**	**3rd**		

Direct Matrix Ranking (DMR)

The DMR exercise revealed that *Cordia africana* was identified as the most threatened species, followed by *Olea europaea* subsp. *cuspidata* and *Terminalia leiocarpa*. These multipurpose medicinal plants were currently being utilized more for furniture, building, and fuel rather than for food, fodder, or agricultural tools (Table 5).

Informant Consensus Factor (ICF)

This study categorized traditional remedies and their corresponding human and livestock diseases into 12 categories (Table 6). The ICF values ranged from 0.63 to 0.93 (Table 6). The highest ICF value (0.93) was associated with diseases and symptoms of the nervous system (febrile illness, headache, migraine, snake bite, spider poison), with 294 use citations and 20 plant species. This was followed by injury, poisoning, and certain other consequences of external causes (bone luxation,

Table 6 Informant Consensus Factor (ICF) for human and livestock ailments Addi Arkay district

Ailment categories	Reported diseases	No of species used (Nt)	Total no of use citation (Nur)	ICF
Diseases and symptoms involving the nervous system	Fibril illness, headache, migraine, snake bite, spider poison	20	294	0.93
Injury, poisoning, and certain other consequences of external causes	Bone luxation, eczema, fire burn, ingestive toxicity, laceration, luxation, wound, swelling, swelling (megerem), tumor	30	380	0.92
Infectious and parasitic diseases	Anthrax, ascaris, calf scour, diarrhea, gastritis, boil, malaria, finger amputation, dandruff, brain abscess, ectoparasite of hen, fleas, gastrointestinal parasite, hen disease, hepatitis, internal parasite, scabies, leech, leprosy, meningitis, mumps, tape worm, rabies, ringworm, tinea capitis, STDs, yellow fever	77	790	0.90
Symptoms, signs, and clinical findings not elsewhere classified	Evil eye, evil spirit, brain enlightenment, flies repellant, glossophobia, incantation, love potion, psychosis, snake repellents	16	137	0.89
Diseases and symptoms involving respiratory system	Asthma, common cold, cough, nasal bleed, tonsillitis, uvula descending	20	128	0.85
Conditions related to sexual health	Impotency, sexual desire, Menorrhagia	5	26	0.84
Diseases and symptoms involving digestive system	Colic and dyspepsia, hemorrhoid, gum bleeding, stomachache, teeth diseases, toothache	26	124	0.80
Diseases of the musculoskeletal system or connective tissue	Back pain, abdominal pain, cold-induced muscle pain, finger pain, rheumatism, stabbing pain	11	46	0.78
Diseases of the ear or mastoid process and visual system	Ear diseases, moth, ear pus, epiphora, eye disease	12	49	0.77
Pregnancy, childbirth, and the puerperium	Sterilization, retained placenta, RH factor	5	17	0.75
Diseases of the circulatory system and blood and blood-forming organs	Hypertension, bleeding	6	19	0.72
Diseases of the genitourinary system	Dysuria (shintemat), kidney stone	4	9	0.63

eczema, fire burn, ingestive toxicity, laceration, luxation, wound, swelling, and tumor) having the second highest ICF value (0.92). Diseases of the genitourinary system (dysuria/shintemat, kidney stone) had the lowest ICF value (0.63), with 9 use citations and 4 plant species.

Fidelity level (FL)

The fidelity level (FL) demonstrated the relative healing potential of individual medicinal plants used for treating human or livestock ailments in the study area. *Phytolacca dodecandra* was identified as the most effective against rabies, followed by *Rubia cordifolia* for cough and *Plumbago zeylanica* for swelling (megerem) (Table 7).

Pharmacological values of some selected plants

The pharmacological values of selected medicinal plants have garnered significant attention within the realm of traditional medicine, particularly due to their diverse therapeutic applications. Based on fidelity levels, the four top-ranked medicinal species identified in this study were *Phytolacca dodecandra*, *Rubia cordifolia*, *Plumbago zeylanica*, and *Ocimum lamiifolium*. These species exhibited important medicinal properties that can be utilized for a wide range of human and livestock ailments.

Phytolacca dodecandra demonstrated substantial pharmacological potential and has been widely employed in traditional medicine for various human and livestock ailments. It is proved particularly effective in treating livestock rabies, where a common preparation involves soaking fresh leaves in water and administering a small quarter cup of the infusion orally to puppies before they are infected. In cases of human hepatitis, the juice extracted from freshly squeezed leaves is consumed orally. For human anthrax, the fresh root is ground, and half a spoon of the extracted juice is ingested. Additionally, for human scabies, a mixture of ground fruit and *Rhamnus prinoides* is prepared with butter for topical application, followed by heat treatment. Other applications include chewing fresh root for human meningitis, preparing a paste of crushed leaves for wound treatment, and for kidney disease, where dried leaf powder is mixed with honey and dissolved in boiled water for consumption until recovery.

Table 7 Fidelity level (FL > 80%) of some commonly used human and livestock medicinal plant

Scientific name	Main ailment treated	IP	IU	FL (%)	Rank
Phytolacca dodecandra L'Hér	Rabies	68	70	97.14	1
Rubia cordifolia L	Cough	87	90	96.67	2
Plumbago zeylanica L	Swelling (megerem)	59	63	93.65	3
Ocimum lamiifolium Hochst. ex Benth	Fibril illness	109	121	90.08	4
Tamarindus indica L	Internal parasite	50	56	89.29	5
Ximenia americana L	Wound	37	42	88.10	6
Myrica salicifolia Hochst. ex A.Rich	Brain abscess (neqerisa)	26	30	86.67	7
Cissus petiolata Hook.f	Snake bite	40	47	85.10	8
Datura stramonium L	Tinea capitis (Quaqucha)	67	79	84.81	9
Euphorbia abyssinica J.F.Gmel	Hemorrhoid	61	73	83.56	10
Verbascum sinaiticum Benth	Fibril illness	86	105	81.90	11
Rumex nervosus Vahl	Wound	49	61	80.33	12

Rubia cordifolia exhibited notable pharmacological properties for a variety of human ailments. For migraines, the fresh or dried root is ground and taken with tea orally. Similar preparations are recommended for treating coughs, eye diseases, and stomachaches. In instances of human nasal bleeding, the fresh or dried root is ground, mixed with butter, and carefully inserted through the nasal passage. Furthermore, for ear parasites, the dried root is ground into a fine powder, mixed with butter, and warmed in the sun before being applied in the ear.

