Local community perception on medicinal plant knowledge use and influencing variables among three ethnic groups in peri-urban areas of south-central Ethiopia

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Research

Abstract

*Background***:** In Ethiopia, affordability, religious beliefs, and access to healthcare facilities are theoretically linked with the preferences for medicinal plant knowledge uses. Yet, there is still insufficient information about the factors contributing to the link between medicinal plant knowledge use and associated drivers. This study aimed to assess the factors influencing local communities' preferences and perceptions of medicinal plant knowledge practice among Gedeo, Oromo, and Sidama ethnic groups.

Methods: The study used ethnobotanical data from 837 participants from Gedeo, Oromo, and Sidama ethnic group, collected through semi-structured interviews. A five-dimensional Likert scale was used to determine preferences and factors affecting the perceived use of medicinal plant knowledge. Nonparametric Kruskal-Wallis chi-squared test was appled to examine the impact of socio-demographic variables on perceived use of medicinal plant knowledge among informants.

*Results***:** The study found that efficacy was the most significant reason for practicing medicinal plant knowledge against several human ailments (RII = 0.686). Misleading communication is a major factor that alters the perceived use of medicinal plant

knowledge among ethnic groups (RII = 0.719). Age, gnder, education, and marital status are significantly ($P < 0.05$) associated variables with the perceived use of medicinal plant knowledge among the variables compared.

*Conclusion***:** The study found that traditional knowledge is widely accepted among the three ethnic groups studied. The effectiveness and beliefs of traditional knowledge is considerable, indicating the need for publicizing its benefits and risks. Moreover, further research needed on safety, validity, and efficacy to make it widely available as an alternative medicine.

Keywords: Ethiopia, perception, rural-urban interface, socio-demographic variables, traditional plant medicine

Background

Humans have always tried to develop strategies for properly managing and using natural resources to meet their daily needs (Grafford *et al***.** 2016). This is especially true regarding using plant resources, which are present in many aspects of people's lives in varied cultures (Kujawska *et al*. 2017; Saynes-Vásquez *et al*. 2016; Teka *et al*. 2020). Inspired by the advancement of human medicine, traditional medicinal plants still constitute the main alternative for treating several pathologies in the tropics (Grafford *et al*. 2016). In fact, for some communities, traditional medicinal plants are the only available therapeutic resources, not only because of the proven therapeutic efficacy of various plants used to treat human and cattle complications, but also because of their lower costs, belief in traditional healers, and cultural acceptability, as well as dissatisfaction with the modern health system (Demie *et al*. 2018; Eshete & Molla 2021; Welz *et al*. 2018). More than 60% of the world's population and 80% of those in developing countries rely almost entirely on traditional medicine for their primary healthcare needs (WHO 2019). According to Vecchiato (2019) in some lower and middle-income countries, traditional healers remain the main health providers for millions living in rural areas. Likewise, in Ethiopia, traditional healers serve an important role in sustaining the majority of the country's primary healthcare system (Gietaneh *et al*. 2023). This is because modern pharmaceuticals and medical procedures remain unreachable to many African people, as well as in Ethiopia, due to their relatively high cost and concentration of health facilities in urban centers (Sibanda & Mothibe 2019).

Despite the great role of traditional knowledge practice around the world, it seems to face notable challenges. For instance, the lack of a reference standard for determining the proper dosage of traditional medicine elsewhere resulted in the creation of incorrect and incomplete information about traditional medicine drugs (Abbott 2014) and a poor national policy to manage and legalize the practice in some countries (Mirzaeian *et al.* 2019; WHO 2019; Eshete & Molla 2021). Despite this, in Ethiopia because of the country's deep-rooted culture of employing traditional medicinal plants, it become an integral part of the local culture and is accessible to most of the population (Lulekal *et al.* 2013; Eshete & Molla 2021). Due to its wide usage, traditional knowledge in Ethiopia is not uniformly practiced and the population of the country has overlapping knowledge as well as knowledge specific to their culture (Giday *et al*. 2007; Teka *et al*. 2020; Tamene *et al*. 2023). Concerning the determinants of traditional knowledge use in Ethiopia, some studies hypothetically linked affordability and religious beliefs, while others explain poor access to modern healthcare facilities (Wassie *et al*. 2015; Hailu *et al*. 2020). Yet, there is still insufficient information about the reasons contributing to the link between traditional medicinal plant knowledge utilization and other associated factors.

Several ethnobotanical studies conducted in Ethiopia and abroad explained that the perceived utilization of traditional knowledge could be influenced by certain parameters, such as educational level, religious belief, gender, cultural influence, and marital status (White 2013; Stanifer *et al*. 2015; Grafford *et al*. 2016; Chali *et al*. 2021; Eshete & Molla 2021). Studies conducted in Nigeria (Aina *et al*. 2020), Saudi Arabia (Abdelmola *et al*. 2021), Uganda (Logiel *et al*. 2021), DR Congo (Mutombo *et al*. 2022), and Australia (Shewamene *et al*. 2022) revealed age significantly influenced the perceived use of traditional knowledge among different community members. Gender is a stated parameter that affects the perceived use of traditional knowledge among community members elsewhere. Several findings in Ethiopia hypothesize that gender differences in perceived uses of traditional medicinal plants might be related to the traditional flow of information along the male line in the country (Lulekal *et al*. 2013; Chekole 2015). Contemporary education is another constraint that exerts an observable impact on perceived uses of traditional knowledge by declining local cultural practices, through creating an intergenerational gap, and changing younger opinions of local indigenous knowledge as inferior to information received via formal schooling elsewhere (Grafford *et al.* 2016; Chali *et al*. 2021; Eshete and Molla 2021; Logiel *et al*. 2021). Moreover, the prior studies in the USA, Sub-Saharan Africa, Cambodia, Australia, and Ethiopia revealed that perceived herbal medicine usage is typically related to lower levels of schooling (Grafford *et al*. 2016; James *et al*. 2018; Pearson *et al*. 2018; Shewamene *et al*. 2020; Chali *et al*. 2021). Besides, according to Eshete and Molla (2021), the erosion of good thoughts toward traditional medicine among young and literate generations implies the loss of indigenous knowledge.

