Muvengwi and Maroyi
Journal of Ethnobiology and Ethnomedicine (2025) 21:55
https://doi.org/10.1186/s13002-025-00809-w

Journal of Ethnobiology
and Ethnomedicine

RESEARCH

Open Access

Traditional ecological knowledge and practices in Zimbabwe: medicinal ethnobotany and ethnozoology among communities in Chipinge district

Justice Muvengwi[1] and Alfred Maroyi[2*]

Abstract

Background Traditional medicine is integral to the culture of the Ndau ethnic group in Chipinge district, Zimbabwe. Traditional healers use a wide range of plant and animal products to treat various ailments, and there is need for documentation and sustainable practices to preserve these resources for future generations and pharmaceutical potential. This study was aimed at documenting the medicinal ethnobotanical and ethnozoological knowledge of traditional healers in Chipinge, identify the species used, and assess the role of traditional healing practices in supporting healers' livelihoods.

Methods Between December 2018 and March 2019, data were collected from 22 traditional healers using semi-structured questionnaires focusing on medicinal species, their uses, harvesting or collection methods, and their socioeconomic impacts. Plant voucher specimens were identified at the National Herbarium of Zimbabwe (SRGH) in Harare, and identities of animal species were confirmed by participants through use of images in the Mammals of Southern Africa field guide. Informant consensus factor (ICF) and use reports (Nur) were calculated to assess agreement among healers.

Results Majority of participants (73.0%) attributed their knowledge to ancestral callings, while 27.0% had received mentorship. A total of 63 plant species from 31 families were documented, with roots (38.0%) and bark (33.0%) being the most commonly used parts. Of the ten vertebrate species reported, nine were mammals and one was a reptile. Ninety-five percent of the healers reported the local unavailability of some medicinal plant species. For plant-based remedies, the highest ICF (0.67) was recorded for AIDS-related infections and ulcers, while STDs had the most use reports (87). For animal-based treatments, AIDS had the highest ICF (0.8), followed by STDs (0.6), which also had the most use reports (11). The high use of traditional remedies for STDs and AIDS may reflect issues of stigma, accessibility, and trust in conventional health care, underscoring the need for culturally sensitive health education and integrated care approaches. Monthly incomes ranged from US$150 to US$600, with most clients coming from low-income local communities.

Conclusion This study highlights the rich ethnopharmacological knowledge in Chipinge while underscoring challenges such as overharvesting and socioeconomic vulnerability. Sustainable harvesting and formal recognition

*Correspondence:
Alfred Maroyi
amaroyi@ufh.ac.za
Full list of author information is available at the end of the article

of healers through national bodies like the Zimbabwe National Traditional Healers Association (ZINATHA) are essential steps toward integrating traditional medicine into modern health care and preserving this vital cultural heritage.

Keywords Ethnopharmacology, Ethnozoology, Medicinal plants, Traditional healers, Traditional medicine, Zimbabwe

Background

Traditional healers play a crucial and often underappreciated role in addressing healthcare needs within communities, particularly in the prevention, control, and treatment of various health conditions [1]. Their role is increasingly acknowledged by international bodies such as the World Health Organization [2]. According to the WHO's "Traditional Medicine Strategy 2014–2023," there is a pressing need for national healthcare systems to integrate and collaborate with traditional healers to enhance healthcare delivery, especially in regions where access to conventional medical services is limited [2]. This strategy underscores the importance of leveraging traditional knowledge systems to complement and support biomedical approaches.

The epidemiological situation in Chipinge district, Zimbabwe, is marked by a high prevalence of diseases such as HIV/AIDS and other sexually transmitted infections (STIs) [3, 4], which is compounded by limited access to modern healthcare facilities [5, 6]. With only one referral hospital, three mission hospitals, and 14 under-resourced clinics serving a population of over 375,000, many residents rely heavily on traditional healers for primary healthcare needs [5]. The lack of adequate medical infrastructure and the high cost of biomedical treatments make traditional healers the first point of contact for a significant portion of the population in Chipinge district [5, 6]. Chipinge district's healthcare context is shaped by broader national challenges, as highlighted in the Zimbabwe National Health Strategy 2016–2020 [7]. During the economic hardship period, particularly from 2000 to 2008, the delivery of health services significantly deteriorated, with some improvements observed only after the economic recovery that began in 2009 [8]. Despite this, the health sector remains underfunded and largely dependent on external support [8]. Although key health indicators such as life expectancy and maternal mortality have shown progress [8], the availability of healthcare facilities and essential services in rural areas like Chipinge remains inadequate. The Zimbabwe Service Availability and Readiness Assessment (ZSARA) report of 2015 highlights that Manicaland province, where Chipinge is located, has a facility density of only 1.7 per 10,000 population, below the ZSARA benchmark of at least two facilities [9]. The economic challenges have led to a severe shortage of medical supplies, further limiting the effectiveness of modern healthcare facilities in the region [5, 6]. As a result, traditional healers play a crucial role in health care, not only due to cultural practices but also because of the limited availability and accessibility of formal healthcare services.

Studies support the formal integration of traditional medicine into national health systems, recognizing the critical role traditional practitioners play in healthcare delivery particularly in rural and underserved areas where biomedical services may be limited [10, 11]. For instance, research has shown that in certain African regions, traditional healers are the first point of contact for up to 80% of the population seeking health care [11, 12]. These practitioners not only offer culturally relevant and accessible care [10] but also contribute significantly to public health by addressing a range of ailments using locally sourced medicinal plants and knowledge passed down through generations [2]. Further statistics in sub-Saharan Africa indicate that the ratio of traditional healers to the population is approximately 1:500, compared to the starkly lower doctor-to-patient ratio of 1:40,000 [13]. In the context of Zimbabwe doctor-to-patient ratio is estimated to be ~ 5000 to 10,000, compared with the WHO recommended of 1:1000 [5, 6, 14]. This disparity underscores the reliance on traditional healers, particularly in rural areas where access to biomedical health care is limited. These figures highlight the critical need to integrate traditional healers into formal healthcare systems, ensuring that they complement the work of medical doctors and enhance overall healthcare delivery.

Ethnobotanical surveys are well-documented in the literature, providing extensive inventories of plant species used for medicinal purposes across various communities [10, 15–22]. The people of Chipinge district, who speak the Ndau dialect, have a rich history of utilizing medicinal plants. A study by Ngaruvhume et al. [23] focusing on the use of medicinal plants for malaria treatment highlighted the extensive medicinal knowledge within the community. The study also underscored the critical role that traditional healers continue to play in providing health care in this rural landscape. However, ethnozoological studies, those focusing on the medicinal use of animals and their products, are comparatively rare [24, 25]. This research fills a critical gap by integrating both ethnobotanical and ethnozoological approaches, targeting traditional healers who possess the most comprehensive knowledge of medicinal practices. This study is grounded in the cultural ecosystem services theory, which posits that traditional ecological knowledge and practices contribute significantly to human well-being and cultural identity [26–28]. In the context of Chipinge district, this theory provides a valuable framework for understanding how traditional healing practices function not only as a form of healthcare delivery but also as expressions of cultural heritage, spiritual connection, and community resilience. Traditional healers are custodians of this biocultural knowledge, using plant and animal resources in ways that reflect and reinforce cultural norms, beliefs, and values. By documenting and analyzing these practices, the study contributes to a deeper understanding of how cultural ecosystem services support both physical health and intangible cultural well-being. This theoretical approach also underscores the importance of conserving the biodiversity on which these services depend, as the erosion of ecological resources would lead to a parallel loss of cultural identity and healing capacity. The study hypothesizes that traditional healers in Chipinge district play an indispensable role in local healthcare systems by providing culturally relevant, accessible, and sustainable medical solutions that bridge the gaps left by formal healthcare services.

Despite the recognized importance of traditional healers in Chipinge district, there remains a significant gap in our understanding of the extent and nature of their contributions to health care. These practitioners not only provide culturally relevant care but also play a pivotal role in filling the healthcare void left by the inadequacies of the formal medical system. However, the specific dynamics of their practices, including the plants and animals they use, the socioeconomic aspects of their work, and the sustainability of their resource sourcing, are poorly documented. To fully appreciate and support the role of traditional healers, it is crucial to systematically explore these dimensions, thereby enabling a more integrated approach to health care in the district. Therefore, this study seeks to achieve the following objectives:

1. Assess the patient engagement levels of traditional healers, including the average number of consultations they handle monthly.
2. Investigate the sources and transmission of medicinal knowledge among traditional healers in Chipinge district.
3. Analyze the economic contributions of traditional healing practices, focusing on the average monthly income of healers.
4. Evaluate the sourcing practices of medicinal plants and animals, with an emphasis on sustainability and conservation.
5. Document the diversity of plants and animals used in traditional medicine and determine the level of consensus among healers regarding their use.

Materials and methods

Study area

The study was conducted in the Chipinge district, located in the southeastern part of Zimbabwe (Fig. 1). The sampled villages lie at low altitudes, ranging between 434 and 567 m above sea level (a.s.l.). The area receives an average annual rainfall of 553 mm, with maximum temperatures exceeding 40 °C during the summer months from August to February, and mean monthly temperatures above 21 °C. The region is predominantly characterized by various types of wooded grasslands and bushlands [29], with a generally flat terrain that is prone to flooding, especially Tongogara and Chibuwe (Fig. 1). Common tree species in the area include *Adansonia digitata* L., *Vachellia nilotica* (L.) P.J.H.Hurter & Mabb., *Senegalia nigrescens* (Oliv.) P.J.H.Hurter, and *Colophospermum mopane* (J.Kirk ex Benth.) J.Kirk ex J.Léonard [30, 31]. The soils are largely alluvial, particularly in areas adjacent to the Save River [29]. The local grass species include *Eragrostis cylindriflora* Hochst., *Digitaria eriantha* Steud., *Oropetium capense* Stapf, *Aristida adscensionis* L., *Urochloa trichopus* (Hochst.) Stapf, and *Aristida rhiniochloa* Hochst. [29]. Chipinge district is part of Manicaland province and is predominantly inhabited by the Ndau ethnic group, with Ndau, a dialect of Shona, being the primary language spoken. Subsistence farming is the main livelihood for the community, with small grains such as finger millet (*Eleusine coracana* (L.) Gaertn., millet (*Cenchrus americanus* (L.) Morrone, and sorghum (*Sorghum bicolor* (L.) Moench being the most commonly cultivated crops. Maize (*Zea mays* L.) is more popular among farmers along the Save River, where irrigation infrastructure is available. According to the 2022 national census, the human population density in the district is estimated at 62 people per square kilometer. The district has human population of over 350,000 [5]. The Ndau people are well known for their strong traditional beliefs and reliance on medicinal plants for primary health care [23].

Questionnaire survey

Data were collected between December 2018 and March of 2019 using a semi-structured questionnaire. The questionnaire was designed to cover key themes, including the types of plants and animals used in treatments must be the same as those used in traditional medicine, the season of harvesting, the animal or plant parts utilized, the number of patients treated weekly, and the income generated from these treatments. The ethnobotanical and

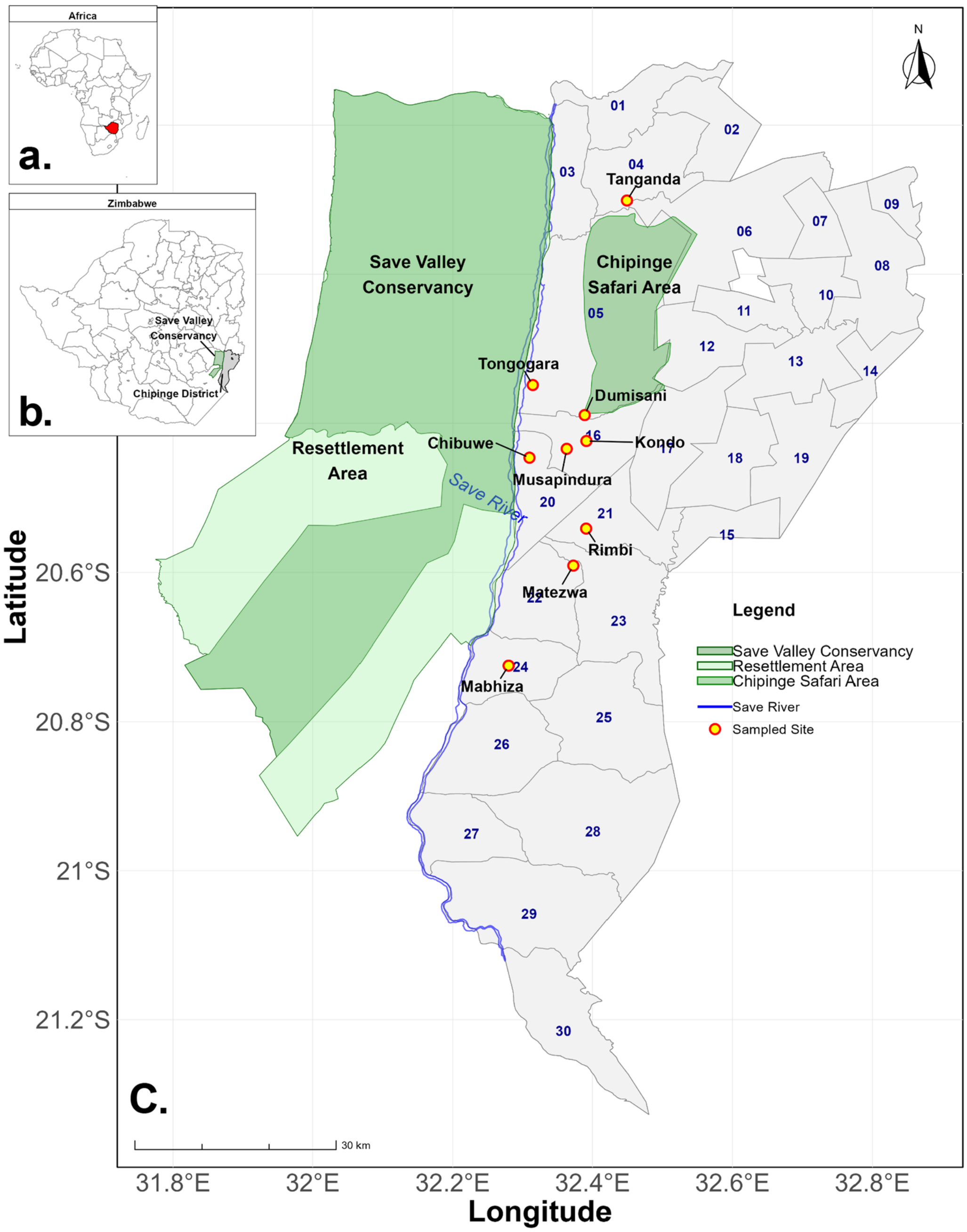

Fig. 1 **a** Inset map of Africa showing the location of Zimbabwe, **b** inset map of Zimbabwe indicating the position of Chipinge district and Save Valley Conservancy and **c** enlarged map of Chipinge district showing traditional healer sampling sites, ward boundaries (blue numbers indicate ward designations) and two conservation areas. In Zimbabwe, a ward is the smallest administrative and political unit, typically comprising several villages or urban neighborhoods and functions under a Rural District Council (RDC) in rural areas or an Urban Council in towns and cities

