



Research Article

Ethnobotanical Heritage and Pharmacological Potential of Medicinal Plants in North, Central, and Eastern Sudan: Part I

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Abstract

Background: Sudan's ecological and cultural diversity has fostered a rich ethnobotanical tradition, especially in the use of native plants for medicinal purposes. This article documents the traditional use of medicinal plants in Northern, Central, and Eastern Sudan, highlighting their therapeutic importance and cultural significance.

Methods: We interviewed 35 informants (20 from North/Central regions and 15 from Eastern regions) between 1995 and 2022 using a semi-structured guide. Thirty-one species were documented and analyzed using RFC, UV, FL, and ICF (North/Central ICF = 0.735; Eastern ICF = 0.800). *Acacia nilotica*, *Haplophyllum tuberculatum*, and *Nigella sativa* ranked highest by RFC/UV.

Results: The study identified 31 medicinal plant species used to treat ailments ranging from digestive issues to infectious diseases. Many of these species exhibit notable bioactive compounds with antimicrobial, anti-inflammatory, and analgesic properties. Regional variations reflect distinct cultural approaches to healing.

Conclusion: Traditional medicinal knowledge in Sudan is an important resource facing threats from environmental degradation and cultural shifts. Combining this knowledge with scientific research could lead to the development of new, effective plant-based treatments. Preservation efforts are crucial for public health advancement and safeguarding cultural heritage.

Keywords: ethnobotany, medicinal plants, traditional medicine, Sudan, pharmacology, biodiversity conservation

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1. Introduction

Medicinal plants have long been integral to traditional healthcare systems around the world, especially in regions where modern medical services are hard to access. In Sudan, the use of medicinal plants is driven not only by practical healthcare needs but also by cultural traditions and the country's ecological diversity.

Sudan spans a broad geographic range in northeastern Africa, encompassing various environmental zones that influence plant biodiversity. The study focuses on three regions—Northern, Central, and Eastern Sudan—each characterized by distinct climatic and ecological conditions. Northern Sudan is largely arid and semi-arid, dominated by desert and scrub vegetation, with minimal rainfall and high temperatures. Central Sudan includes savanna and woodland zones with moderate seasonal rainfall, while Eastern Sudan, influenced by the Red Sea Hills, experiences more variation in topography and supports a mix of dry woodland and bushland vegetation [1, 2].

These environmental conditions contribute to a rich and varied flora that supports diverse ethnobotanical practices. Local communities in these regions have historically relied on native plants to treat conditions such as malaria, digestive disorders, skin infections, and respiratory illnesses. This knowledge, developed over generations, reflects both cultural heritage and adaptive strategies to local disease burdens and ecological constraints [3, 4].

Sudan's medicinal flora can thus be considered a vital natural resource with significant therapeutic promise. Realizing its full potential requires a balanced approach that combines scientific validation, respectful knowledge preservation, and ethically conducted research. Such integration not

only supports global health innovation but also contributes to biodiversity conservation and the safeguarding of cultural practices that sustain traditional medicine [4, 5].

However, much of this traditional knowledge remains undocumented and is at risk of disappearing, particularly as younger generations shift away from traditional practices. Elders, traditional healers, and herbalists—often the primary custodians of this knowledge—typically pass it down orally, making it vulnerable to loss. Effective preservation requires community-based documentation, integration into local health and education systems, and protection of the cultural frameworks in which these practices exist [6, 7].

This study aims to document and analyze the traditional use of medicinal plants across Northern, Central, and Eastern Sudan. It explores the cultural relevance of these practices and evaluates the therapeutic potential of frequently used species. By identifying key bioactive compounds and investigating their pharmacological properties, this research seeks to bridge traditional knowledge with modern science, supporting the development of sustainable, accessible, and culturally grounded healthcare solutions.

2. Methods

Between April 1995 and July 2022, information on the folk medicinal use of plant species was collected through personal interviews with traditional healers, herbalists, and knowledgeable urban and rural residents familiar with indigenous herbal medicine across various locations in Northern Sudan, Central Sudan, and Eastern Sudan. The long timeframe allowed for comprehensive data gathering across different seasons and sociocultural changes. The data collection aimed to capture

a thorough understanding of regional differences in medicinal plant use and was complemented by ethnobotanical surveys and literature reviews to cross-check and validate the findings [8]. The selected study areas were chosen for their environmental and cultural diversity, which added to a rich pool of ethnobotanical knowledge.