Ethnobotanical research has been undertaken elsewhere in the country; however, the majority has focused on rural districts. Particularly in rural-urban interface areas, the preferences related to traditional knowledge and factors influencing the perceptions of traditional medicinal plant knowledge practices were poorly explored, and many plant species associated with local knowledge are on the verge of disappearing (Kewessa *et al*. 2015; Tefera & Kim 2019; Eshete & Molla 2021). Whereas, traditional medicinal plants are widely applicable among the local communities against different chronic and acute ailments (Regassa *et al*. 2017; Tefera & Kim 2019; Teka *et al*. 2020; Tamene *et al*. 2023). Thus, it is vital to investigate the reasons that pushed the local communities to practice traditional medicinal plants knowledge and associated factors. Overall, the present study was carried out to evaluate and characterize the reasons for preferences and contributing factors currently shrinking local communities' perceptions of traditional medicinal plant knowledge practices and associated driving

factors among Gedeo, Oromo, and Sidama ethnic groups. More specifically, the study aimed (1) to assess contributing factors to the practice of traditional medicinal plant knowledge among ethnic groups of Gedeo, Oromo, and Sidama, (2) to investigate **factors affecting the perceived uses of traditional medicinal plant knowledge**, and (3) determining the influences of socio-demographic variables on the perceived use of traditional medicinal plant knowledge among the three selected ethnic groups in the urban-rural interface of south-central Ethiopia. The hypothesis is that the perceived use of traditional medicinal plant knowledge varies depending on socio-demographic variables. The study would also provide baseline information for researchers, local leaders, and practitioners of traditional plant medicines as alternative health care in the study areas.

Materials and Methods

Study areas and ethnographic information

The study was conducted among three selected neighboring ethnic groups, namely Gedeo, Oromo, and Sidama in Dilla, Hawassa, and Shashemene rural-urban interface areas, respectively. Administratively, Hawassa district is part of the Sidama National Regional State, whereas Shashemene and Dilla district is parts of the Oromia regional state, and South Nations and Nationality Regional State, respectively (Fig. 1). Nine peri-urban kebeles (lowest administrative units), three from each study areas, were purposely selected from the peri-urban administrative areas of Hawassa, Shashemene, and Dilla (Fig. 1). These areas were chosen because the ethnic groups living in the districts have coexisted and interacted for many years in specific regions of south-central Ethiopia. Additionally, they are geographically close to the town, have similar urbanization pressures, and are facing alarming natural resource degradation, owing to urbanization (Kindu *et al*. 2013; Gebretsadik 2014; Girma *et al*. 2018; Elias *et al*. 2019).

Hawassa, the capital city of Sidama National Regional State, is situated 273 kilometers south of Addis Ababa, the capital city of Ethiopia (Kinfu et al. 2019), geographically located at 6° 55'-07° 06' N and 38° 25'-38° 33' E, with elevation ranges of 1656 to 2137 m a.s.l. (Wondrade 2014). Hawassa is bordered by Lake Hawassa to the west, Oromia National Regional State to the north, Wondo Genet and Malga districts to the east, and Shebedino and Gorge districts to the south. Hawassa has 15,720 hectares of land within its administrative boundary, while only 6,465 hectares (24.4%) were demarcated within the municipal boundary and planned as urban land, while the rest is rural land (Kinfu et al. 2019). Administratively, the city was organized into three tiers of administration: which were divided into 8 sub-cities and 32 kebeles (Hawassa City Administration annual unpublished report, 2019). Among the sub-cities, Hawella-Tulla and its 12 kebeles were identified as rural and rural-urban interface areas in this study (Figure 1). Residents of the study area are ethnically and religiously diverse. The majority of indigenous and local people living in the area are Sidama (48.68%), followed by Amhara (15.43%), Welaita (13.9%), Oromo (5.21%), Gurage (4.33%) and others (12.45%) (CSA 2007). The major language spoken in the area belongs to the Sidama ethnic group '*Sidamu afoo'* (47.97%), followed by Amharic (31.01%), Welaita (9.58%), Afan Oromo (2.53%), Gurage (1.98%), Kembata (1.82%), and others (5.09%). More than half of the people in the research area practice the Protestant religion (52.71%), followed by Ethiopian Orthodox Christianity (39.99%), Islam (7.3%), and Catholicism (3.78%). According to the (CSA 2007) population forecasts, the projected population for 2022 was 555,480, of whom 277,032 were men and 278,448 were femen .

Shashemene district is located at 7^0 04'50" to 7^0 22'45" N and 38^0 23'00" to 38^0 48'00" E. Which is 250 kilometers to the south of Ethiopia's capital city, and 25 kilometers north of Hawassa city (Jegora *et al*. 2019). Hawassa city borders it to the south, Seraro to the west, Arsi Negele to the north, and Arsi Zone to the east, and its elevation ranges from 1,500 to 2,300 m a.s.l. (Jegora *et al*. 2019). The district has a 767.9km^2 area with 458.3/Km^2 population density (CSA 2007). The district rural and rural-urban interface areas have assembled into 28 kebeles, where the current study was conducted (Fig. 1). The Oromo ethnic group makes up the majority of the indigenous inhabitants in the district (74.11%), followed by the Amhara (9.26%), Welaita (9.5%), Kembata (2.3%), Gurage (2.13%), and others accounted for 7.2% (CSA 1994). The major language spoken in the area belongs to the Oromo ethnic group '*Afan Oromo'* (71.7%), followed by Amharic (18.23%), Welaita (3.49%), Kembata (1.52%), Gurage (1.14%), and others (2.02%). The majority of the inhabitants were Islamic religion followers, with 69.38% of the population, followed by Ethiopian Orthodox Christianity (23.5%), Protestantism (5.62%), and Catholicism (1.05%). According to the (CSA 2007) population forecasts, the projected population for 2022 was 351,898, of whom 174,711 were men and 177,187 were women in the district.

Dilla district was located in southern Ethiopia, 359 kilometers from the capital city, Addis Ababa (Debela & Muhye 2017), and an altitude range of 1,350 to 2,550 m a.s.l. It is situated at 6°15'05" to 6°26'35 N and 38°15'55" to 38°24'02"E. The district has a 122.3 km^2 area with a 1,047/Km^2 population density (CSA 2007). The district rural and rural-urban interface areas were assembled into 19 kebeles, where the current study was carried out (Fig. 1). The district residents are heterogeneous, both

in ethnicity and in religion. The majority of indigenous people inhabiting the area belong to the Gedeo ethnic group (73.5%), followed by the Amhara (6.98%), Oromo (6.37%), Sidama (3.34%), Silte (2.33%), and others (7.48%), (CSA 1994). The Gedeo ethnic group language '*Gedeoffa'* was spoken widely (73.22%), followed by Amharic (13.5%), Afan Oromo (5.43%), Sidamu afoo (3.25%), Silte (1.39%), and others (3.21%). The majority of the people were Protestant religion followers, accounting for 83.13% of the population, followed by traditional belief (7.81%), Ethiopian Orthodox Christianity (5.31%), Catholicism (1.16%), Islam (1.02%), and others (1.57%), (CSA 2007). According to the CSA (2007) population forecasts, the projected population for 2022 was expected to reach 128,050, of whom 64,276 were men and 63,774 were women in the district.