ethnozoological data were gathered from 22 purposively sampled participants in the district using snowball sampling technique [32]. To diversify recruitment and ensure legitimacy, additional names were obtained through consultations with local authorities, including the Headman and several village heads, who helped identify reputable and active practitioners. This combined approach helped enhance trust and broaden the scope of participant inclusion. Importantly, no payments or financial incentives were offered to participants for their involvement in the study. While traditional healers often charge clients for services and may earn income from their practices, none of the participants requested payment for participating in the research. Their willingness to contribute appears to have been motivated by interest in the research topic, recognition from community leaders, and the perceived value of documenting indigenous knowledge. All participating traditional healers were thoroughly briefed on the study's objectives, and informed consent was obtained before the interviews commenced. The questionnaire was administered in the local language, Chindau. Identifying the animals used in traditional medicine was relatively straightforward, as vernacular names and descriptions often corresponded with commonly known terms [33]. To confirm the identification of specific animal species referenced by the traditional healers, we utilized photographic plates from a field guide [34, 35]. For plant species, we compiled a comprehensive list of species used by each healer, along with their associated medicinal uses. Following this, we accompanied the traditional healers to nearby habitats of the species to collect voucher specimens. These specimens were subsequently identified by plant taxonomists at the National Herbarium of Zimbabwe (SRGH) in Harare. This process ensured accurate species identification and documentation, which are critical for ethnobiology and ethnomedicine research as highlighted in the ethical guidelines of the International Society of Ethnobiology (www.ethnobiology.net). These voucher specimens included essential plant parts such as leaves, stems, flowers, and fruits, where available [10]. Photographic documentation was used to aid species identification, with traditional healers identifying animals from illustrated field guides [35]. In most cases, this approach enabled reliable identification. When uncertainty remained, researchers photographed the animal parts or products in question; these images were later verified by taxonomists or compared with reference specimens housed in university collections. Ethical approval for the study was obtained from the headmen of the respective communities, following a process similar to that described by Ngarivhume et al. [23].

Data analysis

Descriptive data were analyzed as percentages. The informant consensus factor (ICF), developed by Trotter and Logan [36], is calculated using the formula: $ICF = (N_{ur} - N_t)/(N_{ur} - 1)$. For the diseases categories, $\boldsymbol{N_{ur}}$ represents the number of use reports by informants for a specific illness category, while $\boldsymbol{N_t}$ refers to the number of taxa used for that illness by all informants. For the plant and animal species, $\boldsymbol{N_{ur}}$ represents total use reports for the species and $\boldsymbol{N_t}$ represents number of unique categories associated with the species. The ICF indicates the level of agreement among informants, ranging from 0 to 1, with higher values reflecting greater consensus. This suggests a cultural coherence in the selection of medicinal plants, highlighting their perceived effectiveness in treating particular ailments [37–40]. Indices were calculated using the R package ethonobotanyR [41]. The informant consensus factor values were calculated exclusively for categories and species with a minimum of four use reports ($\boldsymbol{N_{ur}} \geq 4$). This threshold was set to minimize the risk of inflated ICF values resulting from limited sample sizes. The use reports (UR_s) are a common measure in ethnobiology and ethnomedicine that quantify the number of times a specific species (*s*) is mentioned for a particular use category (*u*) by different informants (i). The formula to calculate the total number of UR_s for a given species is:

$$UR_s = \sum_{u=1}^{uNC} \sum_{i=1}^{iN} UR_{ui}$$

where

- UR_s is the use report for species *s*.
- UR_{ui} represents the use report for each informant *i* within each use category *u* for species *s*.
- *uNC* is the total number of use categories for the species.
- *iN* is the total number of informants who reported uses for the species.

Some of the data were analyzed using descriptive statistics, such as percentages and rankings, to summarize key findings. To explore the relationships between medicinal plants, animals, and the diseases they were used to treat, chord diagrams were employed in R. Chord diagrams are particularly valuable in this context as they visually represent the connections between different species and the ailments they address. This method allows for the simultaneous visualization of multiple relationships, showing not only which diseases are treated by a single species but also highlighting the variety of ailments that a traditional healer may report treating. The use of chord diagrams thus provided a comprehensive and intuitive way to illustrate the complex interactions between traditional remedies and health conditions, enhancing the overall analysis and interpretation of the data.

Results and discussion

Sociodemographic characteristics

About 81.8% of the traditional healers were male while 18.2% were female (Table 1). Several other studies focusing on traditional healers have shown this sex biased gender [23, 42–44]. Most healers (90.9%) were married (Table 1). Marital status was documented as it represents a marker of stability and maturity in traditional

Table 1 Sociodemographic characteristics of traditional healers from Chipinge district, Zimbabwe

Characteristics	Frequency	Percentage (%)
Sex		
Male	18	81.8
Female	4	18.2
Age group		
21–30 years	2	9.1
31–40 years	5	2.7
41–50 years	4	18.2
> 50 years	11	50.0
Marital status		
Married	20	90.9
Not married	2	9.1
Religion		
Traditional	22	100.0
Ethnicity		
Ndau	22	100.0
Occupation		
Subisistence farmer	22	100.0
Healer	22	100.0
Source of traditional knowledge		
Taught by family members	6	27.3
Ancestral	16	72.7
Education		
Primary	12	54.5
Secondary	6	27.3
Tertiary	3	13.6
No education	1	4.5

healing practice [45], while also serving as an important social institution that strengthens healers' positions as respected community leaders and facilitates the intergenerational transmission of healing knowledge [46]. Of the 22 traditional healers interviewed, only nine confirmed the use of both animal and plant products in their healing practices. All the healers interviewed regarded their occupation as traditional healing practice and subsistence farming. Considering that most healers were married, traditional healing and agriculture become their sources of livelihoods. Approximately 50.0% of the traditional healers interviewed were over 50 years old, with the smallest proportion in the youngest age group of 21 to 30 years (Table 1). This trend of increasing numbers of traditional healers with age has also been observed in other regions, such as Mali [47], South Africa [48], and Zambia [12].

Patient engagement

The estimated number of individuals consulting traditional healers ranged from 100 to 250 per month, with a median of 110 patients. For the 22 traditional healers interviewed, this translates to approximately 2420 patients assisted monthly based on the median value. Notably, the number of patients treated by a single traditional healer per month exceeded those consulting a traditional healer in South Africa which ranged between 15 and 30 patients per month [48] The South African study attributed the low number of people consulting traditional healers to several factors, including the abundance of traditional healers, favoritism within communities, and the increased availability of clinics and hospitals [48]. In contrast, a study in Tanzania found that a single traditional healer could be consulted by as many as up to 200 people per week, significantly higher than the figures reported in this study [49]. Given the limitations of Zimbabwe's modern healthcare system [5, 6, 8], the integration of traditional healers into the healthcare framework becomes increasingly essential [2].

Healing knowledge

Seventy-three percent of traditional healers reported that their healing abilities stemmed from an ancestral calling (a culturally embedded belief that individuals are chosen by ancestral spirits, typically deceased relatives or lineage spirits to become traditional healers. This calling often manifests through illness, dreams, or visions, prompting the individual to undergo initiation and training under an established healer [50]), while 27% indicated that they were taught how to harvest and use herbs and animal products. This distinction between traditional healers, categorized as either herbalists (who rely on learned knowledge) or diviners (who draw upon ancestral guidance), has been similarly observed in Zambia [48, 51]. The reliance on divine guidance for selecting species to treat ailments presents challenges in developing new drugs based on traditional healer surveys. Additionally, traditional healers commonly administer remedies as concoctions involving two or more species, complicating the integration of traditional medicine into modern pharmaceuticals [52, 53]. While traditional healers may keep their knowledge within families, preserving this knowledge is crucial for society as a whole. Despite the challenges posed by the secrecy of their practices, the cultural and medicinal value of their expertise remains significant, underscoring the importance of safeguarding this knowledge for future generations.

Healer income

Financially, traditional healers earned between US$150 and US$600 per month, with a median income of US$225. This income range is significantly lower than that reported in neighboring South Africa, where traditional healers reportedly earned around US$2,000 per month [54]. The healers attributed their lower earnings to the fact that 95% of their patients were from local communities who often could not afford their fees. As a result, healers frequently provided their services at reduced rates or even for free, driven by moral obligations. The economic disparity between Zimbabwe and South Africa also allows South African healers to charge higher fees. Gross domestic product per capita is more than three times for South Africa when compared with Zimbabwe [55]. However, the income for these traditional healers in this study is within the range that healers in Brazil were earning per month [21]. Therefore, the contribution of traditional medicinal practices to the livelihoods of healers should not be overlooked.

Resource sourcing

A total of 63 plant species were recorded from 31 families. Ninety-five percent of traditional healers reported that medicinal trees were no longer available in their local communities, forcing them to harvest from protected areas such as the Save Valley Conservancy (SVC), Chipinge Safari Area (Fig. 1), and neighboring Mozambique. This highlights the urgent need for sustainable harvesting practices and the registration of all traditional healers under the Zimbabwe National Traditional Healers Association (ZINATHA), as the majority are currently unregistered. Registration through ZINATHA enables better regulation, promotes adherence to ethical and sustainable harvesting guidelines, and allows for training and monitoring aimed at conserving medicinal plant and animal resources. The healers also noted a noticeable decline in several species they traditionally harvested. The lack of standardized harvesting practices exacerbates this issue, as different healers harvest various parts of the same plant (Fig. 2). Similar to this study, 86% of traditional healers in South Africa reported a decline in the availability of medicinal plants in their harvesting areas [23]. For those using animal products, their sources are often hunters (poachers) who illegally obtain animals from nearby protected areas [56]. Traditional healers mostly used trees in their treatment an observation which is similar to other several studies [10, 18, 23, 57]. Most medicinal plant products used by traditional healers in Chipinge came from different plant parts, with roots contributing 35%, bark 34%, leaves 22%, and stems and ground fruit only 9% (Fig. 2). Although other studies conducted in various landscapes of Zimbabwe support the findings of this study [10, 18, 23], a study in south-western Ghana a region with a wet rainforest climate reported that healers predominantly used leaves [55]. This difference may be attributed to ecological variation, as Zimbabwe's drier savanna woodlands experience seasonal leaf loss during the dry season, potentially limiting the availability and use of leaves. Majority of traditional healers mentioned that they harvest some of their plant products from nearby protected areas, including Save Valley Conservancy and Chipinge Safari Area (Fig. 1).