Plumbago zeylanica emerged as a potential remedy for both human and livestock ailments. A traditional preparation for humans involves soaking the fresh root in water within a new *Lagenaria siceraria* gourd, followed by oral consumption of the resulting fluid. This plant also served as a treatment for swelling in both humans and livestock when the fresh root is soaked in alcohol and the fluid is ingested.

Ocimum lamiifolium was identified as a widely used remedy for various ailments affecting both humans and livestock. For the common cold, fresh leaves are squeezed and mixed with tea or boiled for a steam bath. The same preparation method applies for treating febrile illnesses and hypertension. In cases of ear parasites, a mixture of ground fresh leaves with those of *Cucumis ficifolius* and *Zehneria scabra* is prepared, and a few drops are administered auricular. For livestock suffering from febrile illnesses, a mixture of leaf extracts from *Ocimum lamiifolium* and *Croton macrostachyus* is prepared for oral administration.

Jaccard's Similarity Index

A cross-cultural comparative analysis of indigenous knowledge regarding human and veterinary medicinal plants was performed using Jaccard's Similarity Index (JSI%). These analyses incorporated data from the present study and 22 previously published works on Ethiopia sourced from Scopus and Web of Science databases. The results indicated a wide variation in knowledge share ranging from 6.9% to 68.92% in human medicinal plants and 10.91% to 27.91% in veterinary plants (Table 8).

Rahman's Similarity Index

This study used the Rahman's Similarity Index (RSI) to compare ethnobotanical findings from the Addi Arkay district with 20 previously published in indexed and peer-reviewed journals across Ethiopia. The RSI values ranged from 0.98 to 15.63%, indicating varying degrees of cultural similarity in plant use between the Addi Arkay district and the other studied regions (Table 9). The highest RSI of 15.63% was observed in the Hulet Eju Enese district (RSI = 15.63%), closely followed by the Sedie Muja (RSI = 13.67%) and Habru (RSI = 13.22%) districts of the Amhara region (Table 9).

Threats and conservation practice for medicinal plants

The major threats for medicinal plants claimed in focus group discussion were agricultural land expansion, overgrazing, house construction, timber production, fuel (charcoal and fuel wood), drought, agrochemicals (herbicides and pesticides), and drought (Table 10). A ranking exercise involving ten key informants and seven major threats was conducted to evaluate the relative severity of the identified threats to medicinal plants. The results showed that agricultural expansion was considered the primary threat, followed by overgrazing and fuel (charcoal and fuel wood) (Table 10). Despite these significant threats, conservation efforts in the Addi Arkay district remain limited. Current practices were terracing,

Table 8 Jaccard's Similarity Index ethnobotanical comparison of human and veterinary plants between the study districts and other study areas

Previous studies	J-index for human					J-index for ethnoveterinary					References
	MPH	a	b	c	JI%	VP	a	b	c	JSI%	
Ada'a	112	87	87	25	16.78	46	40	21	6	10.91	[50]
Adwa	115	64	61	51	68.92	11	9	25	2	6.25	[54]
Aleta-Chuko	47	36	101	11	8.73	16	15	26	1	2.50	[60]
Artuma Fursi	78	44	78	34	38.64	96	95	26	1	0.83	[59]
Basona Werana	70	46	88	24	21.82	13	10	24	3	9.68	[57]
Damot Woyde	51	33	94	18	16.51	22	19	24	3	7.50	[96]
Diguna Fango	45	26	93	19	19.00	9	8	26	1	3.03	[53]
Enemay	86	66	92	20	14.49	40	34	21	6	12.24	[6]
Ganta Afeshum	153	101	60	52	47.71	20	19	26	1	2.27	[55]
Hawassa Zuria	97	74	89	23	16.43	52	44	19	8	14.55	[61]
Heban-Arsi	77	56	91	21	16.67	43	34	18	9	20.93	[56]
Hulet Eju Enese	72	32	72	40	62.50	27	23	23	4	9.52	[52]
Kilte Awulaelo	106	65	71	41	43.16	49	41	19	8	15.38	[45]
Mana Angetu	203	171	80	32	14.61	45	38	20	7	13.73	[69]
Raya Kobo	75	60	97	15	10.56	16	13	24	3	8.82	[58]
Sedie Muja	79	40	73	39	52.70	29	25	23	4	9.09	[56]
Seharti Samre	87	56	81	31	29.25	27	19	19	8	26.67	[47]
South Omo	59	48	101	11	7.97	43	39	23	4	6.90	[40]
Toaba	132	114	94	18	9.47	52	40	15	12	27.91	[97]
Tulo	93	57	76	36	37.11	26	19	20	7	21.88	[51]
Wonago	58	42	96	16	13.11	28	26	25	2	4.08	[98]
Yalo	63	53	102	10	6.90	43	41	25	2	3.13	[48]

Key: TMP = total medicinal plant used for human and livestock in the district, MPH = medicinal plant for human, VP = veterinary plant, a = no species only in current study, b = no species only in previous study, c = no of common species in current study and previous studies, and JI (%) = Jaccard's Similarity Index in percent

cultivating medicinal plants in home gardens and arable land, fallow land, and community participation in reforestation campaigns.

Source and transfer of indigenous and local medicinal plant knowledge

The findings from the focus group discussion indicated that the highest levels of indigenous and local medicinal plant knowledge were predominantly passed down through family lines, with significant contributions from paternal, followed by maternal, and brother (Fig. 7). Additionally, religious institutions, particularly the Ethiopian Orthodox Church, played a role in this knowledge transfer. This knowledge was primarily conveyed orally from generation to generation, with little written documentation found in religious books. In the study area, a significant challenge was that elderly traditional healers kept their medicinal plant knowledge secret. They believed that sharing this information would reduce its healing potential and minimize their income.