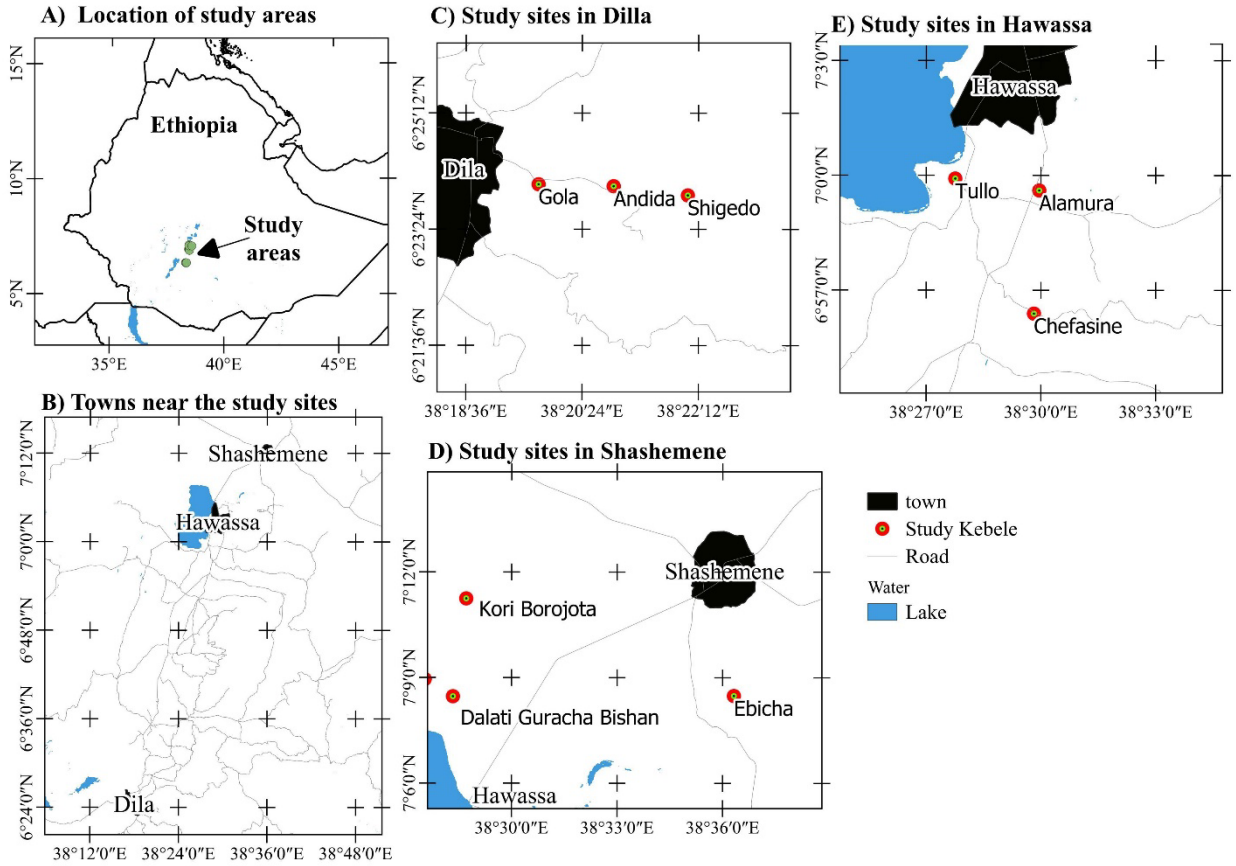

Figure 1. Map of the study sites in Dilla, Shashemene, and Hawassa peri-urban areas

Informants' selection

A multistage cluster sampling design with a different stage was applied following an approach by Sedgwick (2015) and Taherdoost (2017). Due to the presence of ethnic heterogeneity in the study areas, sampling villages, or Kebeles, were purposefully selected. The villages were clustered repeatedly within each stratum, and then clusters of each stratum were randomly selected. Finally, stratified random sampling was applied to select the study respondents or households from each study site (Taherdoost 2017). Following the approach of Alexiades (1996), before the interviews, discussions were held with the informants with the help of local development agents to inform them of the aim of the study. This helped to gain the respondents' confidence in providing truthful information without suspicion. Finally, informed consent was obtained from each informant who participated in the study. The names and private information of the respondents were not displayed here because of their interests and unwillingness to publish it.

Sample size determination

The households were selected through a stratified random sampling technique from the final selected clusters (Taherdoost 2017). The sample size was calculated using the proportion of the population using medicinal plants and the prevalence of knowledge, attitude, and practice based on the following assumptions: In Ethiopia, about 80% of the population uses and practices medicinal plants (Bekele 2007). A formula devised by Njoroge *et al*. (2010) was used to calculate the required sample size, which was 246 for each study area, as shown below. To ensure the representativeness of the sample, 33 informants were considered a non-response rate and added to each study site, and the required sample size became 279 informants for each ethnic group.

$$S = \chi^2 NP (1-P) \div d^2 (N-1) + X^2 P (1-P)$$

Where; S = required sample size, χ2 = table value of chi-square for 1 degree of freedom at the desired confidence level (1.96), P = the population proportion (assumed to be population using and practicing medicinal plants (80%) in Ethiopia (Bekele 2007), N = population size and d = margin of error (5%). Individuals aged older than or equal to 18 years and living for at least 10 years were included in the study.

Data collection methods

The information was gathered using a semi-structured interview (Martin 1995; Alexiades 1996; Cotton 1996), which was divided into three sections starting from May to October 2023. The first section dealt with respondents' demographic characteristics, and the second part inquired about the preference or determinant factors, that push the local communities towards traditional medicines. The third part requested the factors that currently affect the perceptions of local communities, the acquisition, and trust of available information on traditional medicines. The surveyed households are the Sidama, Oromo, and Gedeo ethnic groups, and their communication languages were Sidamu affo, Afaan Oromo, and Gedeoffa, a native language of the respective study location. Interviews were conducted using a checklist of questions prepared in English and, at the end, translated into the local language of the studied ethnic groups.