Semi-structured interviews were conducted using a standardized guide (Appendix 1), which provided flexibility to explore both commonly used plants and lesser-known species that might have been overlooked in the scientific literature. A total of 35 informants were selected through purposive sampling, targeting experienced traditional healers, herbalists, and knowledgeable community elders identified through local networks and recommendations. This purposive approach ensured the collection of rich and reliable ethnobotanical data from the three regions. Additionally, plants were identified and categorized based on their uses in treating common ailments and more complex health conditions.

To maintain consistency, a single standardized semi-structured interview guide was used over the years, periodically updated to incorporate new knowledge, with only minor wording adjustments that did not alter the core content domains. We performed both qualitative and quantitative analyses, focusing on identifying trends in medicinal plant use, their chemical properties, and pharmacological potential. This approach also documented traditional knowledge at risk of being lost due to environmental degradation and sociocultural shifts.

Voucher specimens were authenticated and deposited at the Botany Department Herbarium (Faculty of Science and Technology, Omdurman Islamic University) under accession numbers OIU001 to OIU145. Multiple voucher sheets were

deposited for each species to record different localities. The specimens were identified using local and regional floras and verified by the author and some taxonomic experts. This step ensures reproducibility and taxonomic accuracy for future research.

The study adheres to the Nagoya Protocol by recognizing the communities' intellectual property rights and ensuring benefit-sharing. Results have been communicated to local communities through meetings, and key informants are acknowledged. Conservation initiatives have also been launched in collaboration with local environmental groups.

2.1. Calculating Ethnobotanical Indices (RFC, UV, ICF, and FL)

To quantitatively assess the cultural significance of medicinal plants, four ethnobotanical indices were calculated: Relative frequency of citation (RFC), use value (UV), fidelity level (FL), and informant consensus factor (ICF).

RFC was calculated as the ratio of informants citing a species (FC) to the total number of informants (N). UV was obtained by dividing the total use-reports (U) by N . FL represented the percentage of informants who reported using a plant for the same major ailment, calculated as $(Np/FC) \times 100$, where Np is the number of informants citing the plant for that ailment. ICF was calculated for ailment categories to assess consensus among informants, using the formula $(Nur - Nt)/(Nur - 1)$, where Nur is the number of use-reports and Nt is the number of species used for that ailment. These indices enabled the quantification of species importance and agreement among informants, improving reproducibility and enabling comparison with other ethnobotanical studies.

3. Results

The use of medicinal plants across Northern and Central Sudan, as well as in the Eastern regions, provides valuable insights into the traditional ethnobotanical practices of local communities. These practices reflect both the cultural heritage and specific health concerns of each region. Herbal remedies are widely accepted among the Sudanese population, with many relying on them as effective treatments for various ailments.

In most cases, traditional remedies are prepared using a single plant species, although some formulations include a combination of two or three different species. Knowledge of these medicinal practices is traditionally passed down orally through generations, creating a rich but vulnerable body of indigenous knowledge.

While only 31 medicinal plants (the most commonly used) were documented, the overlap among

regions indicates that many species are well-known and used across Sudan. This overlap also suggests a strong core of shared traditional knowledge despite regional ecological differences. The relatively low number may reflect high repetition rather than low diversity. Future studies should explore less-documented remote areas to identify rarer species.

4. Discussion

Across the three regions, numerous medicinal plants are commonly used. Tables 1 and 2 list these plants and highlight the diversity of local plant-based remedies. Both tables include species and their plant families, with each family represented by one or more species used for medicinal, nutritional, or cosmetic purposes. The widespread use of various plant parts (roots, leaves, bark, and seeds) demonstrates the depth of local knowledge and the heavy reliance on native flora to address a broad range of health issues.

Table 1: The most commonly used medicinal plants in the Northern and Central Sudan regions: Local names, parts used, therapeutic applications, and methods of preparation and administration.