Novel ethnobotanical findings

The ethnobotanical study conducted in the Addi Arkay district revealed several novel findings regarding the utilization of medicinal plants, thereby contributing to the growing body of ethnomedicinal knowledge in Ethiopia. *Tragia brevipes* was identified for its application in brain enlightenment. *Leonotis nepetifolia* was noted for its efficacy in treating anthrax. *Otostegia integrifolia* was utilized to address Rh factor complications during pregnancy as maternal health management. *Laggera crispate* was claimed for managing minor injuries and hemorrhagic conditions as first-aid practices within local communities. In addition, *Capparis tomentosa* and *Juniperus procera* were both found effective for alleviating toothaches. *Terminalia leiocarpa* was associated with treating eye diseases for ophthalmic applications. Remarkably, *Croton macrostachyus* was used in cases of finger amputation (lufe). *Euphorbia tirucalli* was employed to treat hemorrhoids. Furthermore, *Ricinus communis* was reported as a remedy for ear parasites, particularly moth infestations within the auditory canal.

Table 9 RSI comparing the current study (Addi Arkay) with prior research reports

Study area	NMPRPS	MPOPS	MPOOS	CPBA	CMPSU	RSI (%)	References
Ada'a	131	100	81	31	5	2.42	[50]
Adwa	127	74	59	53	21	12.73	[54]
Aleta-Chuko	53	41	100	12	3	2.00	[60]
Artuma Fursi	86	51	77	35	10	6.54	[59]
Basona Werana	76	49	85	27	6	3.87	[57]
Damot Woyde	57	36	91	21	6	4.23	[96]
Diguna Fango	50	25	87	25	9	7.03	[53]
Enemay	92	67	87	25	10	5.92	[6]
Ganta Afeshum	173	108	47	65	25	12.82	[55]
Habru	134	85	63	49	23	13.22	[1]
Hawassa Zuria	105	74	81	31	3	1.64	[61]
Heban-Arsi	120	90	82	30	7	3.59	[56]
Hulet Eju Enese	80	36	68	44	20	15.63	[52]
Kilte Awulaelo	114	65	63	49	15	9.26	[45]
Mana Angetu	230	191	73	39	8	2.71	[69]
Raya Kobo	91	73	94	18	7	3.93	[58]
Sedie Muja	89	46	69	43	19	13.67	[56]
Seharti Samre	90	51	73	39	12	7.95	[47]
South Omo	91	78	97	15	2	1.06	[40]
Toaba	104	74	82	30	8	4.49	[40]
Tulo	104	61	69	43	15	9.49	[51]
Wonago	72	54	94	18	7	4.40	[48]
Yalo	106	94	100	12	2	0.98	[48]

NMPRPS: Number of Medicinal Plants Reported in Previous Studies; MPOPS: Medicinal Plants Only in Previous Studies (Na); MPOOS: Medicinal Plants Only in Our Study (Nb); CPBA: Medicinal Plants Common in Both Areas (Nc), CMPSU: Common Medicinal Plants with Similar Uses (Nd), % RSI: Rahman's Similarity Index in %

Table 10 Ranking exercise of threats to medicinal plants

Threats	Key informants										Total	Rank
	k-1	k-2	k-3	k-4	k-5	k-6	k-7	k-8	k-9	k-10		
Agricultural land expansion	7	4	5	6	7	6	3	7	6	5	56	**1 st**
Fuel (charcoal and fuel wood)	6	7	7	5	4	3	1	4	2	6	45	**3rd**
Overgrazing	5	1	2	7	5	4	6	6	5	7	48	**2nd**
House construction	2	5	6	3	1	7	2	3	7	3	39	**4 th**
Timber production	3	2	3	1	6	2	7	5	1	4	34	**5 th**
Agrochemicals (herbicides and pesticides)	4	6	1	4	2	1	5	1	4	2	30	**6 th**
Drought	1	3	4	2	3	5	4	2	3	1	28	**7 th**

Discussion

Socio-economic and socio-demographic factors

The observed influence of socio-demographic and socio-economic factors on indigenous and local medicinal plants knowledge among informants underscores the dynamic nature of traditional knowledge retention and transmission in Addi Arkay district. Consequently, effective conservation strategies must explicitly consider these factors to safeguarding the knowledge for feature generation. The higher knowledge scores among men compared to women reflected traditional gender roles, where men often engage more in resource gathering and community healthcare, spiritual rules prohibiting women from learning church education, which is the primary source of traditional knowledge, and cultural taboos influencing women not to travel far from their homes as similarly reported in the studies of [50, 68, 99–103]. However, contrasting results emerged from

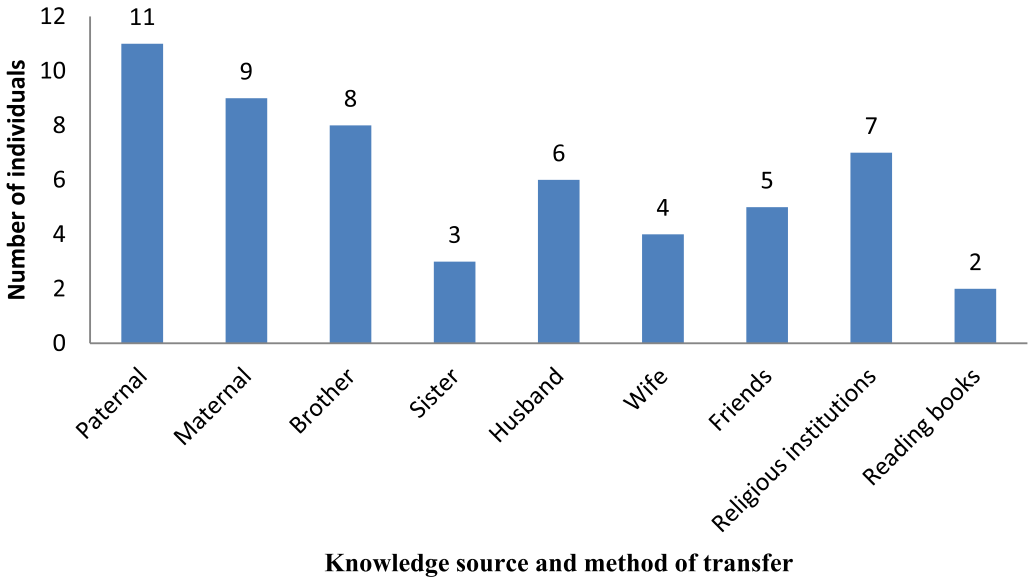

Fig. 7 Sources and methods of transfer for indigenous and local medicinal plant knowledge

a study conducted in the Fiche region, where women were found to play a significant role in herbal medicine practices, often being the primary caregivers and sellers of medicinal herbs in local markets [104]. Key informants cited a significantly higher number of medicinal plants compared to general informants, similar to the findings reported in other studies [54, 56, 68]. This trend reflects their extensive, full-time experience in utilizing these plants for various treatments. The positive correlation between age and knowledge underscored the role of cumulative experience and cultural transmission among older individuals, consistent with findings that traditional knowledge is more deeply rooted in elder generations [40, 56, 61, 101, 102]. The lower medicinal knowledge among younger individuals suggests a potential decline in the transfer of knowledge between generations [52].