Data analysis

Python, Version 3.9.15, 2022 library (scipy.stats, pandas, and plot_likert) was used for data analysis. A five-dimensional Likert scale was used to evaluate participants' preferences and factors affecting perceptions of traditional medicinal plant knowledge practices. Before evaluating the variables, most data from the Likert scale was expected to be considered ordinal; as a result, the median is the ideal summary measurement to use when analyzing an individual sample's overall impression. Ethnicity, age, gender, marital status, education, and religion were considered to determine the influences of socio-demographic variables on the perceived uses of traditional medicinal plant knowledge among informants. Thus, the Kruskal-Wallis chi-squared test, which is a nonparametric approach to the one-way ANOVA, was applied between socio-demographic variables and the median of sampled informant groups. Plot_likert package was used to identify the most agreed Likert item on the preferences and factors affecting perceived uses of traditional medicinal plant knowledge.

Relative importance index (RII)

According to Aibinu & Jagboro (2002), the Relative Importance Index (RII) approach is used to determine the relative importance of specific variables based on the possibility of occurrence using the Likert scale. RII helps in identifying which factors are most influential based on respondents' perceptions as described below.

$$RII = \frac{\sum W}{(A^*N)}$$

Where: W -is the weight given to each factor by the respondents from 1, 2, 3, 4, and 5 (from very low to very high, respectively)

A - is the highest weight (i.e., 5 in this study), and;

N - is the total number of respondents (N = 837)

Results

Characteristics of the respondents

Ninety-five percent of the surveyed households had practiced traditional medicinal plants. Over 58% of the respondents received information from their family members and peers about traditional medicinal plants' use, benefits, and efficacy. There were more male participants than women (Table 1). Informants were grouped into three age categories, and 51% of those participating in the survey were between 41 and 55. Whereas, those under 41 and over 55 accounted for 32% and 17%, respectively. The majority of participants in this study had attended the lower grade education level and were illiterate. Religion is predominated by protestant religious followers, followed by Muslims, and Orthodox Christians. Married participants were more dominant than unmarried, and divorced.

Table 1. Socio-demographic characteristics of the studied population (N = 837)

Sociodemographic characteristics	Categories	Frequency	Percentage
Ethnicity	Sidama	279	33.33
	Oromo	279	33.33
	Gedeo	279	33.33
Age	< 41	271	32
	41-55	422	51
	>55	144	17
Gender	Male	447	53
	Female	390	47
Education	Illiterate	242	29
	Primary (1-8 grade)	408	49
	Above grade 8	187	22
Religion	Protestant	428	51
	Orthodox	113	14
	Islam	296	35
Marital status	Married	709	85
	Divorced	25	3
	Unmarried	103	12
Experiences of participants in visiting traditional healers	No experience	44	5
	One time	181	22
	Two times	120	14
	Three times	181	22
	Many times	311	37

Contributing factors for practicing medicinal plant knowledge among ethnic groups

The effectiveness of traditional medicinal plant knowledge is the most agreed upon reason (64%, RII = 0.686) against different human ailments across ethnic groups studied (χ^2 = 85.66, P < 0.001), followed by accessibility, influence from family and peers, and affordability (Fig. 2 and Table 2). Comparatively, proximity to the health center scored the lowest consensus among the ethnic groups.

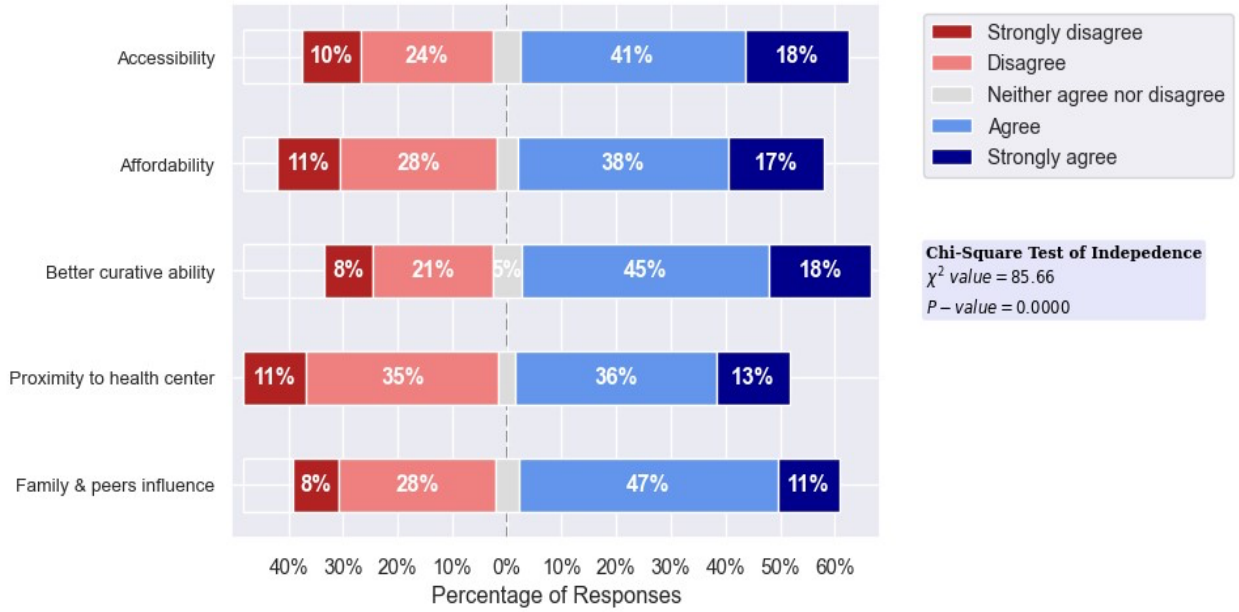

Figure 2. Contributing factors for practicing medicinal plant knowledge

Table 2. Relative importance index (RII) of contributing factors for practicing medicinal plant knowledge

Contributing factors	SD	DA	NAND	A	SA	Total	Weight	RII	Rank
Better curative ability	74	183	44	379	157	837	2873	0.686	1
Accessibility	89	204	41	344	159	837	2791	0.667	2
Family and peers influence	71	239	36	397	94	837	2715	0.649	3
Affordability	96	240	32	324	145	837	2693	0.643	4
Proximity to health center	97	295	25	309	111	837	2553	0.610	5

(SD= Strongly disagree, DA = Disagree, NAND = Neither agree nor disagree, A = Agree, SA = Strongly agree)

Factors altering the perceived uses of traditional medicinal plant knowledge

Misleading communication (69%, RII = 0.719) is the most agreed upon factor among ethnic groups which altered their perceived uses of traditional medicinal plant knowledge (χ^2 = 287.89, P < 0.001), followed by an absence of legal ground, natural resource degradation, modern education, and healing's secrecy (Fig. 3 and Table 3). Comparatively, access to modern medicine scored the lowest point.