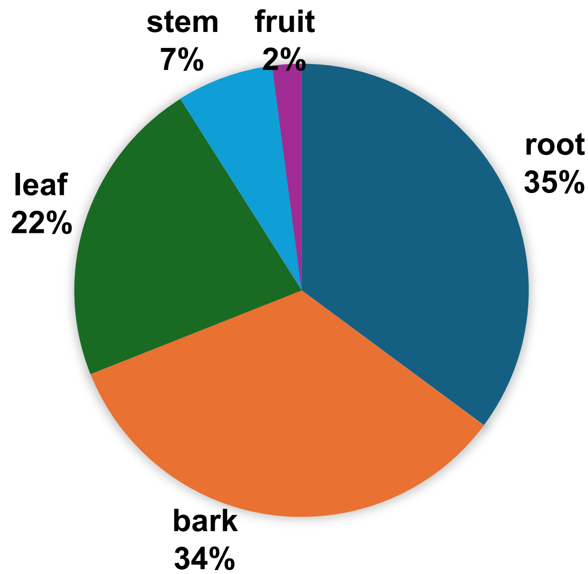

Fig. 2 Proportional percent of use of different plant parts, bark, fruit, leaf, root, and stem by traditional healers in Chipinge district, Zimbabwe

Table 2 Quantitative analysis of medicinal plant use across nine disease categories which had treated by 22 traditional healers interviewed in Chipinge district, Zimbabwe

Use categories	N_{ur}	N_t	ICF
AIDS	16	6	0.67
Fever	30	14	0.55
STDs	87	40	0.56
Aphrodisiac	17	11	0.38
TB	32	22	0.32
Ulcers	25	9	0.67
Childbirth	22	10	0.57
Stomachache	10	7	0.33

Ethnobotanical and ethnozoological practices

The informant consensus factor (ICF) for diseases treated by traditional healers using medicinal plants was notably higher for AIDS and ulcers, both at 0.67 (Table 2). In contrast, back pain had an ICF of zero. Overall, the ICF values for these traditional healers were generally low, potentially due to the secrecy among healers and the fact that many diseases were treated with concoctions of multiple medicinal plants (Fig. 3, Table 3). When responding, healers may have mentioned what they considered the

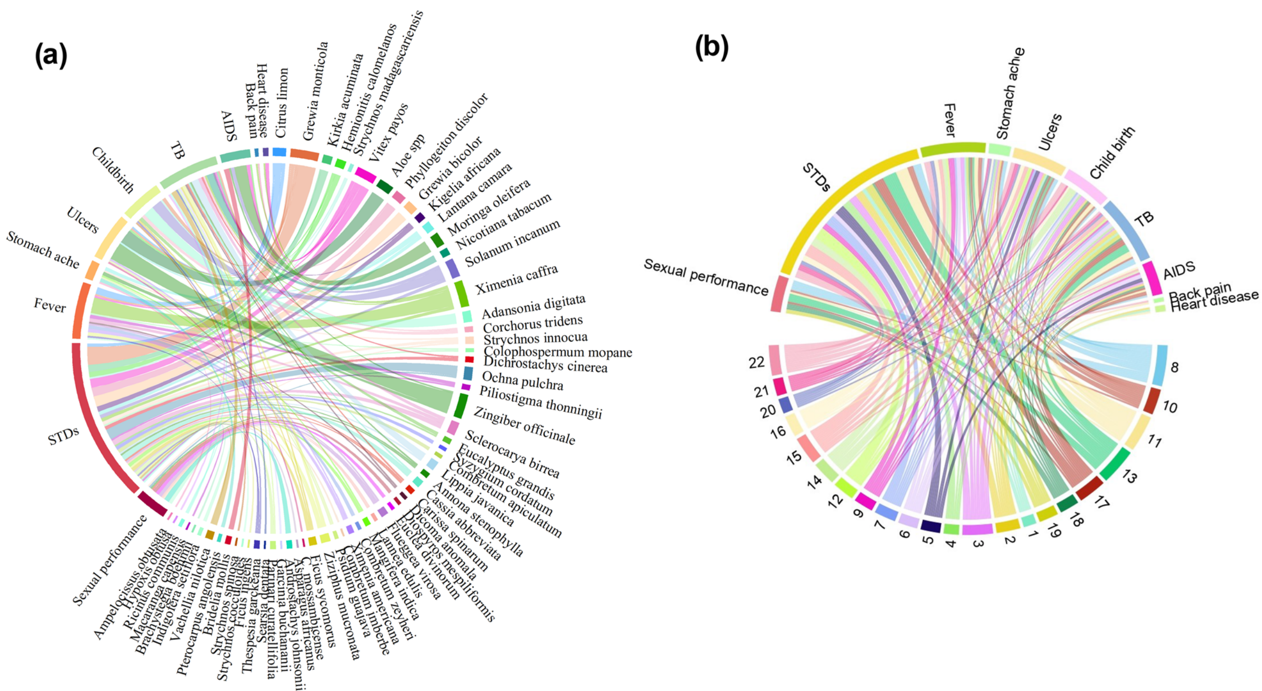

Fig. 3 Chord diagrams for the relationships between each plant species and the different diseases that it is used to treat (**a**) and the relationship between each traditional healer and the diseases that they treat using plant products (**b**). *Note*: uses reported by traditional healers like childbirth support and luck fall outside the conventional disease framework

primary plant in the mixture, leading to lower ICF values. The average ICF across all disease categories for the interviewed traditional healers in Chipinge district was 0.45, significantly lower than the 0.75 reported in a study conducted among traditional healers in the Oshikoto region of Namibia [58]. However, the ICF values we obtained are comparable to those reported in other countries in Africa, for example, in Algeria [59, 60]. The highest number of use reports ($N_{ur} = 87$) was recorded for STDs, with a large number of taxa ($N_t = 40$) used to treat these conditions (Table 2). The high number of plant species used to treat sexually transmitted infections (STIs) in this study reflects the widespread reliance on traditional medicine for managing reproductive health issues in many rural communities [61, 62]. Several factors contribute to this trend. First, there is often limited access to modern healthcare facilities in remote areas such as Chipinge, with long distances to clinics, high consultation fees, and stockouts of essential drugs acting as significant barriers to biomedical treatment [63]. Second, stigma associated with STIs may discourage individuals from seeking care in formal health settings, prompting them to consult traditional healers who offer a more private and culturally familiar environment [64, 65]. Third, many people believe in the efficacy of herbal remedies, particularly for conditions perceived to have both physical and spiritual components, which is often the case with STIs in African traditional belief systems [66]. Thus, the preference for herbal medicine in treating STIs is shaped by a combination of healthcare accessibility, sociocultural perceptions, and trust in indigenous knowledge systems.

Indeed, all the interviewed traditional healers treated STDs, which could have also led to a high N_t (Fig. 3, Table 2). This aligns with country statistics, which indicate an HIV prevalence rate of 14.6% in Zimbabwe, where sexual intercourse is the predominant mode of transmission for both HIV and STDs [67–69]. These statistics support the observed high values of N_{ur}, N_t, and ICF for STDs.

Although the number of taxa and use reports for AIDS were not particularly high, AIDS still had the highest ICF values (Table 2). The top medicinal plants with the highest use reports were *Ximenia caffra* Sond. (14), *Grewia monticola* Sond. (13), *Zingiber officinale* Roscoe (13), *Vitex payos* (Lour.) Merr. (11), and *Solanum incanum* L. (10) (Table 3). Tuberculosis (TB) and fever were the other two diseases that most traditional healers treated. Since TB and fever are usually opportunistic infections for people living with HIV, this might explain why most healers were also treating these diseases.

Some medicinal plant species exhibited high informant consensus factor (ICF) values, highlighting their

Table 3 Medicinal plants, their use categories, and use reports by traditional healers in Chipinge district, Zimbabwe. tCD is the total number of use categories, tUR is the total number of use reports and ICF is the informant consensus factor. Plants with a (–) under the ICF column had tUR < 4 and were not considered for ICF

Family	Growth form	Voucher number	Botanical name (* = cultivated plants)	Common names (E = English, S = Shona	Medicinal uses	Use in Zimbabwe and other countries	Healers' opinion about availability of species	Plant part used	tCD	tUR	ICF	Biological activities
Anacardiaceae	Tree	CHP21	*Lannea edulis* (Sond.) Engl	Mutsambatsi (S), wild grape (E)	STDs (1), sexual performance (1)	STDs [10, 73, 74]	Less available	Root, bark	2	2	–	Antimicrobial, antimalarial and antioxidant [75]
	Tree	CHP18	**Mangifera indica* L	Mango (E)	STDs (2), stomach ache (1)	Diarrhoea and dysentery [10.18]	–	Root, bark	2	3	–	Antidiabetic and antimicrobial [70]
	Tree	CHP33	*Sclerocarya birrea* (A.Rich.) Hochst	Marula (E), mupfura (S)	STDs (3), fever (2), TB (2)	Fever [71]	Common	Root, bark, leaf	3	7	0.67	Antidiabetic, anti-inflammatory [72, 76], antiparasitic and antimicrobial [77]
	Tree	CHP42	*Searsia dentata* (Thunb.) F.A.Barkley	Nana-berry (E)	TB (1)	Mucus on lungs [78]	Common	Root, bark	1	1	–	Anticonvulsant [79]
Annonaceae	Shrub	CHP44	*Annona stenophylla* Engl. & Diels	Dwarf custard-apple (E)	STDs (1), sexual performance (1), TB (1)	Gonorrhoea and syphilis [10, 18, 80]	Less available	Root, bark, leaf	3	3	–	Antioxidant and antimicrobial [81]
Apocynaceae	Shrub	CHP43	*Carissa spinarum* L	Conkerberry (E), mumbambara (S)	STDs (1), sexual performance (1), TB (1)	TB [71, 82]	Common	Root, bark	3	3	–	Anticonvulsant [83]
Asparagaceae	Shrub	CHP45	*Asparagus africanus* Lam	Bush asparagus (E)	STDs (1), childbirth (1)	Dilate birth carnal [10], childbirth [84]	Common	Bark	1	1	–	Anti-inflammatory [85]
Asphodelaceae	Herb	CHP01	*Aloe* spp.	Gavakava (S)	Ulcers (8)	Constipation [18, 50]	Common	Root, leaf, stem, fruits	1	8	1	–
Asteraceae	Herb	CHP08	*Dicoma anomala* Sond	Chifumuro (S)	Fever (1), TB (1)	Panecea [10, 18]	Less available	Leaf, bark	2	2	–	Analgesic and anti-inflammatory [86]
Bignoniaceae	Tree	CHP02	*Kigelia africana* (Lam.) Benth	Mubveve (S), sausage tree (E)	STDs (3), TB (1), sexual performance (1)	Respiratory infections [87], aphrodisiac [88]	Less available	Root, bark	3	5	0.67	Anti-inflammatory [89], antioxidant and anticancer [90]
Chrysobalanaceae	Tree	CHP03	*Parinari curatellifolia* Planch. ex Benth	Mobola plum (E), muchakata (S)	STDs (2), TB (1), ulcers	Constipation [18, 80]	Common	Root, bark, fruit	2	3	–	Antimicrobial [91] and anti-inflammatory [92]
Clusiaceae	Tree	CHP22	*Garcinia buchananii* Baker	Granite garcinia (E), mutunduru (S)	TB (1), sexual performance (1)	Aphrodisiac [18, 80, 93]	Common	Bark	2	1	–	Antioxidative [94] and anti-diarrheal [95]

Table 3 (continued)

Family	Growth form	Voucher number	Botanical name (* = cultivated plants)	Common names (E = English, S = Shona	Medicinal uses	Use in Zimbabwe and other countries	Healers' opinion about availability of species	Plant part used	tCD	tUR	ICF	Biological activities
Combretaceae	Tree	CHP24	*Combretum apiculatum* Sond	Mubhondo (S)	STDs (2)	Syphilis [96]	Common	Root, bark	1	2	–	Anti-inflammatory and anthelmintic [96]
	Tree	CHP23	*Combretum imberbe* Wawra	Mutsviri (S), leadwood (E)	Sexual performance (1)	Infertility [96]	Common	Bark	1	1	–	Antischistosomic and anti-inflammatory [96, 97]
	Tree	CHP04	*Combretum mossambicense* (Klotzsch) Engl	Knobbly bushwillow (E), mubondorokoto (S)	Ulcers (1)	Abdominal pains [96]	Common	Root, bark	1	1	–	Anti-inflammatory and anthelmintic [96]
	Tree	CHP05	*Combretum zeyheri* Sond	Large-fruited bushwillow (E), mupemberekono (S)	Fever (2),	Fever [96]	Common	Root, leaf	1	2	–	Anti-inflammatory and anthelmintic [96]
Ebenaceae	Tree	CHP06	*Diospyros mespiliformis* Hochst. ex A.DC	Jackal-berry (E), mushumha (S)	Sexual performance (2), STDs (1)	STIs [98]	Common	Root, bark	2	2	–	Antimicrobial, antiproliferative, antiparasitic, antioxidant, anti-inflammatory and antiviral [99]
	Shrub	CHP07	*Euclea divinorum* Hiern	Mushangura (S), diamond-leaved euclea (E)	STDs (2)	Gonorrhoea [100]	Common	Bark, leaf	1	2	–	Antimicrobial [101] and antioxidant [98]
Euphorbiaceae	Tree	CHP10	*Macaranga capensis* (Baill.) Benth. ex Sim	Mufukusha (S), river macaranga (E)	Sexual performance (1)	Aphrodisiac [93], male impotence [102]	Common	Root, bark	1	1	–	Antibacterial [102, 103]
	Herb	CHP11	**Ricinus communis* L	Castor-oil plant (E)	STDs (1), TB (1)	Venereal diseases [104]	–	Root, leaf	2	2	–	Anti-inflammatory, antiarthritic [105, 106], antioxidant, anti-inflammatory and antimicrobial [107]
Fabaceae	Tree	CHP19	*Colophospermum mopane* (J.Kirk ex Benth.) J.Kirk ex J.Léonard	Mopane (E), musharu (S)	STDs (1), fever (1)	Syphilis [108]	Common	Root, bark	2	2	–	Antimicrobial, anti-inflammatory and antioxidant [108]
	Herb	CHP20	*Indigofera setiflora* Baker	–	Sexual performance (2)	–	Common	Root	1	2	–	–
	Tree	CHP12	*Pterocarpus angolensis* DC	Bloodwood (E), mubvamaropa (S)	Stomach pain (2)	Menorrhagia [18, 80]	Less available	Root, bark	1	2	–	Antibacterial [109]