In the study area, illiterate (unable to read and write) individuals exhibited greater knowledge than their literate (able to read and write) counterparts, and even as education level increased, indigenous and local knowledge decreased, aligning with the findings of previous research [40, 49, 54, 56, 99]. This trend can be attributed to the disconnection between formal education systems and indigenous and local knowledge practices. Formal education in Ethiopia has historically prioritized modern scientific methodologies, often neglecting traditional cultural knowledge cultivated over generations [105]. Cultural background, religious affiliations, and marital status categories in the study area had substantial impact on the retention of traditional wisdom on medicinal plants aligned with reports of [106–108]. Married informants reported a greater number of medicinal plant species compared to single, divorced, and widowed individuals, suggesting that marital status facilitates access to shared knowledge within families and communities aligned with [55].

Socio-economic factors significantly impacted medicinal plant knowledge in this study, with occupation and wealth status playing pivotal roles aligned with previous studies [46, 49, 109]. Ascetics (Monk/nun), farmers, and poorer individuals demonstrated greater reliance on medicinal plants due to their proximity to natural resources, efficacy, wider cultural acceptability, and limited access to modern healthcare. The inverse relationship between access to transportation or urban centers and knowledge emphasizes the critical role of geographic isolation in preserving traditional practices. Individuals residing in remote areas tend to maintain stronger ties to indigenous and local knowledge systems, as they face limited access to modern medical facilities [49, 110]. In contrast, those with better access to transportation often gravitate toward modern healthcare solutions, which can lead to a decline in the utilization of traditional practices [111, 112].

Diversity of medicinal plants

This study revealed a comprehensive exploration of the ethnobotanical practices in Ethiopia, revealing a total of 112 medicinal plant species utilized for the treatment of humans and livestock ailments. The identification of such a diverse array of medicinal flora underscored the rich cultural heritage and traditional knowledge surrounding

plant-based remedies in the region. Furthermore, the documentation of *Tragia brevipes*, *Leonotis nepetifolia*, *Otostegia integrifolia*, *Laggera crispata*, *Capparis tomentosa*, *Juniperus procera*, *Terminalia leiocarpa*, *Croton macrostachyus*, *Euphorbia tirucalli*, and *Ricinus communis*, with previously unreported therapeutic applications in both Ethiopia and globally, signified a substantial contribution to ethnomedicinal knowledge. This novel documentation not only expanded the existing pharmacopeia but also highlighted the potential for bioprospecting and the discovery of new therapeutic compounds. Compared to other ethnobotanical studies in various districts of Ethiopia, such as Damot Woyde with 57 species [10], Aleta-Chuko with 91 [60], Raya Alamata with 47 species [113], Cheha with 58 species [114], Basona Werana with 76 species [57], Gera with 63 species [80], Seharti Samre with 90 species [47], Sedie Muja with 89 species [5], Ensaro with 44 species [49], Kobo with 91 species [58], and Diguna Fango with 50 species [53], this figure exceeded by the number of species documented. However, the species count in Addi Arkay was lower than that of Mana Angetu with 230 species [69], Ganta Afeshum with 173 species [55], Adwa with 127 species [54], Ada'a with 131 species [50], Habru with 134 species [1], Sekela with 121 species [107], and Dibatie with 170 species [115].

The dominance of Fabaceae, Lamiaceae, and Solanaceae families in the study area aligns with findings in other regions of Ethiopia. For example, Fabaceae was the most represented family in Hawassa Zuria district [61], Raya Alamata district [113] and Dibatie district [115], indicating a widespread reliance on this family for medicinal resources. Similarly, research in Adwa district, northern Ethiopia, identified Fabaceae and Solanaceae as the most important families [54]. These similarities suggest a common ethnomedicinal knowledge base across different ethnic groups and geographical areas in Ethiopia. The dominance of the Fabaceae family among the identified medicinal plants can be attributed to the evolutionary adaptations, nitrogen fixation, and successful dispersion of this plant family within the local environment [116].

The Addi Arkay study emphasized the reliance on natural forests (collected from wild) as a primary source of medicinal plants, with 81 species (72.32%) collected from these areas. This finding had significant implications for conservation efforts, as it suggested that the sustainable management of forest ecosystems was crucial for preserving both biodiversity and access to vital medicinal resources. The relatively smaller contributions from home gardens (16 species, 14.29%) and arable land (15 species, 13.39%) indicate a potential for integrating medicinal plant cultivation into agricultural systems and home gardens, which could alleviate pressure on wild populations and enhance community access to these resources. This was consistent with other studies in Ethiopia, which have also reported that a significant proportion of medicinal plants are harvested from the wild. For instance, in Mana Angetu [69] 90.4% of species, Kilte [45] 74%, Ganta Afeshum [55] 67.1%, Enemay [6] 55.43%, Raya Alamata [113] 53.19%, Dibatie [115]79.41%, Yeki [102] 56.86%, Sekela [107] (70%), were collected from wild or natural vegetation. This implied the importance of forest conservation for preserving access to vital medicinal resources. But continuous destruction of the natural forests of Ethiopia results directly in the loss of unaccounted plant and animal species [117]. In contrast to this study, the Cheha district [114] reported that 65.52% of medicinal plants were obtained from home gardens. This was attributed to the availability of ex situ conservation sites and the community's greater awareness of the importance of ex situ conservation for the long-term sustainability of medicinal plants.

Regarding the growth form of medicinal plants, the study found that the local people of the Addi Arkay district utilized shrubs and herbs in nearly equal proportions followed by trees and climbers. This observation aligns with previous ethnobotanical findings [50, 118]. These patterns may be due to vegetation types and local preferences for specific plant growth forms in traditional medicine, including the accessibility and ease of harvesting herbs and shrubs.