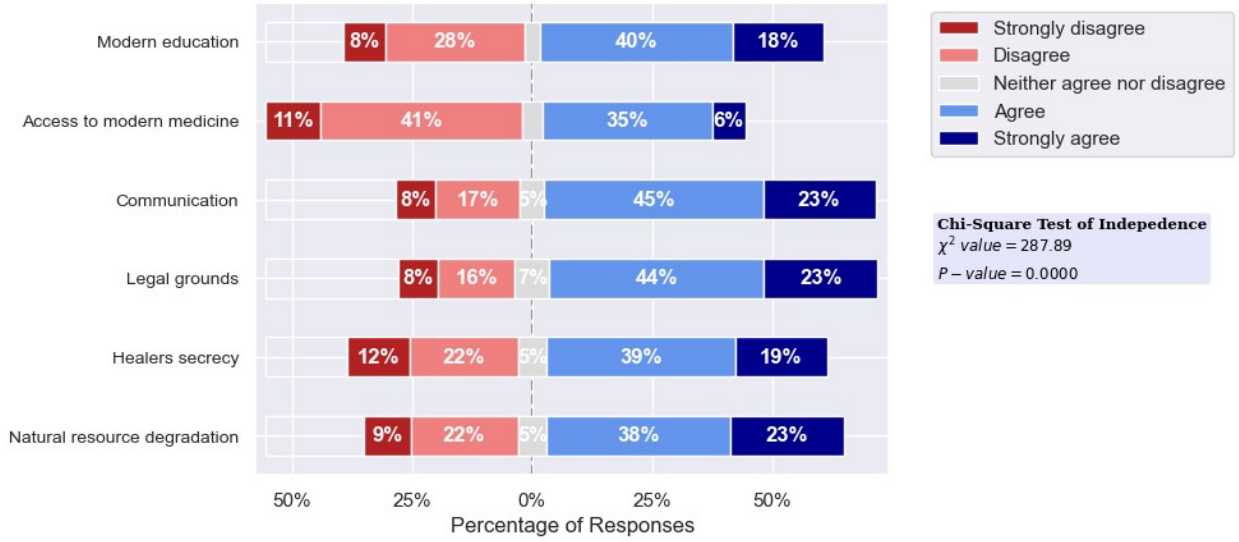

Figure 3. Factors altering the perceived uses of traditional medicinal plant knowledge

Table 3. Relative importance index (RII) of factors altering the perceived uses of traditional medicinal plant knowledge

Factors affecting perceptions of medicinal plant knowledge uses	SD	DA	NAND	A	SA	Total	Weight	RII	Rank
Communication	69	135	60	374	199	837	3010	0.719	1
Legal grounds	70	147	42	382	196	837	2998	0.716	2
Natural resource degradation	81	187	50	321	198	837	2879	0.688	3
Modern education	74	242	27	337	157	837	2772	0.662	4
Healers secrecy	108	190	48	330	161	837	2757	0.659	5
Access to modern medicine	97	351	35	296	58	837	2378	0.568	6

(SD= Strongly disagree, DA= Disagree, NAND = Neither agree nor disagree, A = Agree, SA = Strongly agree)

Influences of socio-demographic variables on perceived use of medicinal plant knowledge

The study found that age, gender, education, and marital status significantly influenced the perceived uses of traditional medicinal plant knowledge among different informant categories (P < 0.05, Table 4). Dunn's test on comparison of perceived uses of traditional medicinal plant knowledge and age groups (25-40 and 41-55) and (25-40 and >55) revealed significant differences (P < 0.05), while there was no significant difference between middle aged and older informant groups. In comparison to secondary school attendees' informants, illiterate informants significantly differed in their perceived use of traditional medicinal plant knowledge (p = 0.038). There was also a significant difference between married and single (unmarried and divorced) informants at p = 0.008 and 0.001, respectively, but no significant difference was observed

between unmarried and divorced participants. Furthermore, no significant difference was found between the perceived application of traditional medicinal plant knowledge, ethnicity, and religious belief (Table 4).

Table 4. Influence of socio-demographic variables on perceived use of traditional medicinal plant knowledge

Parameters	Categories	Number of informants (N = 837)	Mean ± SD	Kruskal-Wallis chi-squared	df	*p*-value
Ethnic group	Gedeo	279	3.61 ± 0.8[a]	3.47	2	0.1763
	Oromo	279	3.60 ± 0.78[a]			
	Sidama	279	3.60 ± 0.81[a]			
Age	Young (25-40)	271	3.45 ± 0.83[b]	15.45	2	0.0001*
	Middle age (41-55)	422	3.67 ± 0.77[a]			
	Older (> 55)	144	3.71± 0.82[a]			
Gender	Male	447	3.68 ± 0.83[a]	7.32	1	0.0068*
	Female	390	3.52 ± 0.90[b]			
Education	Illiterate	242	3.70 ± 0.73[ab]	6.19	2	0.045*
	Primary level	408	3.60 ± 0.82[bc]			
	Secondary level	187	3.48 ± 0.87[c]			
Religion	Protestant	428	3.54 ± 0.82[a]	5.22	2	0.073
	Islam	296	3.64 ± 0.74[a]			
	Orthodox	113	3.72 ± 0.9[a]			
Marital status	Unmarried	103	3.48 ± 0.8[b]	8.19	2	0.016*
	Married	709	3.63 ± 0.8[a]			
	Divorced	25	3.24 ± 0.97[b]			