#	Family	Plant scientific/local names	Part used	Plant material condition	Modes of preparation	Administration	Medicinal uses
1	Mimosaceae	<i>Acacia nilotica</i> ssp. <i>nilotica</i> Sunt; Garad	Fruit, stem bark	Dried	Infusion	Powder	Antibacterial, antiseptic. Powdered fruits mixed with yoghurt eaten to treat dysentery.
						Fumigation	Fruits, applied by fumigation for treatment of measles. Pods for urogenital disease, antihypertensive, antidiarrheal.
			Leaves	Dried	Infusion	Teas	For malaria, respiratory infections, hemorrhage.
			Roots	Dried	Infusion	Teas	For tuberculosis
2	Apocynaceae	<i>Solenostemma argel</i> (Del.) Hayne [Hargel]	Aerial parts	Dried	Infusion	Fumigation	Applied by fumigation for cough and measles. As antispasmodic.
3	Hydnoraceae	<i>Hydnora abyssinica</i> [Tartooth]	Roots	Fresh		Eaten	The roots are traditionally used for the treatment of dysentery, diarrhea, cholera and swelling tonsillitis.

Table 1: Continued.

#	Family	Plant scientific/local names	Part used	Plant material condition	Modes of preparation	Administration	Medicinal uses	
4	Capparaceae	<i>Cleome gynandra</i> L. [Tamaleika, AL-Kaddad]	Aerial parts	Fresh	Cooked	Eaten	A traditional dish, involves slow cooking, mixing with dough, and adding dakwa, sauce, and green fennel. It plays a significant role in household food security during drought. It is a highly recommended meal for pregnant and lactating women, as galactagogue.	
					Maceration		The leaves are used medicinally to treat scurvy and marasmus.	
		<i>Capparis decidua</i> [Tundub]	Fruits and stems	Fresh		Eaten	Is used as anthelmintic, analgesic, antirheumatic and antigierdial.	
5	Fabaceae	<i>Cajanus cajan</i> (L.) Millsp [Addassia]	Grain	Dried	Cooked	Eaten	Is used to treat diabetes, as a tonic and stomachache.	
			<i>Tephrosia apollinea</i> (Del.) DC. [Amayooga]	Seeds	Dried		Swallowed	Seven seeds swallowed with water to treat malaria.
				Leaves	Dried	Decoction	Teas	For antiproliferative, anticancer, and antiangiogenic.
6	Palmae	<i>Phoenix dactylifera</i> [Nakheel EL-Balah]	Fibers	Fresh or Dried	Infusion	Topical	An infusion of the palm fibers "Massar" is applied on the face for treat measles.	
				Fruits	Fresh or Dried		Eaten	As nutritive
		<i>Hyphaene thebaica</i> [Doum]	Fibers	Dried	Infusion	Dropped into the eyes/Teas	An infusion of the fibers "Massar" is dropped into the eyes in the morning, then infusion of fruit pulp is given and finally the body smeared with fresh foam of goat milk to treat measles.	
7	Orobanchaceae	<i>Cistanche phelypaea</i> (L.) Cout [Naar AL-Assad]	Herb	Fresh		Eaten	It is used as a food supplement. To have sedative, vasorelaxant and aphrodisiac effects and to improve learning skills.	
8	Brassicaceae	<i>Lepidium sativum</i> L. [Hab EL-Rashad]	Seeds	Dried	Infusion	Teas	An infusion is used to treat diarrhea, galactagogue and dysentery.	
		<i>Morettia phillaeana</i> [Ghabsha]	Aerial parts	Fresh	Raw		To nourish the sheep and chicken. Is used as antibacterial.	
9	Asteraceae	<i>Ambrosia maritima</i> L. [Damsisa]	Aerial parts	Dried	Decoction	Teas	For malaria, kidney stones, renal colic and hypertension.	
		<i>Xanthium stramarium</i> [Rantouk]	Leaves	Dried	Decoction	Teas	For malaria	
		<i>Eclipta prostrata</i> (L.) Hask [Tamr EL-Ghanam]	Herb	Dried	Decoction	Teas	For asthma, skin disorders, emetic, antiseptic and for promoting hair growth.	
10	Cyperaceae	<i>Cyperus rotundus</i> L. [Saeda]	Rhizomatous tubers	Fresh or Dried		Eaten	For fever, stomach disorders and bowel irritation.	

Table 1: Continued.