Table 3 (continued)

Family	Growth form	Voucher number	Botanical name (* = cultivated plants)	Common names (E = English, S = Shona	Medicinal uses	Use in Zimbabwe and other countries	Healers' opinion about availability of species	Plant part used	tCD	tUR	ICF	Biological activities
	Tree	CHP13	*Vachellia nilotica* (L.) P.J.H.Hurter & Mabb	Muwunga (S), sweet thorn (E)	STDs (1), TB (3)	Gonorrhoea and syphilis [10, 71, 93]	Common	Root, bark, leaf	2	4	0.67	Antibacterial, antifungal, antimycobacterial and antioxidant [110]
	Tree	CHP14	*Brachystegia boehmii* Taub	Mfuti (S), mufuti (E)	STDs (1)	STI [10]	Common	Bark, leaf	1	1	–	Antibacterial and antimicrobial [111]
	Tree	CHP15	*Cassia abbreviata* Oliv	Long-tail cassia (E), murember-embe (S)	STDs (3), TB (1)	Syphilis and gonorrhoea [10, 112]	Less available	Root, leaf	2	4	0.67	Antioxidant [112], antibacterial [113] and antiviral [114]
	Tree	CHP16	*Dichrostachys cinerea* (L.) Wight & Arn	Mupangara (S), sickle bush (E)	STDs (2), TB (1)	STIs [115]	Common	Root, bark, leaf	2	3	–	Antibacterial, antifungal and antioxidant [115]
	Tree	CHP17	*Piliostigma thonningii* (Schumach.) Milne-Redh	Monkey bread (E), musekesa (S)	STDs (1), TB (2)	Bronchitis [116]	Common	Root, bark, leaf	2	3	–	Antibacterial, antifungal and antioxidant [117]
Hypoxidaceae	Herb	CHP25	*Hypoxis obtusa* Burch. ex Ker Gawl	African potato (E)	TB (1), stomach ache	Stomach ache [118]	Rare	Leaf	2	1	–	Antioxidants, anti-inflammatory, anti-diabetics and anti-convulsant [119]
Kirkiaceae	Tree	CHP26	*Kirkia acuminata* Oliv	Mubvumira (S), white seringa (E)	STDs (4), fever (1)	Fever [120, 121]	Less available	Root, bark, leaf	2	5	0.75	Antibacterial [121, 122]
Lamiaceae	Tree	CHP27	*Vitex payos* (Lour.) Merr	Chocolate berry (E), mutsubvu (S)	STDs (5), fever (1), TB (1), AIDS (2), heart disease (2)	Cough [10]	Common	Root, bark, stem	5	11	0.63	Antimicrobial [123, 124]
Loganiaceae	Tree	CHP34	*Strychnos cocculoides* Baker	Corky monkey-orange (E), muzhumwi (S)	Fever (1), sore throat (1)	Abdominal pains and infertility [18, 80]	Common	Bark, leaf	1	1	–	Antimicrobial, anti-inflammatory and antioxidant [125]
	Tree	CHP35	*Strychnos innocua* Delile	Powder-bark monkey-orange (E)	STDs (2), sexual performance (1), stomach ache (1)	Gonorrhoea [126], cholera [127]	Common	Root, bark, leaf, fruit	3	4	0.33	–
	Tree	CHP36	*Strychnos madagascariensis* Poir	Black monkey-orange (E), muhwakwa (Shona)	STDs (1), childbirth (1)	Gonorrhoea [18]	Common	Root, bark	2	2	–	Antidiabetic and antioxidant [128]

Table 3 (continued)

Family	Growth form	Voucher number	Botanical name (* = cultivated plants)	Common names (E = English, S = Shona	Medicinal uses	Use in Zimbabwe and other countries	Healers' opinion about availability of species	Plant part used	tCD	tUR	ICF	Biological activities
	Tree	CHP28	*Strychnos spinosa* Lam	Mutamba (S), spiny monkey-orange (E)	Childbirth (1), STDs (1)	Gonorrhoea [10], STIs [98]	Common	Root, bark	2	1	–	Antimicrobial, anti-oxidant. anti-inflammatory and anti-plasmodial [125]
Malvaceae	Tree	CHP29	*Adansonia digitata* L	Baobab (E), muuyu (S)	Childbirth (6)	-	Common	Bark, stem	1	6	1	Antioxidant, anti-inflammatory, analgesic, and antimicrobial [129]
	Tree	CHP30	*Thespesia garckeana* F.Hoffm	Mutohwe (S), snot apple (E)	STDs (1), childbirth (1), fever (1)	STDs [130]	Common	Root, leaf	3	3	–	Antioxidant and anti-inflammatory [130, 131]
	Forb	CHP31	*Corchorus tridens* L	Gusha (S), horn-fruited jute (E)	Childbirth (2), STDs (1)	STDs [132]	Common	Root, bark	2	3	–	Antioxidant, anti-cancer and anti-microbial [132]
	Shrub	CHP32	*Grewia flavescens* Juss	Climbing raisin (E)	STDs (1), childbirth (1)	Inducing labour [74]	Common	Root, bark	2	2	–	Anti-inflammatory, and antimicrobial [133]
	Shrub	CHP37	*Grewia monticola* Sond	Donkey berry (E), mutewa (S)	STDs (9), childbirth (1), fever (1), ulcers (1), TB (1)	Diarrhoea [10, 18, 71]	Common	Root, bark, stem	5	13	0.67	–
	Shrub	CHP38	*Grewia bicolor* Juss	Mutongoro (S), white-leaved raisin (E)	STDs (6), ulcers (1)	Diarrhoea, gonorrhoea [10]	Common	Root, bark	2	6	1	Antimicrobial [134]
Moraceae	Tree	CHP39	*Ficus ingens* (Miq.) Miq	Mutsamvi (S), red-leaved rock fig (E)	STDs (1)	Genital warts [135]	Common	Root, leaf	1	1	–	Analgesic and anti-inflammatory [136]
	Tree	CHP40	*Ficus sycomorus* L	Muonde (S), sycomore fig (E)	STDs (2), childbirth (1), TB (1)	Cough, TB [135]	Common	Bark, leaf	3	4	0.33	Anti-bacterial [137]
Moringaceae	Shrub	CHP41	**Moringa oleifera* Lam	Horse-radish tree (E)	AIDS (7)	–	–	Root, bark, leaf	1	7	1	Anti-inflammatory, antioxidant, anti-cancer [138], anti-viral and anti-allergic [139]
Myrtaceae	Tree	CHP48	**Eucalyptus grandis* W.Hill ex Maiden	Eucalyptus (E)	STDs (1), childbirth (2)	Infectious diseases [140]	–	Root, bark, leaf	2	3	–	Antibacterial, antiviral, inti-inflammatory, anti-oxidant and analgesic [140]

Table 3 (continued)

Family	Growth form	Voucher number	Botanical name (* = cultivated plants)	Common names (E = English, S = Shona	Medicinal uses	Use in Zimbabwe and other countries	Healers' opinion about availability of species	Plant part used	tCD	tUR	ICF	Biological activities
	Tree	CHP49	**Psidium guajava* L	Guava (E)	Stomach (1), ulcers (1)	Gastrointestinal infections [141, 142]	–	Root, bark, leaf	2	2	–	Anti-inflammatory, antibacterial, anti-diabetic and anti-cancer [143–145]
	Tree	CHP50	*Syzygium cordatum* Hochst. ex C.Krauss	Mukute (S), waterberry (E)	STDs (2), stomach ache (1)	Diarrhoea [135]	Common	Root, bark	2	2	–	Anti-inflammatory, antibacterial, antifungal and antidiarrheal [146]
Ochnaceae	Tree	CHP54	*Ochna pulchra* Hook	Mermaid tree (E), muparamhosva (S)	STDs (6), stomach ache (1)	Diarrhoea [147]	Common	Root, bark, stem	2	7	0.83	Antibacterial [1489]
Olacaceae	Shrub	CHP55	*Ximenia americana* L	Blue sourplum (E), mutengeninyatwa (S)	Fever (2), ulcers (1)	Abdominal pains [149]	Common	Root, bark, leaf	2	3	–	Anti-inflammatory, analgesic, anti-diarrheal, antipyretic, and antioxidant [150]
	Shrub	CHP56	*Ximenia caffra* Sond	Munhengeni (S), sourplum (E)	STDs (2), fever (9), TB (1), back pain (1), heart disease (1)	Back ache, venereal diseases [10, 18]	Common	Root, bark, leaf	5	14	0.82	Anti-inflammatory, antioxidant and antiparasitic [151]
Phyllanthaceae	Tree	CHP57	*Bridelia mollis* Hutch	Mudenhanyani (S), velvet sweetberry (E)	AIDS (3)	AIDS [152, 153]	Common	Root, leaf, stem	1	1		Antibacterial, antifungal and antioxidant [152, 153]
	Shrub	CHP46	*Flueggea virosa* (Roxb. ex Willd.) Royle	Musosoti (S), snowberry tree (E)	STDs (1), fever (1), sexual performance (2)	Venereal diseases, sterility [154]	Common	Root, bark, leaf	3	4	0.33	Antiparasitic, antimicrobial, antiepilepsy and antidiabetic [154]
Picrodendraceae	Tree	CHP09	*Androstachys johnsonii* Prain	Lebombo ironwood (E), musimbiti (S)	Sexual performance (3)	Aphrodisiac [18]	Common	Root, bark	1	1	–	Antibacterial [155], antimicrobial and antifungal [156]
Rhamnaceae	Tree	CHP47	*Phyllogeiton discolor* (Klotzsch) Herzog	Brown ivory (E), munyii (S)	STDs (5), back pain (1)	Body pains [71, 157]	Common	Root, bark	2	6	1	Antimicrobial [157]
	Tree	CHP51	*Ziziphus mucronata* Willd	Buffalo-thorn (E), muchecheni (S)	STDs (1), fever (2), TB (2)	Gonorrhoea, syphilis [135]	Common	Root, bark, leaf	3	5	0.5	Antimicrobial, anti-inflammatory and antioxidant [158]

Table 3 (continued)

Family	Growth form	Voucher number	Botanical name (* = cultivated plants)	Common names (E = English, S = Shona	Medicinal uses	Use in Zimbabwe and other countries	Healers' opinion about availability of species	Plant part used	tCD	tUR	ICF	Biological activities
Rutaceae	Tree	CHP52	**Citrus limon* (L.) Osbeck	Lemon (E)	STDs (2), fever (4), ulcers (1)	Fever [159]	–	Root, bark, leaf	3	7	0.67	Antimicrobial, anti-inflammatory and antioxidant [160]
Pteridaceae	Herb	CHP53	*Hemionitis calomelanos* (Sw.) Christenh	Mumvuri-wedombo (S)	STDs (3), chest problems (1), AIDS (1)	Chest colds, asthma [161]	Common	Leaf	3	5	0.5	Antimicrobial [161]
Solanaceae	Herb	CHP58	**Nicotiana tabacum* L	Chikwarimba (S), tobacco (E)	TB (4)	–	–	Leaf, stem	1	4	1	Anti-oxidation and anti-inflammatory [161]
	Herb	CHP59	*Solanum incanum* L	Nhundurwa (S), bitter tomato (E)	STDs (2), childbirth (6), AIDS (2)	Genital warts [93]	Common	Root, leaf, stem	3	10	0.78	Antibacterial and antioxidant [18]
Verbenaceae	Shrub	CHP60	**Lantana camara* L	Lantana (E), mbarapati (S)	STDs (2), stomach ache (2), ulcers (1)	Stomach ache [163]	–	Root, bark, stem	3	5	0.5	Antimicrobial, antioxidant and anti-inflammatory [163]
	Herb	CHP63	*Lippia javanica* (Burm.f.) Spreng	Zumbani (S), fever tea (E)	STDs (1), TB (4)	Bronchitis, common cold, pneumonia, TB [164, 165]	Common	Root, leaf, stem	2	5	0.75	Anti-inflamatory [164, 165]
Vitaceae	Shrub	CHP61	*Ampelocissus obtusata* (Welw. ex Baker) Planch	Wild grape (E)	Stomach ache (1), STDs	Stomach ache [10], syphilis [135, 147]	Common	Root, bark	2	1	–	Antibacterial [166]
Zingiberaceae	Herb	CHP62	**Zingiber officinale* Roscoe	Ginger (E)	Stomach ache (2), ulcers (10), AIDS (1)	Stomach problems [18], digestive disorders [167]	–	Root	3	13	0.83	Anti-inflammatory, anti-apoptotic, anti-hyperglycemic and anti-lipidemic [168]