*Significant difference ($P < 0.05$) between the averages of paired parameters

Discussion

Practices of traditional medicinal plant knowledge among ethnic groups

The prevalence of traditional medicinal plant knowledge use is considerable among ethnic groups studied (Fig. 2, Table 2), and higher than the studies conducted elsewhere in Ethiopia (Gari *et al*. 2015; Laelago *et al*. 2016; Aragaw *et al*. 2020; Chali *et al*. 2021) and consistent with studies conducted abroad in Brazil (Stanifer *et al*. 2015), DR Congo (Messner *et al*. 2018), Australia (Schioldann *et al*. 2018) and Tanzania (Mutombo *et al*. 2022), respectively. Different kinds of ailments recorded in our previous work (Tamene *et al*. 2023) for which traditional healers were most frequently visited by patients, an evidence of the deep-rooted connections between the local communities and traditional medicinal plant knowledge of healers. However, the lack of adequate healthcare services and the expense of modern medicine were reported as major challenges in the country (WHO 2017), our finding revealed that the effectiveness of traditional medicinal plants against different human ailments is a crucial factor and contributed to the extensive uses among the studied ethnic groups (Fig. 2, Table 2), consistent with studies conducted elsewhere (Stanifer *et al*. 2015; Laelago *et al*. 2016; Messner *et al*. 2018; Schioldann *et al*. 2018; Mutombo *et al*. 2022). Thus, medicinal plants in the peri-urban areas of Hawassa, Shashemene, and Dilla are incredibly important and are deep-rooted in the survival of the community. The credibility of traditional knowledge is not only made up an essential part of healthcare in treating diverse chronic and fatal ailments (Tamene et al. 2023), but it is also a respected part of the culture in the country (Lulekal *et al*. 2013; Eshete & Molla 2021). Which favors their use by the population in general, making it an effective form of health care in the country (Bekele 2007; Lulekal *et al*. 2013; Gari *et al*. 2015; Chali *et al*. 2021; Eshete & Molla 2021).

Contrary to our findings, studies conducted by Vandebroek *et al*. (2004) and Chali *et al*. (2021) revealed poor health facility is a major contributing factor to practicing traditional medicinal plant knowledge in Amazonian communities of Brazil and southwest communities of Ethiopia. However, our study identified poor health facilities as a weak contributing factor for practicing traditional medicinal plant knowledge. These might be related to the consistent uses of traditional medicinal plant knowledge for their primary healthcare and the long-lived attachment (Regassa *et al*. 2017; Tefera & Kim 2019; Teka *et al*. 2020; Tamene *et al*. 2023). Moreover, during our survey we observed that local communities utilize both traditional and hospital medicine, with many interviewees stating that sometimes hospital doctors recommend using traditional knowledge instead. From this, we realized that the traditional knowledge understanding among local communities and outsiders is also

highly valued. These were evident in the treatment of cancer-like ailments, broken bones, kidney diseases, typhoid, heart cases, dizziness, rabies, liver, and sexually transmitted diseases (Tefera & Kim 2019; Teka *et al*. 2020; Tamene *et al*. 2024). Thus, the effectiveness, accessibility, and affordability of traditional medicinal plant knowledge are attributed to the respondents' continued use. Besides, it is confirmed that traditional knowledge and associated flora would remain a major part of healthcare delivery in the study areas and elsewhere in the country.

Factors affecting the perceived uses of traditional medicinal plant knowledge

Although traditional medicines have potential in treating illnesses and are widely used, the related perceptions of local communities were not widely explored. Thus, understanding the perception of traditional medicinal plant knowledge use and associated drivers are vital in view of public health issues. In this study, the effectiveness of traditional medicinal plant knoweldge is well-acknowledged among the ethnic groups studied. Thus, people in south-central Ethiopia have a deep and good perception of traditional knowledge practices. We have also observed that local communities have made efforts to conserve some medicinal plants in their home gardens for easy access, consistent with (Lulekal *et al*. 2013; Chekole 2017; Eshete & Molla 2021) elsewhere in different parts of the country. Thus, traditional medicinal plant knowledge widespread uses and effectiveness are attributed to the dissemination of information among studied communities (Fig. 2). Moreover, this is responsible for 64% of traditional knowledge practices in this study and elsewhere in the country (Mesfin *et al*. 2014; Chekole 2017; Agize *et al*. 2022). On the other hand, our study revealed that most participants claimed that they would not have trusted and were frightened by the current actions of the local government and traditional knowledge use. The ways of communicating about the risks of traditional knowledge and the absence of legality were major challenges claimed during our survey, while, most of the country's population was dependent on traditional knowledge of medicinal plants (Bekele 2007; Lulekal *et al*. 2013; Demie *et al*. 2018). Furthermore, the studied ethnic groups stated that local government offices did not promote traditional medicine, which is considered unlawful, which declined their desire and perception to use traditional medicine and guaranteed that healers would use their knowledge in society widely. Similar evidence was reported by Chekole (2017) in northern Ethiopia.

As a result, for many people, the use of traditional knowledge appears to be illegal, and interest in it as an alternative remedy has diminished over time, particularly in younger generations. Similar results were revealed elsewhere in the country (Chekole 2017; Demie *et al*. 2018; Tefera & Kim 2019; Eshete & Molla 2021; Agize *et al*. 2022; Bekele *et al*. 2022). This flawed perspective leads to the irrational usage of medicinal plants and associated knowledge, consistent with Messner *et al*. (2018) and Chekole (2017), who conducted similar ethnobotanical study in Brazil and northern Ethiopia. In our survey most informants also stated that they have no written information about locally grown medicinal plants and their associated medicinal uses. Similar challenges were reported elsewhere in the country. For instance Lulekal *et al*. (2013), north-central Ethiopia, Ankober district, and Chekole (2017) northern Ethiopia, Gubalafto district. These recalled the need for interventions from stakeholders that are likely to support documentation and introduce trust in practices and practitioners, following the guidelines of WHO (2013). Such as accreditation for healers and giving credit for traditional diagnosis and regulation are basic principles. Establishing protocols, promoting traditional knowledge, and gradually incorporating it into the official health system are important. Besides, these findings support the need for more public education and awareness campaigns on the safe use of traditional knowledge and associated medicinal plants. During the interview session, most participants recommended that public media and school advertisements commend the benefits of traditional medicine.

Healing secrecy is another constraint that affects the perception of local communities' traditional medicinal plant knowledge practices (Fig. 2). In Ethiopia, the majority of healers receive their knowledge from their family in words of extreme secrecy, usually in adulthood (Lulekal *et al*. 2013; Mesfin *et al*. 2014; Chekole 2017; Demie *et al*. 2018; Tefera & Kim 2019; Tamene *et al*. 2020; Agize *et al*. 2022). In our survey, respondents from the ethnic groups studied (Gedeo, Oromo, and Sidama) agreed that healers have not volunteer to share the information with the local communities. Even if, during treatment, the names of plants and preparation methods of the medicine are very secret. Which is often fueled by mistrust by traditional healers and driven by fear of losing inherited traditional knowledge, consistent with (Lulekal *et al*. 2013; Chekole 2017; Eshete & Molla 2021; Agize *et al*. 2022). This could be attributed to the poor system of indigenous knowledge sharing between generations and follows a misunderstanding and decline of the traditional medicinal plant knowledge practices through generations in the communities. Therefore, disclosing local plant names and information about their uses is important to maintain the traditional knowledge flow between generations and keeping this nature-gifted culture.