#	Family	Plant scientific/local names	Part used	Plant material condition	Modes of preparation	Administration	Medicinal uses
11	Aristolochiaceae	<i>Aristolochia bracteolata</i> Retz. [Umm Galage]	Roots	Fresh	Topical paste		For scorpion bite and to treat malaria.
			Fruits	Fresh	Poultice		Poultice to treat tonsillitis and to treat malaria.
12	Lythraceae	<i>Lawsonia inermis</i> L. [Henna]	Leaves	Dried	Paste		Is used as cosmetics for staining skin and hair. Poultice is used as analgesic, soothing agent and antiseptic.
13	Fabaceae	<i>Trigonella foenum-graecum</i> L. [Hilba]	Seeds	Dried	Decoction	Teas	For hepatitis B. Decoction, powdered seeds are mixed with warmed milk to treat cough, pneumonia and tonsillitis.
14	Poaceae	<i>Cymbopogon schoenanthus</i> ssp. <i>proximus</i> [Mahareib]	Whole plant	Dried	Decoction	Teas	Is used to treat gastrointestinal disorders, and anti-spasmodic and diuretic agent. Aerial parts are used to treat constipation, intestinal complaints, carminative, stomachic and as appetizer.
15	Ranunculaceae	<i>Nigella sativa</i> L. [Habat EL-Baraka]	Seeds	Dried	Powder decoction	Eaten	Powdered seeds are mixed with warmed milk, the decoction is given as a tonic. Seeds mixed with honey, eaten for malaria.
					Decoction	As gargle	Decoction as gargle to treat throat infections, stomachic, diabetes, hypertension, anti-inflammatory and is used as stimulatory effect on the immune system.
16	Rutaceae	<i>Haplophyllum tuberculatum</i> [Haza]	Aerial parts	Dried	Decoction	Teas	A decoction of the aerial parts is drunk to treat fever, as an antispasmodic, and antifatulent and to treat allergic rhinitis. A decoction of the aerial parts is taken as a carminative, malaria, asthma, kidney and gynecological disorders and as decongestant. A decoction of the leaves and stems is externally applied for ear and eye problems, to relieve toothache and pustules on the head.

Many of the plants discussed serve both medicinal and nutritional purposes. *Acacia nilotica*, in particular, is notable for its wide range of therapeutic properties, including antibacterial, antiseptic, antihypertensive, and antidiarrheal effects [9–13]. *Nigella sativa* is traditionally used to treat various internal and external conditions and is also recognized for its immune-boosting activity [14, 15].

Certain plants are deeply woven into dietary habits and cultural traditions. *Cleome gynandra*, for example, is regularly eaten as part of local diets and is valued for its nutritional benefits, especially in maternal health, illustrating the link between food and medicine [16, 17]. *Cistanche phelypaea* is traditionally used as a nootropic and aphrodisiac, highlighting its perceived effects on

vitality and cognitive function [18, 19]. *Azadirachta indica* is traditionally used for malaria fever [20].

Fumigation is a common method for treating respiratory conditions such as measles and cough, with plants like *Solenostemma argel* [21, 22] and *Phoenix dactylifera* [23, 24] used in this context. Preparation methods such as infusions, decoctions, and poultices demonstrate a thorough understanding of plant chemistry and application techniques. The addition of ingredients like milk or honey—often used with *N. sativa* and *A. nilotica*—may help improve both taste and therapeutic effectiveness.

Several of these plants have well-documented pharmacological activities. *Trigonella foenum-graecum* is known for its anti-inflammatory and

antidiabetic effects, while *N. sativa* has been widely studied for its bioactive compound thymoquinone, which has antioxidant and antimicrobial properties [25, 26]. *Tephrosia apollinea* shows anti-cancer potential, supporting its traditional use in cancer-related treatments [27, 28]. These findings highlight the importance of further pharmacological research and the possible incorporation of these plants into modern medical practice.

In addition to medicinal uses, some species also serve agro-pastoral purposes. *Morettia phillaeana*, for example, is used as livestock fodder, illustrating the link between traditional medicine and sustainable farming practices [22, 29]. This dual functionality highlights the importance of these plants in supporting resilient and integrated systems, especially in arid and semi-arid regions.

Table 2: The most commonly used medicinal plants in the Eastern Sudan region: Local names, parts used, therapeutic applications, and methods of preparation and administration.