significant role in traditional medicine. *Adansonia digitata*, used to prevent birth complications, and *Moringa oleifera* Lam., used to treat AIDS opportunistic infections, both achieved an ICF value of 1.0, indicating complete agreement among traditional healers on their medicinal uses (Table 2). In the case of *A. digitata*, respondents reported that pregnant women chew the bark from around five to six months of pregnancy; the bark extracts are believed to help prepare the birth canal by promoting tissue flexibility and gradual expansion, thereby reducing the risk of perineal tearing during delivery. Similarly, *Grewia bicolor* Juss., utilized for treating STDs, *Phyllogeiton discolor* (Klotzsch) Herzog for STDs and back pain, and *Nicotiana tabacum* L. for TB, also had ICF values of 1.0. These results underscore the high reliability and cultural consensus on the medicinal applications of these species within the community. A unique finding in this study is the use of *A. digitata* for childbirth, which contrasts with its predominant uses reported in the literature [169]. Typically, *A. digitata* is documented as traditional medicine for conditions such as malaria, TB, fever, microbial infections, anemia, and toothache [169]. This novel application highlights the dynamic and context-specific nature of ethnobotanical knowledge, demonstrating the need for localized studies to capture unique traditional ecological practices. Other species with high ICF values included *Ochna pulchra* Hook. (0.83), *X. caffra* (0.82), and *Z. officinale* (0.83). Both *O. pulchra* and *X. caffra* were predominantly used for treating STDs, while *Z. officinale* was used for ulcers and other stomach-related ailments. The high ICF values for these species suggest strong consensus and potentially effective bioactive compounds in addressing these health concerns. The high ICF values for several species point to a robust shared knowledge system among traditional healers, reflecting the cultural importance and perceived efficacy of these plants. The discovery of *A. digitata* being used for childbirth is particularly significant, as it extends the known medicinal uses of this species and may inform further pharmacological studies. Additionally, the high consensus on species like *Z. officinale*, widely recognized for its medicinal properties, aligns with global ethnopharmacological findings and validates the local traditional knowledge about the species. Nine species recorded in this study are exotic to Zimbabwe and therefore, cultivated in home gardens, agricultural fields or occurred as weeds (Table 3). About 75% of the recorded species were categorized as common or widespread by participants. But *Hypoxis obtusa* Burch. ex Ker Gawl. was categorized as rare while *Annona stenophylla* Engl. & Diels, *Cassia abbreviata* Oliv., *Dicoma anomala* Sond., *Kigelia africana* (Lam.) Benth., *Kirkia acuminata* Oliv., *Lannea edulis* (Sond.) Engl., and *Pterocarpus angolensis* DC. were categorized as less available and difficult to get. Plant species such as *A. digitata* and K. africana are extensively harvested not only for medicinal bark but also for their fruits and seeds, which are vital for regeneration. Similarly, herbaceous and subshrub species such as *D. anomala, H. obtusa* and *L. edulis* are usually uprooted while *C. abbreviata* and *Pterocarpus angolensis* are often stripped of their bark and used for medicinal or other traditional uses. While these species are currently categorized as "least concern" by the International Union for Conservation of Nature (IUCN) Red List, certain species may be vulnerable to overharvesting in the long term, with frequent bark and fruit harvesting posing potential threats to their long-term sustainability if not managed properly. Unsustainable harvesting, especially of bark and reproductive parts, can severely compromise natural recruitment and population viability. Therefore, while their conservation status remains stable for now, ongoing monitoring and sustainable harvesting practices are crucial to avoid future population declines of some of these species.

For animal products, AIDS opportunistic infections had the highest ICF values (0.8) among traditional healers, with a similar N_t to plants. Additionally, STDs also had a high ICF value (0.67) with the highest number of use reports (11) (Table 4, Fig. 3). Interestingly, some use categories were unique to animal products, such as luck, particularly in the context of poaching in Save Valley Conservancy and Chipinge Safari Area (Table 5, Fig. 3). Another important use category unique to ethnozoology was the chasing away of evil spirits (Table 4, Fig. 4). The apparent prevalence of animals over plants in spiritual contexts can be attributed to several interconnected factors. Animals exhibit observable agency, movement, and communicative behaviors that facilitate anthropomorphizing and spiritual attribution [170, 171]. The biological similarities between humans and animals create stronger kinship connections, making them more intuitive intermediaries between physical and spiritual realms [172].

Table 4 Quantitative analysis of animal products uses across six disease categories treated by nine traditional healers interviewed in Chipinge district, Zimbabwe

Use categories	N_{ur}	N_t	*ICF*
AIDS	6	2	0.8
Evil spirits	5	4	0.25
Lucky charm	10	4	0.67
STDs	11	5	0.6
Aphrodisiac	8	5	0.43
Skin diseases (infections/problems)	4	3	0.33

Table 5 List of medicinal animals their use categories and use reports from Chipinge traditional healers, Zimbabwe. tCD is the total number of use categories, tUR is the total number of use reports and ICF is the informant consensus factor. Animals with a (–) under the ICF column had tUR < 4 and were not considered for ICF

Family	Scientific name	Local name (E = English; S = Shona)	Animal part	Healers' opinion about availability of species	Medicinal uses	Use in Zimbabwe and other countries	tCD	tURs	IFC
Bovidae	*Aepyceros melampus melampus,* Lichtenstein 1812	Impala (E), mhara (S)	Fat oil	Common	Childbirth (2)	Antenatal care [180]	1	2	–
Chamaeleonidae	*Chamaeleo chamaeleon* (Linnaeus, 1758)	Chameleon (E), rwaivhi (S)	Fat oil	Common	STDs (2)	Convulsions, antenatal care [180]	1	2	–
Hyaenidae	*Crocuta crocuta* (Erxleben 1777)	Bere (S), hyena (E)	Fat oil	Common	STDs (2), luck (2), aphrodisiac (1)	Dry eyes, tooth ache, TB [181], invoke witches [180]	1	5	0.50
Cercopithecidae	*Cercopithecus pygerythrus* (F. Cuvier, 1821)	Monkey (E), tsoko (S)	Tail fat, penis	Common	Luck (4), aphrodisiac (1), evil spirits (2), skin disease (1)	Rashes [180]	4	8	0.57
Elephantidae	*Loxodonta africana* (Blumenbach 1797)	Elephant (E), nzou (S)	Fat oil	Common	Childbirth (1), aphrodisiac (1)	Hepatitis [181]	2	2	–
Suidae	*Potamochoerus larvatus* (F. Cuvier, 1822)	Bush pig (E), nguruve (S)	Fat oil	Common	Skin disease (1)	Stomach ulcers [181]	1	1	–
Pythonidae	*Python natalensis* Smith 1833	Python (E), shato (S)	Fat oil	Less available	STDs (5), evil spirits (1), skin disease (2), AIDS (3)	Treat back pain [181]	4	11	0.70
Cercopithecidae	*Papio ursinus* Kerr 1792	Baboon (E), gudo (S)	Tail fat	Common	STDs (1), luck (2), aphrodisiac (4), evil spirits (1)	Aphrodisiac [44]	4	8	0.57
Bovidae	*Syncerus caffer* (Sparrman 1779)	Buffalo (E), nyati (S)	Ground horn	Common	Aphrodisiac (1)	Asthma, fever, aphrodisiac [182]	1	1	–
Syngnathidae	*Smutsia temminckii* (Smuts 1832)	Haka (S), pangolin (E)	Tail fat	Rare	STDs (1), luck (2), evil spirits (1), AIDS (3)	Goodluck [181], spiritual ailments, cancer, epilepsy [183], cough [180]	4	7	0.50

Furthermore, the historical hunter–prey relationships established more immediate and intense spiritual bonds with animals than with stationary plants [173]. Animals' visible life force through breath, blood, and discernible death transitions reinforces their connection to spiritual concepts of animation and soul [174]. While plants do feature prominently in many spiritual traditions through sacred groves, psychoactive substances, and agricultural deities [175], their slower, less visible responsiveness and communication generally position them as secondary spiritual actors in many cultural contexts [176]. This differential spiritual positioning reflects fundamental differences in human perception and relationship with various forms of life rather than an inherent spiritual hierarchy.

Ulcers, stomach problems, back pain, and heart disease were only treated with plants (Table 3, Fig. 3). Surprisingly, skin diseases were not found among the use categories for plants, despite being frequently mentioned in other ethnobotanical surveys conducted in the country and elsewhere [10, 18, 21]. Animal oil or fat was the commonly used animal part in this study, similar to research findings obtained in South Africa [177]. *Python natalensis* had the highest informant consensus factor (ICF) among animals, with a value of 0.70. This species was used in the treatment of STDs, exorcising evil spirits from sick patients, skin diseases, and AIDS opportunistic infections. Despite this relatively high ICF, the overall consensus on the use of animal products in traditional medicine among the Ndau people of Manicaland, Zimbabwe, was generally low, with most ICF values being around 0.5. This suggests that animal-based remedies are less popular compared to plant-based treatments in Ndau traditional healing practices. The limited use of animal products is further underscored by the fact that

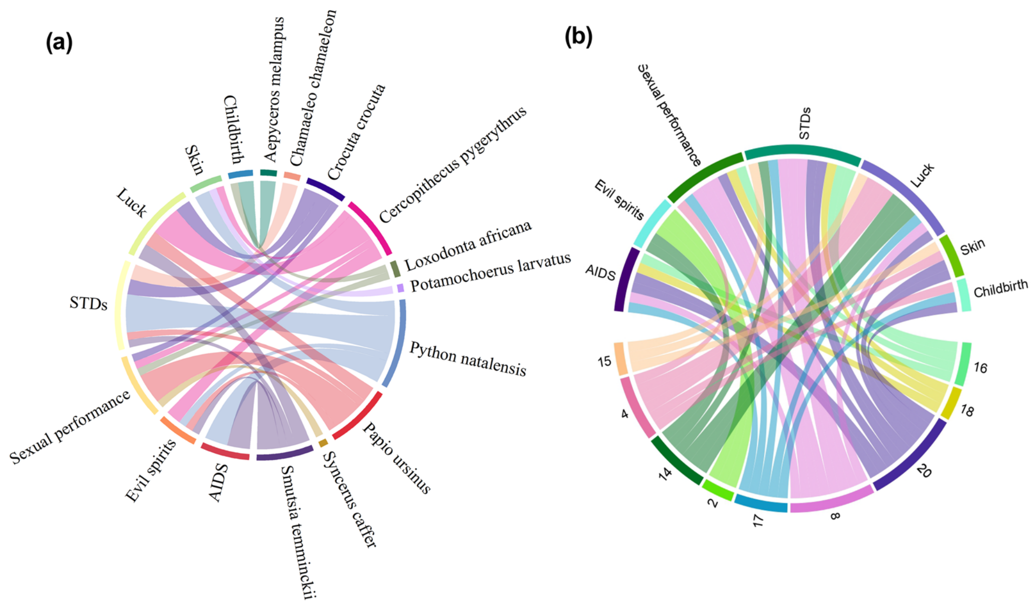

Fig. 4 Chord diagrams for the relationships between each animal species and the different diseases that it is used to treat (**a**) and the relationship between each traditional healer and the diseases that they treat using animal products (**b**). Some uses reported by traditional healers (e.g., for luck or childbirth support) fall outside the conventional disease framework

only 9 out of 22 traditional healers interviewed employed animal-derived remedies. This finding highlights a cultural inclination toward plant-based treatments, which are more commonly integrated into traditional medicine systems [10, 18]. Moreover, the reliance on plant-based remedies aligns with global trends, as many biomedical drugs are derived from plant sources rather than animals [178]. Indeed, a comprehensive review of existing ethnozoological studies reveals that relatively few investigations have been conducted (see Table 5). One critical example is *Smutsia temminckii* (ground pangolin), which has an ICF value of 0.5 and is classified as Vulnerable on the IUCN Red List (Table 5). *Smutsia temminckii* was categorized as rare by the participants while *Python natalensis* (python) was regarded as less available, and the rest of the species were perceived as common. The consensus on species uses and their availability or local conservation status suggests an urgent need to discourage the use of such endangered animals in traditional medicine. Instead, traditional healers could be encouraged to focus more on plants, which are not sustainable but their harvesting may be, and also offer a diverse range of bioactive compounds for therapeutic purposes [179]. Encouraging the use of plant-based remedies over animal-derived products could reduce pressure on vulnerable wildlife species, like *Smutsia temminckii*, while promoting the conservation of biodiversity. Additionally, the higher ICF values are associated with plants point to their central role in traditional healing systems, offering opportunities for further research into their pharmacological properties and potential integration into modern medicine. Overall, the uses of plants highlighted by many traditional healers agreed with what was observed in other studies that were carried out in Zimbabwe as well as in the region (Table 3). The pharmacological activity of many medicinal plants was mainly anti-inflammatory [72, 76], antiparasitic, antimicrobial, antibacterial [102, 103], antioxidant, anti-inflammatory [85], antioxidant, and anticancer [90]. (Table 3).

Conclusion

The findings from this study provide a compelling narrative on the critical role of traditional healers in Zimbabwe, particularly in regions where modern health care is limited. The high engagement of patients with traditional healers underscores the perpetual reliance on indigenous medical practices, which are deeply rooted in cultural and ancestral traditions. The diversity of medicinal plants and animal products utilized, coupled with the observed decline in resource availability, highlights the urgent need for sustainable practices and the preservation of this invaluable knowledge. The economic analysis reveals significant disparities in the earnings of traditional healers across different regions, emphasizing the socioeconomic challenges faced by these practitioners. Moreover, the study's ethnobotanical and ethnozoological data reveal a complex and nuanced landscape of traditional medicinal practices, with significant implications for bioprospecting and the integration of traditional knowledge into modern pharmacology. As the demand for traditional medicine persists, it is crucial to safeguard and integrate these practices within the broader healthcare framework, ensuring that both the cultural heritage and the biodiversity on which they depend are preserved for future generations. This study contributes valuable insights into the potential for traditional medicine to complement modern health care, while also highlighting the challenges that must be addressed to fully realize this potential.