Plant parts and preparation methods used for remedies

The most frequently used plants part in this study were leaves followed by roots, fruits, stem bark, and seeds. These statistics underscore the importance of foliar and subterranean plant parts in traditional remedies, suggesting a potential preference for these components due to their perceived efficacy or availability. The result was aligned with other ethnobotanical studies in various parts of Ethiopia [10, 45, 46, 54, 55, 57, 61, 102, 107, 113, 114] and elsewhere [119–121]. The predominant use of leaves for remedy preparation can be due to the presence and rapid absorption of high concentrations of bioactive compounds, accessibility for sustainable harvesting, and ease of processing into various forms, and cultural beliefs often emphasize the effectiveness of leaf-based remedies. However, roots were predominantly used in a few other studies [40, 69, 122], due to the storage of stable medicinal properties, persistence in the ground, specific therapeutic actions, cultural significance, and sometimes, greater accessibility compared to other plant parts [2, 63]. In additionally, less use of some roots may be due to toxic compounds in roots compared with other parts, requiring careful preparation and knowledge for safe

use [123, 124]. Harvesting roots is also more destructive to the plant than harvesting leaves or fruits, potentially harming plant populations if not done sustainably [125].

Grinding was the most frequently used preparation technique, followed by squeezing and crushing, consistent with the findings of previous studies [58, 61] and crushing, which was predominant in many other studies [6, 40, 45, 49, 54, 60, 115], and pounding in [102, 113]. The predominant use of grinding over crushing in the study area for remedy preparation was due to its ability to produce a finer, more uniform particle size, which enhances the extraction of bioactive compounds, improves bioavailability, and ensures consistent dosing in the final remedy. The preference for fresh plants in traditional remedies may be attributed to the belief that bioactive compounds are most potent in their fresh state and may degrade during drying, a notion supported by observations in several studies [45, 54, 55, 57, 60]. Contrarily, the use of dry forms of remedial plants is often associated with lower efficacy because the drying process can lead to the evaporation and deterioration of bioactive components [78]. Furthermore, high drying temperatures can cause thermal degradation of sensitive compounds, significantly reducing their antioxidant properties and altering their chemical composition, which may affect their therapeutic potential [126].

Additives, dosage, and route of administration for remedies

In the study area, various additives, including honey, dairy products (such as milk, yogurt, and butter), and seed oils, are incorporated into remedies to mitigate toxicity or enhance flavor. This practice illustrates the intricate knowledge surrounding the preparation of traditional remedies, where the role of additives extends beyond mere taste. This practice is consistent with findings in the Kilte Awulaelo district [45], Raya Alamata district [113], Gubalafto district [78], Hamar district [127], and Muja district [5], where water and various additives (honey, sugar, butter, salt, coffee, tea, milk) were reported to be used to either reduce poisoning or improve flavor. Local communities employ various tools for measuring doses of remedies, such as glass containers, bottle gourds, cups, and teaspoons. However, many remedies lack precise traditional dosage guidelines, potentially leading to dose-dependent adverse effects. This adaptability in dosage was reflected in an inherent understanding within traditional medicine systems of the importance of tailoring treatments to individual needs, emphasizing the role of traditional knowledge in guiding therapeutic practices. This observation aligns with similar findings reported in other studies, where dosage is often determined using non-standardized measures like cups, spoons, drops, and fingers [45], spoons, coffee cups, and tea glasses [57], or handfuls, cups, and spoons [24].

The results of this study revealed that oral administration is the predominant method, followed by topical administration and nasal administration. This distribution indicated a strong cultural preference for oral intake, likely attributable to its practicality and effectiveness in achieving systemic effects. The significant use of topical applications suggested an awareness of the need for localized treatments. The less frequent use of nasal administration likely reflected the sensitivity of the nasal mucosa, as some individuals may experience discomfort with this route. The current findings align with previous studies of Ethiopian [46, 55, 57, 60, 69] and elsewhere [128–130]. The reason for the dominance of oral application of remedies may be due to its ease of use, cultural acceptance, and familiarity to users; perceived safety due to its non-invasive nature (avoiding painful skin penetration and entry into body cavities, thereby minimizing infection risks); and effective absorption in the gastrointestinal tract [2, 131].

Ranking of remedies for human and livestock ailments

Preference ranking

The higher preference ranking of *Opuntia ficus-indica*, followed by *Cucumis ficifolius* and *Euphorbia tirucalli*, in the treatment of human hemorrhoids warrants further investigation, encompassing phytochemical analysis, pharmacological investigation, and conservation measures. Ethnobotanical research has corroborated the use of these plants for various ailments. *Opuntia ficus-indica* has been documented for treating coughs [1], anthrax [45], uterine fibroids [132], and as a larvicide against malaria vectors [133]. *Cucumis ficifolius* has a broader range of reported applications, including the treatment of anthrax, snake and scorpion bites, black spider bites, wounds/sores, jaundice/hepatitis, tonsillitis, toothache, abdominal pain, and vomiting [45]. *Euphorbia tirucalli* has been cited for wound treatment [1], hemorrhoids, and snake bite [56].

In addition, a similar ranking for medicinal plants used in the treatment of rabies in livestock identified *Phytolacca dodecandra* as the top choice, followed by *Verbascum sinaiticum* and *Cissus petiolata*. These findings align with documented traditional uses: *Phytolacca dodecandra* for rabies, jaundice, eye infections, anthrax, and ectoparasites [54]; *Verbascum sinaiticum* for febrile diseases and wounds [1], snake bites [6, 53], Anthrax [46], burns, tonsillitis, the"evil eye,"toothache, hemorrhoids, external wounds, and anthrax [45]; and *Cissus petiolata* for snake bites [54]. The convergence of high preference ranking with

documented ethnomedicinal uses strengthens the rationale for rigorous scientific investigation of these promising plant species.

Direct Matrix Ranking (DMR)

DMR revealed *Cordia africana* as the most threatened species, followed by *Olea europaea* subsp. *cuspidata* and *Terminalia leiocarpa*. This ranking suggests a concerning trend of overexploitation of these multipurpose medicinal plants, primarily for furniture, building materials, and fuel. This shift away from sustainable use is likely driven by increasing demand for timber and fuel wood, reflecting broader socio-economic pressures on natural resources [45]. Similar studies have documented the overexploitation of medicinal plants due to their diverse applications, resulting in habitat degradation and species decline. Specifically, *Cordia africana* is threatened primarily due to its use in construction and furniture [57]; *Olea europaea* subsp. *cuspidata* is a multipurpose species mainly exploited for charcoal production, construction, and food [54]; *and Terminalia leiocarpa* is threatened by its use in medicine, livestock forage, and as a food source [68]. Further research is needed to explore alternative livelihood options and promote sustainable harvesting practices to mitigate the threats to these valuable plant species and preserve their medicinal and ecological value.