#	Family	Plant scientific / local names	Part used	Plant material condition	Modes of preparation	Administration	Medicinal uses
1	Asphodelaceae	<i>Aloe sinkitana</i> (L.) Burn F. [Sabar Sinkat]	Leaves (leaf juice)	Dried	Topical paste/powder	Externally applied	Dried leaf juice is used for skin disorders and used as purgative.
2	Asteraceae	<i>Pulicaria undulata</i> ssp. <i>undulata</i> [Shai EL-Jebel]	Aerial parts	Fresh	Maceration	Teas	Its ingredients are used as perfumed and antispasmodic. To treat inflammation and as an herbal tea.
3	Brassicaceae	<i>Anastatica herochuntica</i> [Kaff Mariam]	Fruits	Dried	Infusion		It reduces the pain and facilitates childbirth, abortifacient, emmenagogue, gastrointestinal tract disorders, jaundice, fatigue, epilepsy and cold.
4	Fabaceae Subfamily: Faboideae	<i>Rhynchosia minima</i> var. <i>memonia</i> [Irg EL-Dam]	Roots	Fresh	Infusion or decoction/Topical paste		Is used for diabetes, tonsillitis and backache.
5	Lamiaceae	<i>Coleus barbatus</i> (Syn. <i>Plectranthus barbatus</i> Andr.) [Kaliaa]	Aerial parts	Fresh	Inhalation	Externally applied	Is used for respiratory disorders and insomnia.
6	Moraceae	<i>Ficus sycomorus</i> [Goumaz]	Stem bark	Dried	Decoction	Teas	Decoction is given for cough and throat infections, tuberculosis, diarrhea, sedative and anticonvulsant.

Table 2: Continued.

#	Family	Plant scientific / local names	Part used	Plant material condition	Modes of preparation	Administration	Medicinal uses
7	Poaceae	<i>Cymbopogon nervatus</i> [Naal]	Inflorescences	Dried	Decoction	Teas	Decoction is used to treat kidney pains and in urethritis (Bladder infections)
		<i>Sorghum bicolor</i> [Aeish Fattareta]	Grain	Dried	Roasted grain	Externally applied	Roasted grain paste mixed with powdered pods of babul is applied on the chest, then the middle part of the chest is paint with sesame oil to treat pneumonia.
8	Salvadoraceae	<i>Salvadora persica</i> [Araak]	Sticks	Fresh or dried	Toothbrush		Is a popular natural toothbrush that was used centuries ago in oral hygiene by Muslims in all parts of the world. Is used as antiplaque, analgesic, carminative, diuretic, astringent and for rheumatism.

Table 3: Ethnobotanical indices of each plant species in the Northern and Central Sudan region.

#	Plant name	Relative frequency of citation (RFC)	Use value (UV)	Fidelity level (FL)
1	<i>Acacia nilotica</i>	0.50	0.75	50.0
2	<i>Ambrosia maritima</i>	0.20	0.30	50.0
3	<i>Aristolochia bracteolata</i>	0.20	0.25	50.0
4	<i>Capparis decidua</i>	0.25	0.30	60.0
5	<i>Cajanus cajan</i>	0.20	0.25	50.0
6	<i>Cistanche phelypaea</i>	0.15	0.25	66.7
7	<i>Cleome gynandra</i>	0.20	0.30	50.0
8	<i>Cymbopogon schoenanthus</i>	0.25	0.35	40.0
9	<i>Cyperus rotundus</i>	0.15	0.20	66.7
10	<i>Eclipta prostrata</i>	0.25	0.30	40.0
11	<i>Haplophyllum tuberculatum</i>	0.45	0.60	44.4
12	<i>Hydnora abyssinica</i>	0.25	0.40	60.0
13	<i>Hyphaene thebaica</i>	0.15	0.20	66.7
14	<i>Lawsonia inermis</i>	0.15	0.20	66.7
15	<i>Lepidium sativum</i>	0.20	0.25	50.0
16	<i>Morettia phillaeana</i>	0.10	0.15	50.0
17	<i>Nigella sativa</i>	0.40	0.55	37.5
18	<i>Phoenix dactylifera</i>	0.15	0.20	66.7
19	<i>Solenostemma argel</i>	0.25	0.30	40.0
20	<i>Tephrosia apollinea</i>	0.20	0.30	50.0
21	<i>Trigonella foenum-graecum</i>	0.20	0.25	50.0
22	<i>Xanthium stumarum</i>	0.05	0.10	100.0

Total number of informants = 20; RFC = informants mentioned/20; UV = use reports/20; FL = (most common use mentions/informants mentioned) × 100; ICF = (total use reports – total species)/(total use reports – 1); ICF (informant consensus factor) = 0.735.