However, the studied ethnic groups had a good insight into traditional medicinal plant use; it was also notable that more than half of the interviewed participants agreed that contemporary education is among the constraints that alter the perceived uses of traditional knowledge in the community (Fig. 2). In producing intellectual understandings, education can

and should act as a changing agent in a society (Constant & Tshisikhawe 2018); reversely, it affects the perceptions and beliefs of local communities associated with traditional practices. The main observable impact is the decline of local cultural practices associated with indigenous knowledge (Chali *et al*. 2021; Mutombo *et al*. 2022). Thus, in this study, informants explained that modern education is a primary challenge of changing traditional values among younger generations and declining traditional knowledge transfer, while traditional knowledge is culturally respected values in the communities studied and elsewhere in the country (Lulekal *et al*. 2013; Gari *et al.* 2015; Demie *et al*. 2018; Chali *et al.* 2021; Eshete & Molla 2021). Thus, it created an intergenerational gap by changing younger opinions of local indigenous knowledge as inferior to information received via formal schooling. As a result, it deteriorated local communities' perceptions of this knowledge acquisition system, particularly in the young and literate generation in the studied communities and elsewhere in the country (Lulekal *et al*. 2013; Demie *et al*. 2018; Tefera & Kim 2019; Eshete and Molla 2021). Grafford *et al*. (2016), Shewamene *et al*. (2020), and Constant and Tshisikhawe (2018) abroad in the USA, Australia, and South Africa, respectively. Therefore, systems of establishing contact and engagement with traditional practices through schooling and the presence of knowledgeable elders and learners are desirable to maintain the knowledge and practices.

Besides, over-harvesting and degradation of plants due to climate variability, unwise use, and the absence of replacement planting for the utilized medicinal plants have raised concerns from the local communities. This has consequences in minimizing exposure to practices and making it impossible to learn about plants that no longer exist in the area, consistent with Chekole (2017) and Eshete & Molla (2021), which have negative implications for long-term practices and perceived uses. Thus, learning opportunities may be lost because of the extinction of entire vegetation types or specific species that once supplied essential natural resources to local communities (Wassie *et al*. 2015; Chekole 2017). Therefore, the conservation of existing flora and ensuring the safety, efficacy, and quality of traditional medicine and its associated knowledge are crucial to widespread acceptance and its consistency as viable alternative healthcare in communities. Furthermore, the need for a centralized database for traditional plant medicine products is concerning. Such a database is valuable in documenting the healer's traditional knowledge and the healing potential of traditional medicinal plants for future references and research studies.

Association between perceived uses of medicinal plant knowledge and socio-demographic variables

The practices and perceived uses of traditional medicinal plant knowledge are well-appreciated among the studied ethnic groups. However, it was notable that age, gender, level of education, and marital status significantly influenced the perceived use of traditional medicinal plant knowledge. The respondents' age groups showed a significant difference in their perceived use of traditional plant medicine ($p = 0.0004$, Table 4). Comparatively, the perceived use of traditional knowledge was more widespread among older people across the ethnic groups studied. Middle-aged and older informants were 3.67 and 3.7 times more likely to perceive the uses of traditional medicinal plant knowledge, respectively, as compared to young informants (3.45). This infers a threat to the reduction of perceived uses of traditional knowledge through generations. According to different scholars' views, elderly individuals have a higher perceived use of traditional knowledge, which might be related to both cultural influences and long-lasting and direct contact with plant resources (Chekole *et al*. 2015; Demie *et al.* 2018; Logiel *et al*. 2021). Such conditions encourage the use of traditional medicinal plant knowledge in Uganda. Correspondingly, several ethnobotanical studies conducted elsewhere in the country revealed similar information: older individuals are better perceived and conscious of the uses of traditional knowledge compared to the younger generation (Lulekal *et al*. 2013; Chekole *et al*. 2015; Demie *et al*. 2018; Tefera & Kim 2019; Eshete & Molla 2021). Several studies conducted abroad revealed similar findings. For instance, Aina *et al*. (2020), Abdelmola *et al*. (2021), Logiel *et al*. (2021), Mutombo *et al*. (2022), and Shewamene *et al*. (2022) in Nigeria, Saudi Arabia, Uganda, DR Congo, and Australia, respectively. Hence, we concur with other studies and confirm that elderly individuals possess extensive knowledge and experience in the therapeutic characteristics of medicinal plants among the studied ethnic groups, surpassing younger respondents. On the other hand, local communities claim that younger generations are less interested in learning ethnomedicinal expertise and more exposed to contemporary education, resulting in migration for other occupations. This is attributed to the loss of indigenous and local ethnobotanical knowledge. Similar findings were reported elsewhere in the country (Lulekal *et al*. 2013; Chekole *et al*. 2015; Tefera & Kim 2019; Eshete & Molla 2021).

A significant difference was also observed between gender groups ($p = 0.0068$, Table 4). Male informants were 3.68 times more likely to perceive the use of traditional knowledge than female informants (3.52). The hypothesis of the relative dominance of men (Lulekal *et al*. 2013; Chekole 2015) in identifying and recognizing traditional medicinal plants may be related to the traditional flow of information along the male line in the country elsewhere. This is usually favored in the transfer of indigenous knowledge about traditional medicinal plants, which is supported by our finding of men's dominance in the perceived use of traditional medicinal plants compared to women in the studied ethnic groups. This could be because,

in our previous study (Tamene *et al*. 2024), a large percentage of medicinal plants (71%) were sourced from wild areas, where women might need to be more secure to go and collect from long distances. Similar studies conducted elsewhere also revealed similar findings. For instance, Demie *et al*. (2018), in their ethnobotanical investigation around the Dirre Sheikh Hussein heritage site in South-eastern Ethiopia, explained the same trends. Moreover, women in the studied ethnic groups (Gedeo, Oromo, and Sidama) are more engaged in-house activities, whereas men are more engaged in outdoor activities. Such as medicinal plant collection and other livelihood activities. Abroad, Moeng and Potgieter (2011) described the dominance of men in the perceived use of traditional knowledge on medicinal plants in South Africa. They revealed that men are generally more involved in the traditional medicinal plant collection and trade, which might be physically risky for women. Other scholars reflected contradictory results: women show greater perceived use and attachment to traditional knowledge related to medicinal plants as compared to men (Mutombo *et al*. 2022). Thus, the "secret" aspect of traditional knowledge would foster this attachment; permitting tasteful treatment of disorders associated with femininity and childcare.