Informant Consensus Factor

The study reported Informant Consensus Factor (ICF) values, ranging from 0.63 to 0.93, suggesting a notable consensus among informants regarding the therapeutic uses and efficacy of specific medicinal plant species. The highest ICF value of 0.93, observed for diseases related to the nervous system (febrile illness, headache, migraine, snake bite, spider poison), is consistent with findings from other studies [110]. Such high ICF values often indicate a strong community agreement on the effectiveness of particular plants for treating common ailments [68]. In contrast, other researches have reported varying ICF values across different ailment categories [49, 50, 56, 57]. These discrepancies may reflect differences in regional disease prevalence, cultural knowledge, and the availability of specific plant species [134, 135]. Despite these variations, the use of ICF remains a valuable tool in ethnobotanical research for identifying reliable and culturally significant medicinal plants, thus guiding further pharmacological investigations and conservation efforts [5, 134].

Fidelity level (FL)

Fidelity level (FL) analysis, used to assess the perceived healing potential of medicinal plants for specific ailments, identified *Phytolacca dodecandra* as the most effective species against rabies, followed by *Rubia cordifolia* for cough, and *Plumbago zeylanica* for swelling (megerem). The identification of *Phytolacca dodecandra* as highly effective against rabies is particularly significant, considering the disease's severity and the limited access to conventional treatments in the study area. Similarly, the recognition of *Rubia cordifolia* for cough aligns with its traditional use in various medicinal systems for respiratory ailments. These findings are consistent with previous reports from Ethiopia documenting the use of *Phytolacca dodecandra* for rabies [6, 49, 127] and also for gonorrhea and anthrax [52]; *Plumbago zeylanica* for wounds [79]; and *Rubia cordifolia* for wounds, cough, and cataracts, as evidenced by a high number of informant citations [50].

Threats and conservation practice for medicinal plants

Four endemic and one nearly endemic medicinal plants classified within IUCN Red List categories have been documented. These species, previously reported at various threat levels, include *Echinops kebericho* (Near Threatened/NT), and *Millettia ferruginea* (Least Concern/LC) (https://www.iucnredlist.org), *Kalanchoe petitiana* (Least Concern/LC) [136], *Thymus schimperi* (Near Threatened/NT) [137], and *Urtica simensis* (Least Concern/LC) [136–138].

Results indicated that agricultural expansion, overgrazing, fuel (charcoal and fuel wood), house construction, timber production, agrochemicals (herbicides and pesticides), and drought were the major threats of medicinal plants. Agricultural expansion was driven by the confluence of rapid population growth, inherently low land productivity, and infertile soils. Consequently, the escalating demand for land in the study area is a direct result of the need to compensate for these constraints. Despite these efforts, the local people continues to struggle with food insecurity, resulting in a concerning dependence on external food aid. This aligns with other studies in Ethiopia that identify agricultural expansion as a major threat to medicinal plant sustainability [6, 46, 47, 54, 68, 102]. Other documented threats include habitat destruction, overharvesting, pollution, secrecy, stereotype, derogatory attitudes, oral knowledge transfer, lack of awareness, urbanization, herbicide use, fires, drought, informal export, settlement expansion, land degradation, and the introduction of alien species. The excessive use of agrochemicals, particularly herbicides and pesticides, in the Addi Arkay

district affects medicinal plants directly and indirectly. Directly, these chemicals harm the medicinal plants themselves [139]. Indirectly, they disrupt the populations of pollinating agents, such as insects, which are crucial for the reproduction of many flowering medicinal plant species [140]. This disruption can lead to reduced seed sets, decreased genetic diversity, and ultimately, a decline in medicinal plant populations.

Despite the significant threats facing medicinal plants in the Addi Arkay district, conservation efforts remain limited and insufficient to reverse the ongoing decline. While initiatives such as terracing, cultivating medicinal plants in home gardens, fallow land management, and community participation in reforestation campaigns exist, they do not adequately address the scale of the problem. This observation aligns with findings from other regions in Ethiopia where similar conservation strategies have been implemented but have struggled to achieve substantial impact [46, 54, 68, 69].

Pharmacological values of some selected plants

The pharmacological values of *Phytolacca dodecandra*, *Rubia cordifolia*, *Plumbago zeylanica*, and *Ocimum lamiifolium* were extensively studied, revealing their therapeutic potential and richness in bioactive compounds through various in vitro and in vivo investigations. These plants demonstrate a strong cultural consensus regarding their efficacy, which is supported by their extensive use in treating a diverse range of ailments. *Phytolacca dodecandra* has demonstrated promising molluscicidal activity against schistosomiasis vectors in vitro, highlighting its potential in combating parasitic diseases [141, 142]. *Plumbago zeylanica* contains plumbagin, a naphthoquinone with significant antibacterial, antifungal, antiulcer, antioxidant, and anticancer activities that result from its principal chemical components, which are concentrated in the roots, leaves, and stems of plants [143–145]. In vivo and in vitro studies have confirmed its efficacy in reducing tumor growth and its antiproliferative properties against various cancers, including breast, lung, pancreatic, melanoma, prostate, and leukemia [146].

In Ethiopia, the leaf of *Ocimum lamiifolium* is traditionally used for the treatment of stomach disorders, headaches, abdominal pains, diarrhea, and fever [147, 148]; cough [98]; pain and malaise [149]; colds, eye infections, and measles [150]; and mosquito repellent [151]. The essential oil of *O. lamiifolium* contains bioactive compounds such as alkaloids, sterols, carbohydrates, glycosides, tannins, flavonoids, bornyl acetate, p-cymene, camphene, a-pinene, and sabinene used for its antimicrobial, anti-inflammatory, and antipyretic properties supported by in vitro studies [147, 152]. Similarly, *Rubia cordifolia* has been extensively studied due to the presence of anthraquinones and other phytochemicals for its anti-inflammatory and anticancer properties [153, 154], treatment of abnormal uterine bleeding, internal and external hemorrhage, bronchitis, rheumatism, stones in the kidney, bladder, and gall, dysentery, burns, ulcers, bone fractures, skin diseases, and disorder of spleen [153].