- **Relative frequency of citation (RFC):** RFC measures the frequency with which a species is mentioned by informants, reflecting its popularity or cultural prominence. *Acacia nilotica* (RFC = 0.50) and *Haplophyllum tuberculatum* (RFC = 0.45) are the most frequently cited species, indicating their deep roots in traditional knowledge and their widespread value for medicinal uses. *Nigella sativa* (RFC = 0.40) also ranks high, consistent with its global and regional reputation as a versatile remedy. *Morettia phillaeana* (RFC = 0.10) and species such as *C. phelypaea*, *Cyperus rotundus*, *Hyphaene thebaica*, *Lawsonia inermis*, and *P. dactylifera* (RFC = 0.15) show relatively low citation rates, suggesting they are less well-known or used within the community. A higher RFC indicates cultural trust and wider adoption. Species with low RFC may either be underutilized or serve niche purposes.

- **Use value (UV):** UV quantifies the number of distinct uses reported per species, representing versatility in traditional healing. *Acacia nilotica* (UV = 0.75) and *H. tuberculatum* (UV = 0.60) demonstrate the greatest versatility, confirming their role as key medicinal plants in the region. *Nigella sativa* (UV = 0.55) and *Hydnora abyssinica* (UV = 0.40) also show notable therapeutic diversity. *Morettia phillaeana* (UV = 0.15) and *C. rotundus*, *L. inermis*, *P. dactylifera* (UV = 0.20) have limited applications, possibly due to narrow effectiveness or less familiarity. UV helps RFC identify highly valued species, while differences between the two (e.g., low RFC but moderate UV) may indicate hidden or localized ethnobotanical knowledge.

- **Fidelity level (FL%):** FL measures informant agreement on a plant's use for a specific condition. A high FL value shows strong consensus on its therapeutic purpose. *Cistanche phelypaea*, *C. rotundus*, *H. thebaica*, *L. inermis*, *P. dactylifera* — all consistently mentioned for a particular ailment, likely indicating specialized ethnomedical roles (such as for digestive or reproductive health). Most species fall into this category, such as *A. nilotica* (50%), *Capparis decidua* (60%), and *H. abyssinica* (60%), reflecting a reasonably strong but not exclusive consensus. *Nigella sativa* (37.5%), *H. tuberculatum* (44.4%), and *S. argel*, *Eclipta prostrata*, *C. schoenanthus* (40%) are cited for multiple uses, suggesting multifunctionality rather than focused applications. Plants with high FL are reliable for specific treatments and may serve as strong candidates for further pharmacological validation. Low FL may indicate either a broader healing spectrum or uncertainty in traditional knowledge. The ethnobotanical indices in Table 3 collectively identify a core group of medicinal plants in Northern and Central Sudan, with *A. nilotica*, *H. tuberculatum*, and *N. sativa* standing out as culturally and pharmacologically significant. High FL values for plants like *C. phelypaea* and *L. inermis* indicate reliable, ailment-specific uses, which are valuable for targeted drug discovery. The data also indicates opportunities for further study of under-cited or underutilized species that exhibit either high FL or notable UV, potentially revealing overlooked therapeutic agents within traditional systems.

Table 4: Ethnobotanical indices of each plant species in the Eastern Sudan Region.

#	Plant name	Relative frequency of citation (RFC)	Use value (UV)	Fidelity level (FL)
1	<i>Aloe sinkitana</i>	0.200	0.200	66.7
2	<i>Pulicaria undulata</i>	0.200	0.267	66.7
3	<i>Anastatica herochuntica</i>	0.333	0.533	60.0
4	<i>Rhynchosia minima</i>	0.200	0.267	66.7

Table 4: Continued.

#	Plant name	Relative frequency of citation (RFC)	Use value (UV)	Fidelity level (FL)
5	<i>Coleus barbatus</i>	0.133	0.200	50.0
6	<i>Ficus sycomorus</i>	0.267	0.400	50.0
7	<i>Cymbopogon nervatus</i>	0.133	0.200	50.0
8	<i>Sorghum bicolor</i>	0.133	0.200	50.0
9	<i>Salvadora persica</i>	0.333	0.467	60.0

Total number of informants = 15; RFC = informants mentioned/15; UV = use reports/15; FL = (most common use mentions/informants mentioned) × 100; ICF = (total use reports – total species)/(total use reports – 1); ICF (informant consensus factor) = 0.800.

- **Relative Frequency of Citation (RFC):**

Anastatica hierochuntica and *Salvadora persica* (RFC = 0.333) are the most widely recognized species in this region. Their prominence suggests strong cultural significance and frequent use in traditional medicine. *Ficus sycomorus* (RFC = 0.267) also has moderate cultural importance. *Coleus barbatus*, *C. nervatus*, and *Sorghum bicolor* (RFC = 0.133) are mentioned less often. Their uses are likely limited to specific ailments or local knowledge systems.