Abbreviations

ICF	Informant consensus factor
IUCN	International Union for the Conservation of Nature
AIDS	Acquired Immunodeficiency Syndrome
STD	Sexual transmitted disease
ZINATHA	Zimbabwe National Traditional Healers Association
WHO	World Health Organization
HIV	Human immunodeficiency virus
N_{ur}	Number of use reports
N_t	Number of taxa
SVC	Save Valley Conservancy
TB	Tuberculosis
ZSARA	Zimbabwe Service Availability and Readiness Assessment

Acknowledgements
We would like to thank the field assistant Innocent Mlambo.

Author contributions
JM conceived the research idea, collected the data, analysed the data, and wrote the paper. AM reviewed the manuscript and checked the taxonomy of documented species.

Funding
Not applicable for this study.

Availability of data and materials
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
This study, conducted in 2019, adhered to rigorous ethical standards to ensure the protection and respect of all participants. The study tools, including the consent form and participant information sheet, were reviewed and approved for suitability by the headmen of each traditional healer's community. The study was carried out in compliance with the ethical principles outlined in the 1964 Declaration of Helsinki and its subsequent amendments. All participants provided informed consent for the interviews and the publication of the research findings. We extend our sincere gratitude to the Zimbabwe National Traditional Healers Association for their invaluable support and for granting permission to conduct this research in the selected areas.

Consent for publication
Informed consent was obtained from all interviewed traditional healers prior to their participation in the study.

Competing interests
The authors declare no competing interests.

Author details
[1]School of Animal, Plant and Environmental Sciences, University of the Witwatersrand, Private Bag 3, Wits 2050, South Africa. [2]Department of Biotechnology and Biological Sciences, University of Fort Hare, Private Bag X1314, Alice 5700, South Africa.

Received: 5 June 2025 Accepted: 28 July 2025
Published online: 14 August 2025

References

1. Gietaneh W, Simieneh MM, Endalew B, Petrucka P, Eyayu D. Traditional healers' roles, and the challenges they face in the prevention and control of local disease outbreaks and pandemics: the case of the East Gojjam Zone in northwestern Ethiopia. Front Trop Dis. 2023;4: 978528.
2. WHO. WHO traditional medicine strategy: 2014–2023. Rome: World Health Organization; 2013.
3. UNAIDS, WHO. Zimbabwe epidemiological fact sheet on HIV/AIDS and sexually transmitted infections. Geneva: UNAIDS; 2000.
4. UNAIDS. Country factsheets HIV and AIDS estimates, Zimbabwe. Geneva: UNAIDS; 2023.
5. Mangundu M, Roets L, Janse Van Rensberg E. Accessibility of healthcare in rural Zimbabwe: the perspective of nurses and healthcare users. Afr J Prim Health Care Fam Med. 2020;12(1):1–7.
6. Mangundu M, Roets L, Janse Van Rensberg ES. The economic crisis (2008–2019) and health care in Zimbabwe: a structured literature review. Open Public Health J. 2013;16:e187494452302211.
7. MHCC. The national health strategy equity and quality in health: leaving no one behind for Zimbabwe. Harare: Ministry of Health and Child Welfare; 2016.
8. Atieno R, Moyo T, Nyang'oro O. Bringing rigour and evidence to economic policy making in Africa service delivery in fragile states: the case of health sector in Zimbabwe. Nairobi: African Economic Research Consortium; 2022.
9. MHCC. Zimbabwe service availability and readiness assessment 2015 report. Harare: Ministry of Health and Child Welfare; 2015.
10. Maroyi A. Ethnobotanical study of medicinal plants used by people in Nhema communal area, Zimbabwe. J Ethnopharmacol. 2011;136:347–54.
11. Krah E, de Kruijf J, Ragno L. Integrating traditional healers into the health care system: challenges and opportunities in rural northern Ghana. J Comm Health. 2018;43:157–63.
12. Stekelenburg J, Jager BE, Kolk PR, Westen EHMN, Van Der Kwaak A, Wolffers IN. Health care seeking behaviour and utilisation of traditional healers in Kalabo, Zambia. Health Policy. 2005;71:67–81.
13. Richter M. Traditional medicines and traditional healers in South Africa. Johannesburg: Witwatersrand University; 2003.
14. Chikanda A. Medical migration from Zimbabwe: magnitude, causes and impact on the poor. Dev S Afr. 2007;24:47–60.
15. Cunningham AB. African medical plants: setting priorities at the interface between conservation and primary healthcare. Paris: UNESCO; 1993.
16. Lee S, Xiao C, Pei S. Ethnobotanical survey of medicinal plants at periodic markets of Honghe Prefecture in Yunnan Province, SW China. J Ethnopharmacol. 2008;117:362–77.
17. Šarić-Kundalić B, Dobeš C, Klatte-Asselmeyer V, Saukel J. Ethnobotanical survey of traditionally used plants in human therapy of east, north and north-east Bosnia and Herzegovina. J Ethnopharmacol. 2011;133:1051–76.
18. Maroyi A. Traditional use of medicinal plants in south-central Zimbabwe: review and perspectives. J Ethnobiol Ethnomed. 2013;9:31.
19. Vitalini S, Iriti M, Puricelli C, Ciuchi D, Segale A, Fico G. Traditional knowledge on medicinal and food plants used in Val San Giacomo (Sondrio, Italy): an alpine ethnobotanical study. J Ethnopharmacol. 2013;145:517–29.
20. Mahwasane ST, Middleton L, Boaduo N. An ethnobotanical survey of indigenous knowledge on medicinal plants used by the traditional healers of the Lwamondo area, Limpopo province, South Africa. S Afr J Bot. 2013;88:69–75.
21. Bieski IGC, Leonti M, Arnason JT, et al. Ethnobotanical study of medicinal plants by population of Valley of Juruena Region, Legal Amazon, Mato Grosso, Brazil. J Ethnopharmacol. 2015;173:383–423.
22. Abbas Z, Khan SM, Alam J, et al. Medicinal plants used by inhabitants of the Shigar Valley, Baltistan region of Karakorum range-Pakistan. J Ethnobiol Ethnomed. 2017;13:15.

23. Ngarivhume T, Van'T Klooster CIEA, De Jong JTVM, Van Der Westhuizen JH. Medicinal plants used by traditional healers for the treatment of malaria in the Chipinge district in Zimbabwe. J Ethnopharmacol. 2015;159:224–37.
24. Lev E. Traditional healing with animals (zootherapy): medieval to present-day levantine practice. J Ethnopharmacol. 2003;85:107–18.
25. Alves RRN, Rosa IML. Biodiversity, traditional medicine and public health: where do they meet? J Ethnobiol Ethnomed. 2007;3:14.
26. Chan KMA, Satterfield T, Goldstein J. Rethinking ecosystem services to better address and navigate cultural values. Ecol Econ. 2012;74:8–18.
27. Daniel TC, Muhar A, Arnberger A, et al. Contributions of cultural services to the ecosystem services agenda. Proc Natl Acad Sci USA. 2012;109:8812–9.
28. Fish R, Church A, Winter M. Conceptualising cultural ecosystem services: a novel framework for research and critical engagement. Ecosyst Serv. 2016;21:208–17.
29. Muvengwi J, Ndagurwa HGT, Nyenda T, Mlambo I. Termitaria as preferred browsing patches for black rhinoceros (*Diceros bicornis*) in Chipinge Safari Area, Zimbabwe. J Trop Ecol. 2014;30:591–8.
30. Khosa A, Ndagurwa HGT, Witkowski ETF, et al. The impact of elephants (*Loxodonta africana*) on the Baobab (*Adansonia digitata*) in a semi-arid savanna. Glob Ecol Conserv. 2023;46:e02556.
31. Khosa A, Ndagurwa HGT, Witkowski ETF, et al. Spatial point pattern of the baobab (*Adansonia digitata*) in semi-arid savanna, Southeast Zimbabwe. Trees For People. 2023;14:100452.
32. Ting H, Memon MA, Thurasamy R, Cheah J-H. Snowball sampling: a review and guidelines for survey research. Asian J Bus Res. 2025;15(1):1–15.
33. Mullin L. A new Zimbabawean botanical checklist of English and African plant names. Harare: The Tree Society of Zimbabwe; 2006.
34. Skinner JD, Chimimba CT. The mammals of the southern African subregion. Cambridge: Cambridge University Press; 2006.
35. Stuart C, Stuart M. Stuarts' field guide to mammals of southern Africa: including Angola, Zambia and Malawi. Johannesburg: Penguin Random House; 2015.
36. Trotter RT, Logan MH. Informant consensus: a new approach for identifying potentially effective medicinal plants. In: Ektin NL, editor. Plants and indigenous medicine and diet. New York: Redgrave Pub. Co.; 1986. p. 91–112.
37. Heinrich M, Ankli A, Frei B, et al. Medicinal plants in Mexico: healers' consensus and cultural importance. Soc Sci Med. 1998;47:1859–71.
38. Leonti M, Vibrans H, Sticher O, Heinrich M. Ethnopharmacology of the Popoluca, Mexico: an evaluation. J Pharm Pharmacol. 2001;53:1653–69.
39. Weckerle CS, de Boer HJ, Puri RK, et al. Recommended standards for conducting and reporting ethnopharmacological field studies. J Ethnopharmacol. 2018;210:125–32.
40. Whitney C. EthnobotanyR: calculate quantitative ethnobotany indices. Bonn: Cran R Project; 2022.
41. Leonti M. The relevance of quantitative ethnobotanical indices for ethnopharmacology and ethnobotany. J Ethnopharmacol. 2022;288:115008.
42. Roy Choudhury P, Dutta Choudhury M, Ningthoujam SS, et al. Ethnomedicinal plants used by traditional healers of North Tripura district, Tripura, North East India. J Ethnopharmacol. 2015;166:135–48.
43. Ngezahayo J, Havyarimana F, Hari L, et al. Medicinal plants used by Burundian traditional healers for the treatment of microbial diseases. J Ethnopharmacol. 2015;173:338–51.
44. Nieman WA, Leslie AJ, Wilkinson A. Traditional medicinal animal use by Xhosa and Sotho communities in the Western Cape province, South Africa. J Ethnobiol Ethnomed. 2019;15:34.
45. Mokgobi MG. Understanding traditional African healing. Afr J Phys Health Educ Recreat Dance. 2014;20:24–34.
46. Zuma T, Wight D, Rochat T, Moshabela M. The role of traditional health practitioners in Rural KwaZulu-Natal, South Africa: generic or mode specific? BMC Complement Altern Med. 2016;16(1):304.
47. Baratti-Mayer D, Daou MB, Gayet-Ageron A, et al. Sociodemographic characteristics of traditional healers and their knowledge of Noma: a descriptive survey in three regions of Mali. Int J Environ Res Public Health. 2019;16(22): 4587.
48. Mathibela MK, Egan BA, Du Plessis HJ, Potgieter MJ. Socio-cultural profile of Bapedi traditional healers as indigenous knowledge custodians and conservation partners in the Blouberg area, Limpopo Province, South Africa. J Ethnobiol Ethnomed. 2015;11:49.
49. Gessler MC, Msuya DE, Nkunya MHH, et al. Traditional healers in Tanzania: sociocultural profile and three short portraits. J Ethnopharmacol. 1995;48(3):145–60.
50. Gelfand M, Drummond RB, Mavi S, Ndemera B. The traditional medical practitioner in Zimbabwe: his principles of practice and pharmacopoeia. Gweru: Mambo Press; 1985.
51. Podolecka A, Cheyeka AM. Ng'angas: Zambian healers-diviners and their relationship with Pentecostal Christianity: the intermingling of pre-Christian beliefs and Christianity. J Study Relig. 2021;34:1–27.
52. Vickers A, Zollman C. ABC of complementary medicine: herbal medicine. BMJ. 1999;319:1050–3.
53. Ozioma E-OJ, Chinwe OAN. Herbal medicines in African traditional medicine. In: Herbal medicine. London: IntechOpen; 2019. p. 191–214.
54. Mander M, Ntuli L, Diederichs N, Mavundla K. Economics of the traditional medicine trade in South Africa. S Afr Health Rev. 2007;1:189–96.
55. World Bank. Gross national income per capita 2022: Atlas method and purchasing power parity. Geneva: World Bank; 2023.
56. Lindsey PA, Romañach SS, Matema S, et al. Dynamics and underlying causes of illegal bushmeat trade in Zimbabwe. Oryx. 2011;45:84–95.
57. Asigbaase M, Adusu D, Anaba L, et al. Conservation and economic benefits of medicinal plants: insights from forest-fringe communities of Southwestern Ghana. Trees For People. 2023;14:100462.
58. Cheikhyoussef A, Shapi M, Matengu K, Muashekele H. Ethnobotanical study of indigenous knowledge on medicinal plant use by traditional healers in Oshikoto region, Namibia. J Ethnobiol Ethnomed. 2011;7:10.
59. Benarba B, Belabid L, Righi K, et al. Ethnobotanical study of medicinal plants used by traditional healers in Mascara (North West of Algeria). J Ethnopharmacol. 2015;175:626–37.
60. Belhouala K, Benarba B. Medicinal plants used by traditional healers in Algeria: a multiregional ethnobotanical study. Front Pharmacol. 2021;12:760492.
61. Chinsembu KC. Model and experiences of initiating collaboration with traditional healers in validation of ethnomedicines for HIV/AIDS in Namibia. J Ethnobiol Ethnomed. 2009;5:30.
62. Semenya SS, Maroyi A. Medicinal plants used by the Bapedi traditional healers to treat diarrhoea in the Limpopo province, South Africa. J Ethnopharmacol. 2012;144(2):395–401.
63. Mudyarabikwa O, Mbengwa A. Distribution of public sector health workers in Zimbabwe: a challenge for equity in health. Equinet Discussion Paper 34. Regional Network for Equity in Health in East and Southern Africa, Stocklohm, Sweden; 2006.
64. Hood JE, Friedman AL. Unveiling the hidden epidemic: a review of stigma associated with sexually transmissible infections. Sex Health. 2011;8(2):159–70.
65. Garcia J, Parker C, Parker RG, Wilson PA, Philbin M, Hirsch JS. Psychosocial implications of homophobia and HIV stigma in social support networks: insights for high-impact HIV prevention among Black men who have sex with men. Health Educ Behav. 2016;43(2):217–25.
66. Ndubani P, Höjer B. Traditional healers and the treatment of sexually transmitted illnesses in rural Zambia. J Ethnopharmacol. 1999;67(1):15–25.
67. Piot P, Laga M. Genital ulcers, other sexually transmitted diseases, and the sexual transmission of HIV. BMJ. 1989;298:623–4.
68. Ward H, Rönn M. Contribution of sexually transmitted infections to the sexual transmission of HIV. Curr Opin HIV AIDS. 2010;5:305–10.
69. Lowe S, Mudzviti T, Mandiriri A, et al. Sexually transmitted infections, the silent partner in HIV-infected women in Zimbabwe. S Afr J HIV Med. 2019;20:1–6.
70. Masud PGM. Pharmacological activities of mango (*Mangifera Indica*): a review. J Pharmacogn Phytochem. 2016;5(3):1–7.
71. Mabogo DEN. The ethnobotany of the VhaVenda. MSc thesis. Pretoria: University of Pretoria; 1990.
72. Ojewole JAO. Evaluation of the analgesic, anti-inflammatory and anti-diabetic properties of *Sclerocarya birrea* (A.Rich.) Hochst. stem-bark aqueous extract in mice and rats. Phytoth Res. 2004;18:601–8.
73. Chingwaru W, Vidmar J, Kapewangolo PT. The potential of sub-Saharan African plants in the management of human immunodeficiency virus infections: a review. Phytoth Res. 2015;29:1452–87.