Jaccard's Similarity Index

A comparative analyses using Jaccard's Similarity Index between the current study and previous studies in Ethiopia revealed a wider similarity range (6.9% to 68.92%) for medicinal plants used in human healthcare. The highest Jaccard Similarity Index (JSI) was observed between the current study and Adwa (JSI = 68.92%) [54], whereas the lowest similarity was recorded for Yalo (JSI = 6.9%) [48]. This variability may be attributed to the extensive cultural emphasis, historical documentation, and widespread use of medicinal plants for treating human ailments across different regions of Ethiopia [99, 155]. Similar trends were observed in previous studies from Pakistan, which reported a Jaccard's Similarity Index (JSI) range of 11.11% to 51.85% [156]. This further underscored the diversity in medicinal plant applications and highlighted the variability in ethnobotanical knowledge across different geographical and cultural contexts.

The Jaccard's Similarity Index cross-cultural comparison of veterinary medicinal plant use in this and previous studies in Ethiopia revealed a narrow similarity range (10.91% to 27.91%). The highest similarity was observed with Toaba (JSI = 27.91%) [97] and the lowest with Ganta Afeshum (JSI = 0.83%) [55]. Similar narrow ranges of Jaccard's Similarity Index were noted globally, including 10% to 35% in Central Benin [157], 1.92% to 13.07% among the Zemmour and Zayane tribes in the Middle Atlas of Morocco [158], and 0.37% to 12.25% in Punjab, Pakistan [159]. The relatively lower similarity range in veterinary plant use indicates more localized and specialized knowledge, which is often geographically restricted, tailored to meet the health needs of livestock within specific ecological and cultural contexts [160]. This lower JSI percentage for veterinary plants in Ethiopia and globally may also reflect the under-documentation of ethnoveterinary practices, influenced by ecological and cultural factors that shape the use of medicinal plants for livestock health [161]. These findings underscore the need for further research and documentation of ethnoveterinary knowledge, especially in regions where livestock are vital for livelihoods and food security. Integrating ethnoveterinary practices into broader ethnobotanical frameworks could enhance the

preservation and sustainable use of medicinal plants for both human and livestock health while contributing to the conservation of traditional knowledge systems.

Rahman's Similarity Index

The RSI analysis revealed notable patterns in traditional medicinal plant knowledge across various districts in Ethiopia. The highest RSI observed in the Hulet Eju Enese district [52], closely followed by the Sedie Muja [5] and Habru [1] districts of the Amhara region. Comparatively high similarity was also noted in the Ganta Afeshum [55] and Adwa [54] districts of the Tigray region. In contrast, the Tulo district [51] of the Oromia region and the Yalo district [48] of the Afar region exhibited lower similarity indices. These findings suggest that geographical proximity and cultural exchange significantly influence the homogeneity of ethnomedicinal knowledge. The high similarity among the Hulet Eju Enese, Sedie Muja, and Habru districts, all located within the Amhara region, supports the notion that shared cultural practices and environmental conditions foster a common understanding and utilization of similar medicinal plants. Similarly, the relatively high RSI values in the Tigray region's Ganta Afeshum and Adwa districts indicate a regional coherence in traditional medicine practices, potentially due to similar vegetation and historical interactions transboundary movements of community members.

The lower RSI values observed in the Tulo district of the Oromia region and, particularly, the Yalo district of the Afar region may reflect distinct cultural traditions, ecological differences, or limited knowledge exchange among the cultural groups. The Afar region, characterized by its arid environment and pastoralist lifestyle, likely possesses a unique set of medicinal plant resources and traditional practices that differ significantly from the more agrarian-based societies of Amhara and Tigray.

Source and transfer of indigenous and local medicinal plant knowledge

The findings of this study revealed that familial transmission of indigenous and local medicinal plant knowledge, primarily through paternal, maternal, and sibling lines, was consistent with recent studies in Ethiopia, such as those in Gozamin district [79], Raya Alamata district [113], and Ensaro district [162], where oral inheritance within families was the dominant mode of knowledge transfer, often accompanied by cultural ceremonies and secrecy. Similarly, studies in other regions of Ethiopia, like Sedie Muja District, confirmed that traditional healers pass down knowledge orally and selectively to trusted individuals, emphasizing secrecy due to misconceptions about the efficacy of shared remedies [5]. Contrastingly, while religious institutions like the Ethiopian Orthodox Church discreetly contribute to knowledge preservation through ancient manuscripts in Ethiopia, such roles are less prominent in global contexts where formal documentation is more common [163]. Elderly traditional healers face several challenges in sharing their knowledge of medicinal plants [164]. A key issue is the secrecy they maintain, driven by fears that revealing their knowledge would diminish its healing power and reduce their income. This aligns with findings in Botswana and South Africa, where traditional healers often withhold information due to concerns about exploitation, lack of intellectual property protection, and societal stigma [165].

Novel ethnobotanical findings

This study identified 112 medicinal plant species used to treat 84 distinct diseases, revealing ten species with previously undocumented medicinal use in Ethiopia and globally. Similarly, a novel study was reported in Quara district [68], local communities around Simien Mountains National Park [73], and Bensa district [103]. A particularly striking novel finding in this study was the use of *Tragia brevipes*. The plant remedy was prepared for cognitive enhancement ("brain enlightenment") by cutting the root into seven pieces and ingesting them with white honey. Previous reports disclose its use for stomachaches [1], abortion and "evil eye" [5], dactylitis, impotency, and retained placenta [78]. Similarly, *Otostegia integrifolia* was found to be used to manage Rh factor incompatibility ("shotelay") during pregnancy, where the root is tied around the mother's waist until delivery. Previous research has documented its use for ascariasis, abdominal pain, livestock infestations (lice and fleas) [45], "evil spirit" [6], stomachache [62], as an insecticide [54], and for nasal bleeding, stomachache, and diarrhea [52].

A novel application of *Leonotis nepetifolia* was recorded for treating anthrax, specifically by chewing the root and swallowing the extracted liquid. The other uses with existing literature describe its use for eye aches [54], influenza, chest conditions, insect stings, and snake bites [166], as well as a broader range of conditions including bronchial asthma, diarrhea, fever, influenza, malaria, cough, womb prolapse, epilepsy, burns, skin ailments, and rheumatism [167]. *Laggera crispata* was newly observed being used to manage minor injuries and hemorrhagic conditions by applying the squeezed leaf extract to stop bleeding. Prior studies have reported its use for anthrax [6], bloat [56], jaundice, inflammation, leukemia, removing phlegm, bronchitis, and bacterial diseases [64].