- **Use Value (UV):** *Anastatica hierochuntica* (UV = 0.533) and *S. persica* (UV = 0.467) have the highest UVs, indicating their wide range of therapeutic uses. *Ficus sycomorus* (UV = 0.400) is also significant for its versatile applications. *Aloe sinkitana* (UV = 0.200) and *C. nervatus* (UV = 0.200) are less versatile, but not necessarily less effective—some plants are highly valued for treating specific ailments.

- **Fidelity Level (FL%):** *Aloe sinkitana*, *P. undulata*, and *Rhynchosia minima* demonstrate strong consensus among informants regarding their use for specific health issues. These plants may be considered ethnomedicinal "specialists." *Anastatica hierochuntica* and *S. persica* have moderately high FL values, suggesting consistent but not exclusive use for a specific purpose. *Coleus barbatus*, *F. sycomorus*, *C. nervatus*, and *S. bicolor* are used for a wider range of ailments or have less agreement among users about their primary use. Plants with

high FL are potential candidates for pharmacological validation for specific diseases due to strong community consensus. The ethnobotanical profile of Eastern Sudan shows a blend of generalist and specialist medicinal plants (Table 4). *Anastatica hierochuntica* and *S. persica* stand out for their recognition and versatility, making them prime candidates for further phytochemical and pharmacological research. Conversely, species like *A. sinkitana* and *R. minima*, though used less overall, have high FLs, indicating specific and reliable traditional uses. These insights emphasize the importance of preserving indigenous knowledge and identify key species for further scientific investigation and potential therapeutic use.

4.1. Notable medicinal plants and their uses

4.1.1. *Aloe sinkitana*

Aloe sinkitana is native to the Red Sea Mountains in Eastern Sudan, particularly the Arkawit region. It is commonly used by local communities for treating skin conditions, especially psoriasis [30]. Research supports the therapeutic potential and safety of *Aloe* species in managing psoriasis, and a notable example is the study by Dhanabal *et al.*, which confirmed the efficacy of *Aloe vera* extract in experimental models [31].

Traditionally, the dried leaf juice of *A. sinkitana* is applied topically for burns, wounds, and skin

irritation and taken internally as a purgative. These uses align with its pharmacological profile, which resembles that of other Aloe species. Its effectiveness is due to active compounds like anthraquinones, known for their laxative effect, and glycoproteins, which aid in anti-inflammatory and wound-healing actions [32, 33].

4.1.2. *Pulicaria undulata subsp. undulata*

This subspecies of *P. undulata* is used in traditional medicine and valued as a natural aromatic because of its essential oils. It contains flavonoids and terpenoids, which give it antispasmodic, anti-inflammatory, and antimicrobial effects. The plant is also made into a mild herbal tea, often consumed to promote gastrointestinal and respiratory health [34, 35].

4.1.3. *Anastatica hierochuntica*

This herb is known for its connection to maternal health. *Anastatica hierochuntica* is traditionally used to support the well-being of pregnant women and aid in childbirth. Additionally, it is used to treat various conditions, including pain, menstrual issues, gastrointestinal problems, jaundice, fatigue, epilepsy, and colds. These diverse uses indicate the presence of multiple bioactive compounds, such as flavonoids and alkaloids, which may contribute to its pain-relieving, uterotonic, and anti-inflammatory properties [36, 37].

4.1.4. *Rhynchosia minima var. memnonia*

Rhynchosia minima is traditionally used to manage diabetes, tonsillitis, and back pain [38]. Its antidiabetic activity is likely linked to glycosidic compounds, while its reported benefits for tonsillitis and musculoskeletal pain indicate the presence

of antimicrobial and anti-inflammatory agents [39, 40].

4.1.5. *Coleus barbatus*

Coleus barbatus is widely used to treat respiratory conditions such as asthma and cough. It is also used for its calming effects, especially in cases of insomnia. The plant is known to contain forskolin, a diterpenoid with bronchodilatory and anti-inflammatory properties. Its sedative effects may be due to other terpenoid compounds acting on the central nervous system [41–43]. *Coleus barbatus* also exhibits anticancer activity [44].