As observed in this and earlier studies, the rate of perceived usage of traditional knowledge was influenced by the level of education (Aragaw *et al*. 2020; Chali *et al*. 2021; Mutombo *et al*. 2022). There was a significant ($p = 0.0452$, Table 4) difference between respondents' educational level and their perceived use of traditional medicinal plant knowledge. In comparison, the perceived use of traditional knowledge was more widespread among illiterate and primary education attendees across the studied ethnic groups (Table 4). Compared to primary education attendees, illiterate informants were 3.7 times more likely to perceive the uses of traditional medicinal plant knowledge; however, no significant difference was observed. Whereas, compared to secondary education attendees, illiterate participants are significantly different in their perceived uses of traditional knowledge (Table 4). This condition might be explained by a variation in the perception of traditional knowledge, which is irregularly influenced by school-based information elsewhere (Chali *et al*. 2021; Mutombo *et al*. 2022). The main observable impact is the decline of local cultural practices, through creating an intergenerational gap, and changing local community thoughts, particularly those of younger generations, local indigenous knowledge as inferior to information received via formal schooling (Logiel *et al*. 2021). Participants in the studied areas also claim that particularly local communities that attended secondary and tertiary education prefer modern health centers to traditional medicine. This is consistent with prior results in Sub-Saharan Africa, Cambodia, and Australia showing that herbal medicine usage is typically related to lower levels of schooling (James *et al*. 2018; Pearson *et al*. 2018; Shewamene *et al*. 2020). However, the findings of Nigussie *et al*. (2022) and Abdelmola *et al*. (2021) contradict our findings. They reported that a participant with a higher educational level was associated with a higher perceived use of traditional medicinal plants and had more knowledge and opportunities to take care of themselves than people with a lower level of education.

Marital status also identified major socio-demographic variables influencing the perceived use of traditional medicinal plant knowledge among ethnic groups ($p = 0.0167$, Table 4). Married community members were 3.63 times more likely to perceive the use of traditional medicinal plant knowledge as compared to those who were unmarried (3.48) and divorced (3.24). Other studies conducted in Ethiopia and abroad hypothesized that traditional plant knowledge users compared with non-users often reported being married (Mohamad *et al*. 2019; Aragaw *et al*. 2020; Chali *et al*. 2021; Logiel *et al*. 2021) in Malaysia, Ethiopia, and Uganda, respectively. During our survey, we also realized that the couple's background could influence the use of traditional knowledge among married people. Therefore, the background and effect of the spouse on the use of traditional medicinal plant knowledge reside in the influence of marital status on the perceived usage of traditional medicinal plant knowledge. The insight is that some conditions could be cured by traditional medicine only, family care, and the associated costs might be the reason to use traditional knowledge (Demie *et al*. 2018; James *et al.* 2018; Tefera & Kim 2019; Aragaw *et al*. 2020). The same is true in our study: the studied ethnic groups have profound knowledge of several ailments for which traditional medicinal plant knowledge is the only available treatment (Tamene *et al.* 2024). Rabies, snake venom, cancer, mental illness, and dizziness disease are a few examples. "Even if modern medicine is available, they will continue to use traditional medicinal plant knowledge because of its effectiveness and beliefs," informants claimed, and they firmly advised that if conventional treatment fails, traditional medication is the final alternative. Concerning ethnicity and religious groups, significant differences were not observed on perceived uses of traditional knowledge ($P > 0.05$, Table 4). This might be related to the deep-rooted culture of traditional medicnal plant knowledge practices among the studied ethnic groups and elsewhere in the country (Lulekal *et al*. 2013; Demie *et al*. 2018; Eshete & Molla 2021). Thus, we realized that ethnicity and religion are not barriers that affect the perceived use of traditional knowledge related to plants among ethnic groups in south-central Ethiopia; this finding is in line with Pearson *et al*. (2018) in Cambodia. Contrary to this, studies by Kideghesho & Msuya (2010), Arumugam (2019), and Aragaw *et al.* (2020) revealed a significant relationship between ethnicity, religion, and perceived use of traditional knowledge in Tanzania, Malaysia, and Ethiopia. This was associated with cultural variation and the small number of Muslim participants compared to Christian participants.

Conclusion

The practices and perceived uses of traditional knowledge of medicinal plants are considerable among the ethnic groups of Gedeo, Oromo, and Sidama. Effectiveness, accessibility, information sharing among families and relatives, and affordability were the most contributing factors for the preferences of traditional medicinal plant knowledge to treat a variety of human ailments and to the extensive use in the study areas. Thus, the medicinal plants use culture in the peri-urban area of south-central Ethiopia are essential and deep-rooted. However, misleading communication, absence of legality, natural resource degradation, education, and healers' secrecy were identified constraints that could disrupt the perception of the local community's traditional medicinal plant knowledge practices. As a result, for many people, the use of traditional knowledge appears to be illegal, and interest in it as an alternative remedy has diminished over time, particularly in younger generations. This flawed perspective leads to the irrational uses of medicinal plants and associated knowledge. Furthermore, our study confirms the perceived use of traditional medicinal plant knowledge was influenced by socio-demographic variables and in comparison, which is more widespread among older people, married couples, men , and low-grade attendees. These recalled the need for interventions from the government and stakeholders that are likely to introduce trust in practitioners and users. An accreditation system for healers and careful evaluation of traditional diagnosis and products were noted challenges. Therefore, establishing protocols, promoting traditional knowledge through public education, and gradually incorporating it into the official health system are mandatory.

Declarations

List of abbreviations: A - Agree; ANOVA - Analysis of variance; CSA - Central Statistical Agency; DA - Disagree; NAND - Neither agree nor disagree; RII - Relative importance index; SA - Strongly agree; SD - Strongly disagree.

Ethics approval and consent to participate: Written permission to conduct the research was obtained from the Sokoine University of Agriculture (SUA) Office of the Vice-Chancellor research committee (Ref. no. SUA/FSC/D/2020/0012/12, dated February 17, 2022), and the three chosen peri-urban area local government heads (Hawassa, Shashemene, and Dilla District) were given authorization for the field study and plant collection via an official letter (Ref No: D/Z/W/03-23/1031, dated: 23/03/2022, (R/T/T/O/303/2021, dated March 28, 2021). Before providing oral informed consent, study participants were given a brief explanation of the study's objectives. Each participant gave his or her free consent to take part in the study. Finally, all interviewees' private information was protected and kept private.

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Data and material availability: The data is only stored by authors**.**

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