74. Chinsembu KC, Hijarunguru A, Mbangu A. Ethnomedicinal plants used by traditional healers in the management of HIV/AIDS opportunistic diseases in Rundu, Kavango East Region, Namibia. S Afr J Bot. 2015;100:33–42.
75. Maroyi A. Medicinal uses, biological and chemical properties of wild grape (*Lannea edulis*): an indigenous fruit plant of Tropical Africa. Asian J Pharma Clin Res. 2019;12:16–20.
76. Fotio AL, Dimo T, Nguelefack TB, et al. Acute and chronic anti-inflammatory properties of the stem bark aqueous and methanol extracts of *Sclerocarya birrea* (Anacardiaceae). Inflammopharmacology. 2009;17:229–37.
77. Ojewole JAO. Evaluation of the anti-inflammatory properties of *Sclerocarya birrea* (A.Rich.) Hochst. (family: Anacardiaceae) stem-bark extracts in rats. J Ethnopharmacol. 2003;85:217–20.
78. Hulley IM, Van Wyk BE. Quantitative medicinal ethnobotany of Kannaland (western Little Karoo, South Africa): non-homogeneity amongst villages. S Afr J Bot. 2019;122:225–65.
79. Marchetti C, Gavazzo P, Stafford GI, Van Staden J. South African plants used in traditional medicine to treat epilepsy have an antagonistic effect on NMDA receptor currents. J Ethnopharmacol. 2011;137:382–8.
80. Gelfand M. Diet and tradition in an African culture. Edinburgh: Livingstone; 1971.
81. Taderera T, Chagonda LS, Gomo E, et al. *Annona stenophylla* aqueous extract stimulate glucose uptake in established C2CL2 muscle cell lines. Afr Health Sci. 2019;19:2219–29.
82. Mavi S. Medicinal plants and their uses in Zimbabwe. In: Norman H, Snyman I, Cohen M, editors. Indigenous knowledge and its uses in southern Africa. Pretoria: Human Sciences Research Council; 1996. p. 67–73.
83. Ya'u J, Yaro AH, Abubakar MS, et al. Anticonvulsant activity of *Carissa edulis* (Vahl) (Apocynaceae) root bark extract. J Ethnopharmacol. 2008;120:255–8.
84. Msonthi J, Magombo D. Medicinal herbs in malaria and their uses. Hamdard Med. 1983;20:94–100.
85. Hassan HS, Ahmadu AA, Hassan AS. Analgesic and anti-inflammatory activities of *Asparagus africanus* root extract. Afr J Tradit Complement Altern Med. 2008;5:27–31.
86. Mangisa M, Peter XK, Khosa MC, et al. Ethnomedicinal and phytochemical properties of sesquiterpene lactones from *Dicoma* (Asteraceae) and their anticancer pharmacological activities: a review. Sci Afr. 2021;13:e00919.
87. Assanti G, Kaur R, Nizard S, et al. Biology, chemistry, and pharmacological activity of *Kigelia africana* (Bignoniaceae) and *Garcinia kola* (Clusiaceae): a review. J Med Active Pl. 2022;11:1–21.
88. Sianangama PC, Nundwe E, Harrison SJ, et al. The effect of sausage tree fruit (*Kigelia africana*) on gonadal development and growth performance of *Oreochromis andersonii*. Worlds Vet J. 2023;13:25–133.
89. Abbas Z, Mustafa S, Khan MF, et al. Therapeutic importance of *Kigelia africana* subsp. *africana*: an alternative medicine. Nat Prod Res. 2023;38(23):4208–22.
90. Bello I, Shehu MW, Musa M, et al. *Kigelia africana* (Lam.) Benth. (sausage tree): phytochemistry and pharmacological review of a quintessential African traditional medicinal plant. J Ethnopharmacol. 2016;189:253–76.
91. Mawire P, Mozirandi W, Heydenreich M, et al. Isolation and antimicrobial activities of phytochemicals from *Parinari curatellifolia* (Chrysobalanaceae). Adv Pharmacol Pharm Sci. 2021;2021:8842629.
92. Gororo M, Chimponda T, Chirisa E, Mukanganyama S. Multiple cellular effects of leaf extracts from *Parinari curatellifolia*. BMC Complement Altern Med. 2016;16:305.
93. Chigora P, Masocha R, Mutenheri F. The role of indigenous medicinal knowledge (IMK) in the treatment of ailments in rural Zimbabwe: the case of Mutirikwi communal lands. J Sustain Dev Afr. 2007;9:26–43.
94. Stark TD, Salger M, Frank O, et al. Antioxidative compounds from *Garcinia buchananii* stem bark. J Nat Prod. 2015;78:234–40.
95. Boakye PA, Brierley SM, Pasilis SP, Balemba OB. *Garcinia buchananii* bark extract is an effective anti-diarrheal remedy for lactose-induced diarrhea. J Ethnopharmacol. 2012;142:539–47.
96. McGaw LJ, Rabe T, Sparg SG, et al. An investigation on the biological activity of *Combretum* species. J Ethnopharmacol. 2001;75:45–50.
97. Maroyi A. The leadwood tree (*Combretum imberbe* Wawra, family Combretaceae): medicinal uses and ethnopharmacological properties. Ethnobot Res Appl. 2025;30:50.
98. Lawal F, Bapela MJ, Adebayo SA, et al. Anti-inflammatory potential of South African medicinal plants used for the treatment of sexually transmitted infections. S Afr J Bot. 2023;125:62–71.
99. Ramadwa TE, Meddows-Taylor S. Traditional uses, pharmacological activities, and phytochemical analysis of *Diospyros mespiliformis* Hochst. ex. A.DC (Ebenaceae): a review. Molecules. 2023;28(23):7759.
100. Feyissa T, Asres K, Engidawork E. Renoprotective effects of the crude extract and solvent fractions of the leaves of *Euclea divinorum* Hierns against gentamicin-induced nephrotoxicity in rats. J Ethnopharmacol. 2013;145:758–66.
101. Maroyi A. *Euclea crispa*: Review of its botany, ethnomedicinal uses and pharmacological properties. Asian J Pharm Clin Res. 2018;11(10):5–9.
102. Ragunathan M, Solomon M. The study of spiritual remedies in orthodox rural churches and traditional medicinal practice in Gondar Zuria district, Northwestern Ethiopia. Pharmacogn J. 2009;1(3):178–83.
103. Hashim I, Omosa LK, Nchiozem-Ngnitedem V-A, et al. Antibacterial activities and phytochemical screening of crude extracts from Kenyan *Macaranga* species towards MDR phenotypes expressing efflux pumps. Pharmacogn Commun. 2021;11:119–26.
104. Scarpa A, Guerci A. Various uses of the castor oil plant (*Ricinus communis* L.): a review. J Ethnopharmacol. 1982;5(2):117–37.
105. Ilavarasan J, Mallika M, Venkataraman S. Anti-inflammatory and free radical scavenging activity of *Ricinus communis* root extract. J Ethnopharmacol. 2006;103:478–80.
106. Mmushi TJ. Screening, isolation and purification of bioactive compounds with antibacterial activity against *Mycobacterium smegmatis*. MSc Thesis. Mangweng: University of Limpopo; 2011.
107. Jena J, Gupta AK. *Ricinus communis* Linn: a phytopharmacological review. Int J Pharm Pharm Sci. 2012;4:25–9.
108. Cheikhyoussef A, Mumbengegwi D, Maroyi A. Traditional uses, phytochemistry and pharmacology of mopane (*Colophospermum mopane*) in southern African countries. In: Martinez JL, Maroyi A, Wagner ML, editors. Ethnobotany: from traditional to ethnopharmacology. Boca Raton: CRC Press; 2023. p. 203–20.
109. Samie A, Housein A, Lall N, Meyer JJ. Crude extracts of, and purified compounds from, *Pterocarpus angolensis*, and the essential oil of *Lippia javanica*: their *in-vitro* cytotoxicities and activities against selected bacteria and *Entamoeba histolytica*. Ann Trop Med Parasitol. 2009;103:427–39.
110. Hafez LO, Brito-Casillas Y, Abdelmageed N, Alemán-Cabrera IM, Morad SAF, Abdel-Raheem MH, Wägner AM. The *Acacia* (*Vachellia nilotica* (L.) P.J.H. Hurter & Mabb.): traditional uses and recent advances on its pharmacological attributes and potential activities. Nutrients. 2024;16(24):4278.
111. Sibanda S, Shoko R, Chishaya K, et al. Antimicrobial effect of *Brachystegia boehmii* extracts and their green synthesised silver zero-valent derivatives on burn wound infectious bacteria. All Life. 2022;15:1117–25.
112. Sobeh M, Mahmoud MF, Abdelfattah MAO, et al. A proanthocyanidin-rich extract from *Cassia abbreviata* exhibits antioxidant and hepatoprotective activities *in vivo*. J Ethnopharmacol. 2018;213:38–47.
113. Madureira AM, Ramalhete C, Mulhovo S, Duarte A, Ferreira M-JU. Antibacterial activity of some African medicinal plants used traditionally against infectious diseases. Pharm Biol. 2012;50:481–9.
114. Leteane MM, Ngwenya BN, Muzila M, Namushe A, Mwinga J, Musonda R, Moyo S, Mengestu YB, Abegaz BM, Andrae-Marobela K. Old plants newly discovered: *Cassia sieberiana* D.C. and *Cassia abbreviata* Oliv. root extracts inhibit *in vitro* HIV-1c replication in peripheral blood mononuclear cells (PBMCs) by different modes of action. J Ethnopharmacol. 2012;141:48–56.
115. Mazimba O, Kwape TE, Gaobotse G. *Dichrostachys cinerea*: ethnomedicinal uses, phytochemistry and pharmacological activities: a review. Nat Prod J. 2021;12(3):15–9.
116. Ibewuike JC, Ogungbamila FO, Ogundaini AO, et al. Antiinflammatory and antibacterial activities of C-methylflavonols from *Piliostigma thonningii*. Phytother Res. 1997;11:281–4.