This study also reported novel uses of *Capparis tomentosa* and *Juniperus procera* for alleviating toothaches, suggesting their potential in dental care. *Capparis tomentosa* is prepared by chewing the root with *Zingiber officinale* and holding it against the teeth, while *Juniperus procera* resin is ground with *Rosa hybrida* fruit, *Euphorbia abyssinica* latex, *Myrica salicifolia* root, and *Lobelia rhyncopetalum* root to create a paste applied to the teeth. Previous reports have documented additional uses for *Capparis tomentosa*, including treatment for"evil spirit"[6], epidemic, and asthma [59], "evil spirit," and "evil eyes" [1], and *Juniperus procera* for hemorrhoids, menstrual irregularities, emaciation in children, skin diseases [56], wounds [52], uterus problems [46], and fire burns [1].

Finally, this study identified novel applications for three additional species: *Terminalia leiocarpa* for eye diseases (using squeezed leaf extract); *Croton macrostachyus* for finger amputation (grinding the leaf and mix with butter and applying as a cream); and *Euphorbia tirucalli* for hemorrhoids (using the extracted latex). Additional use information on the previous reports of *Terminalia leiocarpa* mentioned for its use for a wide range of conditions, including African trypanosomiasis, animal diarrhea, asthma, cancer, cough, diabetes, dysentery, erectile dysfunction, fever, giardiasis, helminthiases, meningitis, menstrual disorders, monkey pox, oral infections, poliomyelitis, sickle cell anemia, snake bites, toothache, urinary schistosomiasis, and yellow fever [168]. *Croton macrostachyus* has been previously reported for jaundice, *Tinea capitis*, malaria, abdominal pain [45], "evil eye," asthma [6], ringworm [46], swelling [53], atopic eczema, liver problem, stomachache, gonorrhea, malaria, chronic skin diseases, scabies, wound, minor bleeding, and febrile disease [1].

Conclusions

The documentation of 112 medicinal plants including four endemic and one nearly endemic species for human and livestock remedies in the Addi Arkay district of northwestern Ethiopia revealed the significant array of plant uses as the primary healthcare services. The reliance of wild-sourced plants emphasizes the community's connection to their natural habitats and highlights the importance of conservation efforts to these areas. The predominance of harvesting leaves and roots, combined with grinding as the primary method for preparing remedies, indicated the higher medicinal values of these parts. In addition, the widespread use of oral administration and the incorporation of additives to enhance efficacy and reduce toxicity reflected the locals' depth of ethnobotanical knowledge and practices. These findings underscored the importance of further exploration and preservation of indigenous knowledge related to medicinal plant use of the study area.

Fidelity level (FL) analyses identified *Opuntia ficus-indica* as the most preferred treatment for human hemorrhoids and *Phytolacca dodecandra* as the primary remedy for rabies in livestock. This showed widespread use and reliance of local the community for healthcare on these species, suggesting promising avenues for further pharmacological investigation. The Direct Matrix Ranking (DMR) identified *Cordia africana*, *Olea europaea* subsp. *cuspidata*, and *Terminalia leiocarpa* as the most threatened multipurpose medicinal plants, highlighting the urgent need for conservation priority to these species. The Jaccard Similarity Index (JSI%) and Rahman's Similarity Index (RSI) revealed varying degrees of overlap in medicinal plant knowledge compared to other studies in Ethiopian. The lowest values indicate unique and localized ethnobotanical knowledge, reflecting the distinct cultural practices and medicinal plant diversity of the study area, while the highest values suggest shared knowledge and common plant use across regions. The relatively lower similarity in veterinary plant use reflects more localized and specialized knowledge, often confined to specific communities, where ethnoveterinary practices are tailored to address the health needs of livestock in particular ecological and cultural contexts. Agricultural expansion, overgrazing, and the use of fuel were the primary threats to medicinal plants in the study area. These factors have led to habitat degradation and valuable medicinal plant loss, underscoring the need for more coordinated in situ and ex situ conservation initiatives aimed at protecting these vital resources.

In addition, the research revealed that socio-demographic (healing experience, gender, age, education status, education level, marital status, ethnic background, and religion) and socio-economic factors (occupation, transport access, income level, and distance from town) significantly influence indigenous knowledge regarding medicinal plant use in the Addi Arkay district. Understanding these factors is crucial for conservation and effectively integrating traditional knowledge with conventional scientific approaches. Furthermore, the transmission of indigenous and local knowledge about medicinal plants is largely familial and oral, which poses challenges for its preservation. The tendency for secrecy among traditional healers can inhibit the sharing of valuable knowledge, risking the loss of critical information about medicinal plant uses and practices. To address these issues, it is essential to promote community engagement in conservation efforts and establish platforms for knowledge sharing that respect traditional practices while encouraging collaboration.

Limitations of this study

This study is limited to document medicinal plants with the associated indigenous knowledge for treating human and livestock ailments in the Addi Arkay district that did not include further phytochemical analyses of the most preferred and frequently cited medicinal plants. Future studies should focus on antimicrobial assays, phytochemical, and pharmacological validations, as well as in vitro and in vivo investigations.

Supplementary Information

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Supplementary material 1

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Author contributions
WM led the study, including conceptualization, proposal development, fieldwork (data collection and specimen identification), investigation, and drafting the initial manuscript. GM provided critical insights and feedback throughout the research process, contributing to the proposal, fieldwork, and final manuscript preparation. AA contributed to the study design, specifically in proposal development and methodology refinement. EL played a key role in proposal development, methodology refinement, and ensuring the manuscript's finalization. All authors reviewed and approved the submitted manuscript.

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Availability of data materials
The necessary data collected for this study were analyzed and included in this manuscript, and its supplementary information file is attached as additional file 1.

Declarations

Ethics approval and consent to participate
Ethical approval for this research was granted by the University of Gondar, College of Natural and Computational Science, Biology Department (clearance number 419/2024). Prior to participation, all informants were fully informed about the study's objectives, and verbal consent was obtained.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Supplementary Information
Supplementary Material: List of medicinal plant species used by the communities of the Addi Arkay district, Northwestern Ethiopia.

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