117. Afolayan M, Srivedavyasasri R, Asekun OT, et al. Phytochemical study of *Piliostigma thonningii,* a medicinal plant grown in Nigeria. Med Chem Res. 2018;27:2325–30.
118. Pereus D, Otieno JN, Ghorbani A, et al. Diversity of *Hypoxis* species used in ethnomedicine in Tanzania. S Afr J Bot. 2019;122:336–41.
119. Van Wyk BE. The potential of South African plants in the development of new medicinal products. S Afr J Bot. 2011;77:812–29.
120. Clarkson C, Maharaj VJ, Crouch NR, et al. *In vitro* antiplasmodial activity of medicinal plants native to or naturalised in South Africa. J Ethnopharmacol. 2004;92:177–91.
121. Maroyi A. *Kirkia acuminata* Oliv. (Kirkiaceae): a review of its ethnobotany and pharmacology. Afr J Trad Complement Altern Med. 2017;14:217–26.
122. Mmushi TJ, Masoko P, Mdee LK, Mokgotho MP, Mampuru LJ, Howard RL. Antimycobacterial evaluation of fifteen medicinal plants in South Africa. Afr J Tradit Complement Altern Med. 2010;7(1):34–9.
123. Kamal N, Mio Asni NS, Rozlan INA, et al. Traditional medicinal uses, phytochemistry, biological properties, and health applications of *Vitex* sp. Plants. 2022;11(15):1944.
124. Islam Z, Caldeira GI, Caniça M, et al. *Vitex* genus as a source of antimicrobial agents. Plants. 2024;13(3):401.
125. Aremu AO, Moyo M. Health benefits and biological activities of spiny monkey orange (*Strychnos spinosa* Lam.): an African indigenous fruit tree. J Ethnopharmacol. 2022;283:114704.
126. Achika JI, Ayo RG, Khan EM, Shehu A. Identification of antioxidant compounds from the stem bark fraction of *Strychnos innocua* Del. J Agric Food Res. 2023;14:100833.
127. Uttu AJ, Sallau MS, Iyun ORA, Ibrahim H. *In vitro* antimicrobial studies of some major bioactive compounds isolated from *Strychnos innocua* (Delile) root bark. Steroids. 2023;195:109241.
128. Oboh MO, Osunsanmi FO, Zharare GE, et al. *In vitro* antioxidant and antidiabetic potential of crude extracts from the seed coat and fruit pulp of *Strychnos madagascariensis*. Pharmacogn J. 2020;12:1504–11.
129. Silva ML, Rita K, Bernardo MA, et al. *Adansonia digitata* L. (baobab) bioactive compounds, biological activities, and the potential effect on glycemia: a narrative review. Nutrients. 2023;15(9):2170.
130. Maroyi A. *Azanza garckeana* fruit tree: phytochemistry, pharmacology, nutritional and primary healthcare applications as herbal medicine. Res J Med Plant. 2017;11:115–23.
131. Alozieuwa UB, Lawal B, Sani S, et al. Luteolin-rich extract of *Thespesia garckeana* F. Hoffm. (Snot Apple) contains potential drug-like candidates and modulates glycemic and oxinflammatory aberrations in experimental animals. Oxid Med Cell Longev. 2022;2022:1215097.
132. Kudumela RG, Ramadwa TE, Mametja NM, Masebe TM. *Corchorus tridens* L.: a review of its botany, phytochemistry, nutritional content and pharmacological properties. Plants. 2024;13(8):1096.
133. Patel K, Kumar V, Pant V, Ravikumar R. Biological, nutritional, and therapeutic significance of *Grewia flavescens* Juss. Med Plants. 2023;15:636–44.
134. Jaspers WJMM, Bashir AK, Zwaving JH, Malingré TM. Investigation of *Grewia bicolor* Juss. J Ethnopharmacol. 1986;17:205–11.
135. Chinsembu KC. Ethnobotanical study of plants used in the management of HIV/AIDS-related diseases in livingstone, southern province, Zambia. Evid-Based Complement Altern Med. 2016;2016:4238625.
136. Aiyelero OM, Ibrahim ZG, Yaro A. Analgesic and anti-inflammatory properties of the methanol leaf extract of *Ficus ingens* (Moraceae) in rodents. Nig J Pharm Sci. 2009;8(2):79–86.
137. Gbonjubola OA, Claire-Lorentz EO, Nonyelum OO, Joseph OE. Preliminary *in-vitro* antibacterial activities of ethanolic extracts of *Ficus sycomorus* Linn. and *Ficus platyphylla* Del. (Moraceae). Afr J Microbiol Res. 2010;4:598–601.
138. Kou X, Li B, Olayanju JB, et al. Nutraceutical or pharmacological potential of *Moringa oleifera* Lam. Nutrients. 2018;10(3):343.
139. Pareek A, Pant M, Gupta MM, et al. *Moringa oleifera*: an updated comprehensive review of its pharmacological activities, ethnomedicinal, phytopharmaceutical formulation, clinical, phytochemical, and toxicological aspects. Int J Mol Sci. 2023;24(3):2098.
140. Chandorkar N, Tambe S, Amin P, Madankar C. A systematic and comprehensive review on current understanding of the pharmacological actions, molecular mechanisms, and clinical implications of the genus *Eucalyptus*. Phytomed Plus. 2021;1(4):100089.
141. Gutiérrez RMP, Mitchell S, Solis RV. *Psidium guajava*: a review of its traditional uses, phytochemistry and pharmacology. J Ethnopharmacol. 2008;117:1–27.
142. Daswani PG, Gholkar MS, Birdi TJ. *Psidium guajava*: a single plant for multiple health problems of rural Indian population. Pharmacogn Rev. 2017;11:167–74.
143. Sobral-Souza CE, Silva ARP, Leite NF, et al. *Psidium guajava* bioactive product chemical analysis and heavy metal toxicity reduction. Chemosphere. 2019;216:785–93.
144. Beidokhti MN, Eid HM, Villavicencio MLS, et al. Evaluation of the antidiabetic potential of *Psidium guajava* L. (Myrtaceae) using assays for α-glucosidase, α-amylase, muscle glucose uptake, liver glucose production, and triglyceride accumulation in adipocytes. J Ethnopharmacol. 2020;257:112877.
145. Amadike Ugbogu E, Emmanuel O, Ebubechi Uche M, et al. The ethnobotanical, phytochemistry and pharmacological activities of *Psidium guajava* L. Arab J Chem. 2022;15(5):103759.
146. Maroyi A. *Syzygium cordatum* Hochst. ex Krauss: an overview of its ethnobotany, phytochemistry and pharmacological properties. Molecules. 2018;23(5):1084.
147. Chinsembu KC. Bioprospecting for 'green diamonds': medicinal plants used in the management of HIV/AIDS-related conditions. In: Chinsembu KC, Cheikhyoussef A, Mumbengegwi DR, Kandawa-Schulz M, Kasanda CD, Kazembe L, editors. Indigenous knowledge of Namibia. Windhoek: University of Namibia Press; 2015. p. 9–40.
148. Makhafola TJ, McGaw LJ, Eloff JN. *In vitro* cytotoxicity and genotoxicity of five *Ochna* species (Ochnaceae) with excellent antibacterial activity. S Afr J Bot. 2014;91:9–13.
149. Maikai VA, Kobo PI, Maikai BVO. Antioxidant properties of *Ximenia americana*. Afr J Biotechnol. 2010;9:7744–6.
150. Shettar AK, Kotresha K, Kaliwal BB, Vedamurthy AB. Evaluation of *in vitro* antioxidant and anti-inflammatory activities of *Ximenia americana* extracts. Asian Pac J Trop Dis. 2015;5:918–23.
151. Maroyi A. *Ximenia caffra* Sond. (Ximeniaceae) in sub-Saharan Africa: a synthesis and review of its medicinal potential. J Ethnopharmacol. 2016;184:81–100.
152. Samie A, Tambani T, Harshfield E, et al. Antifungal activities of selected Venda medicinal plants against *Candida albicans, Candida krusei* and *Cryptococcus neoformans* isolated from South African AIDS patients. Afr J Biotechnol. 2010;9:2965–76.
153. Maroyi A. Utilization of *Bridelia mollis* as herbal medicine, nutraceutical and functional food in southern Africa. Trop J Pharm Res. 2019;18:203–9.
154. Bailly C. Traditional uses, pharmacology and phytochemistry of the medicinal plant *Flueggea virosa* (Roxb. ex Willd.) Royle. Future Pharmacol. 2024;4:77–102.
155. Samie A, Obi CL, Bessong PO, Namrita L. Activity profiles of fourteen selected medicinal plants from rural Venda communities in South Africa against fifteen clinical bacterial species. Afr J Biotechnol. 2005;4:1443–51.
156. Molotja GM, Ligavha-Mbelengwa MH, Bhat RB. Antifungal activity of root, bark, leaf and soil extracts of *Androstachys johnsonii* Prain. Afr J Biotechnol. 2011;10:5725–7.
157. Cheikhyoussef A, Maroyi A. Bird plum; *Berchemia discolor* (Klotzsch) Hemsl.: a review of its ethnobotany, phytochemistry and pharmacology. In: Neffati M, Najjaa H, Mathé A, editors. Medicinal and aromatic plants of the world: Africa, vol. 3. Leiden: Springer; 2017. p. 143–56.
158. Mongalo NI, Mashele SS, Makhafola TJ. *Ziziphus mucronata* Willd. (Rhamnaceae): it's botany, toxicity, phytochemistry and pharmacological activities. Heliyon. 2020;6(4):e03708.
159. Klimek-szczykutowicz M, Szopa A, Ekiert H. *Citrus limon* (Lemon) phenomenon: a review of the chemistry, pharmacological properties, applications in the modern pharmaceutical, food, and cosmetics industries, and biotechnological studies. Plants. 2020;9(1):119.
160. Del Río JA, Fuster MD, Gómez P, et al. *Citrus limon*: a source of flavonoids of pharmaceutical interest. Food Chem. 2004;84:457–61.
161. Mahlangu SG, Serepa-Dlamini MH. First report of bacterial endophytes from the leaves of *Pellaea calomelanos* in South Africa. S Afr J Sci. 2018;114(9/10):#4235.

162. Zhang W, Pan X, Fu J, et al. Phytochemicals derived from *Nicotiana tabacum* L. plant contribute to pharmaceutical development. Front Pharmacol. 2024;15:1372456.
163. Kazmi I, Rahman M, Afzal M, et al. Anti-diabetic potential of ursolic acid stearoyl glucoside: a new triterpenic gycosidic ester from *Lantana camara*. Fitoterapia. 2012;83:142–6.
164. Maroyi A. *Lippia javanica* (Burm. F.) Spreng: traditional and commercial uses, phytochemical and pharmacological significance. Evid-Based Complement Altern Med. 2017;2017:6746071.
165. Mfengu MOM, Shauli M, Engwa GA, et al. *Lippia javanica* (zumbani) herbal tea infusion attenuates allergic airway inflammation via inhibition of Th2 cell activation and suppression of oxidative stress. BMC Complement Med Ther. 2021;21(1):192.
166. Koné WM, Kamanzi Atindehou K, Terreaux C, et al. Traditional medicine in North Côte-d'Ivoire: screening of 50 medicinal plants for antibacterial activity. J Ethnopharmacol. 2004;93:43–9.
167. Malhotra S, Singh AP. Medicinal properties of ginger (*Zingiber officinale* Rosc.). Nat Prod Res. 2003;2:296–301.
168. Ali BH, Blunden G, Tanira MO, Nemmar A. Some phytochemical, pharmacological and toxicological properties of ginger (*Zingiber officinale* Roscoe): a review of recent research. Food Chem Toxicol. 2008;46:409–20.
169. Asogwa IS, Ibrahim AN, Agbaka JI. African baobab: Its role in enhancing nutrition, health, and the environment. Trees For People. 2021;3:100043.
170. Boyer P. Religion explained: the evolutionary origins of religious thought. New York: Basic Books; 2001.
171. Guthrie SE. Faces in the clouds: a new theory of religion. Oxford: Oxford University Press; 1993.
172. Nadasdy P. The gift in the animal: the ontology of hunting and human-animal sociality. Am Ethnol. 2007;34(1):25–43.
173. Ingold T. The perception of the environment: essays on livelihood, dwelling and skill. London: Routledge; 2000.
174. Tylor EB. Primitive culture: researches into the development of mythology, philosophy, religion, art, and custom. London: John Murray; 1871.
175. Schultes RE, Hofmann A, Rätsch C. Plants of the gods: their sacred, healing, and hallucinogenic powers. Vermont: Inner Traditions; 2001.
176. Descola P. Beyond nature and culture. Chicago: University of Chicago Press; 2013.
177. Green J, Hankinson P, de Waal L, et al. Wildlife trade for belief-based use: insights from traditional healers in South Africa. Front Ecol Evol. 2022;10:906398.
178. Atanasov AG, Waltenberger B, Pferschy-Wenzig EM, et al. Discovery and resupply of pharmacologically active plant-derived natural products: a review. Biotechnol Adv. 2015;33:1582–614.
179. Chaachouay N, Zidane L. Plant-derived natural products: a source for drug discovery and development. Drugs Drug Candidates. 2024;3:184–207.
180. Yaa N-B. Indirect contribution of wildlife to food security. In: Wildlife and food security in Africa. Rome: FAO; 1997.
181. Vats R, Thomas S. A study on use of animals as traditional medicine by Sukuma tribe of Busega District in North-western Tanzania. J Ethnobiol Ethnomed. 2015;11:38.
182. Cyrille-Joseph AA, Ouattara S, Blaise K, Roger KY. Some uses of the African buffalo *Syncerus caffer* (sparrman, 1779) by the populations living around the Comoé National Park (North-East Ivory Coast). J Anim Pl Sci. 2021;47:8484–96.
183. Baiyewu AO, Boakye MK, Kotzé A, et al. Ethnozoological survey of traditional uses of Temminck's ground pangolin (*Smutsia temminckii*) in South Africa. Soc Anim. 2018;26:306–25.

Publisher's Note