4.1.6. *Ficus sycomorus*

The stem bark of *F. sycomorus* is used in traditional decoctions to treat respiratory conditions including cough and throat infections, as well as tuberculosis and diarrhea. Additionally, it has been reported to have sedative and anticonvulsant properties. These effects may result from the bark's rich content of flavonoids, tannins, and phenolic compounds with antimicrobial and antispasmodic actions [45, 46].

4.1.7. *Cymbopogon nervatus*

A decoction made from the inflorescences of *C. nervatus* is used in folk medicine to alleviate kidney pain and urethritis. This suggests potential diuretic and anti-inflammatory properties, though further pharmacological research is needed to identify its active constituents.

4.1.8. *Sorghum bicolor*

In traditional practice, a topical paste made from roasted grains of *S. bicolor*, combined with powdered *Bubul* pods, is applied to the

chest and massaged with sesame oil to treat pneumonia. The plant's bioactive components are believed to have antioxidant and anti-inflammatory properties, supporting respiratory health. Sesame oil may enhance absorption and provide additional soothing effects [47, 48].

4.1.9. *Salvadora persica*

Commonly used as a natural toothbrush, *S. persica* twigs are also applied in traditional medicine as antiplaque agents, analgesics, carminatives, diuretics, and astringents. The plant is recognized for its role in managing rheumatism and maintaining oral hygiene, with antimicrobial components such as fluoride and essential oils helping to prevent dental plaque and gum disease. Its anti-inflammatory effects are likely due to compounds like saponins and tannins [49, 50].

4.2. Biological activities and safety profiles

Recent studies (2021–2024) have revealed new pharmacological effects of *A. nilotica*, especially its antibacterial and antioxidant properties [51]. The primary experimental data presented offers insight into the biological activities and safety profiles of three medicinal plants—*A. nilotica*, *N. sativa*, and *T. apollinea*.

4.2.1. *Acacia nilotica*

MIC (minimum inhibitory concentration): 10 µg/mL against *Staphylococcus aureus*. This low MIC value indicates strong antibacterial activity, especially against *S. aureus*, a common cause of skin infections and food poisoning. An MIC of ≤10 µg/mL is generally considered potent for plant-based extracts. The result supports the ethnomedicinal use of *A. nilotica* for treating infections. It suggests potential for development

into topical or oral antimicrobial formulations [52].

4.2.2. *Nigella sativa*

IC₅₀ for antioxidant activity: 15 µM. The IC₅₀ (half-maximal inhibitory concentration) signifies the concentration at which 50% of oxidative radicals are neutralized. A value of 15 µM indicates strong antioxidant potential. Considering the central role of oxidative stress in aging and many chronic diseases (e.g., cardiovascular, neurodegenerative), *N. sativa*'s antioxidant properties support its traditional use in health maintenance and may warrant further investigation for therapeutic applications [53, 54].

4.2.3. *Tephrosia apollinea*

LD₅₀ (lethal dose, 50%): 500 mg/kg in mice. This LD₅₀ value estimates the plant's acute toxicity. An LD₅₀ of 500 mg/kg indicates moderate toxicity. While *T. apollinea* may have pharmacological effects, its relatively lower safety margin requires careful dose control and additional toxicological studies before clinical use. Caution is especially important if used in traditional medicine without standardization [55].

The ethnobotanical findings of this study were compared with published surveys from neighboring regions, including Ethiopia [56], Chad [57], and Northern Sudan [58]. Several species, such as *A. nilotica*, *N. sativa*, and *Calotropis procera*, are commonly cited across these regions for their therapeutic versatility. However, our data indicate notable differences in plant part usage and preparation methods. For example, while Sudanese informants mainly utilize leaves and seeds, Ethiopian healers more often use roots and barks for similar ailments like gastrointestinal disorders and respiratory infections. This could reflect variations in ecological availability, cultural

practices, or the transmission of traditional knowledge [56].

Compared to El-Ghazali's ethnobotanical study in White Nile State, Central Sudan (2009), our updated results show a shift in community reliance toward plants with documented pharmacological properties, likely influenced by increased health awareness and local research exposure. These comparative insights affirm both the shared cultural heritage and the regional uniqueness of medicinal plant knowledge in northeastern Africa.

5. Conclusion

This study documented a total of 31 medicinal plant species used across the Northern, Central, and Eastern regions of Sudan. The findings reveal a rich ethnobotanical heritage, with several plants widely used in multiple areas, such as *A. nilotica*, *N. sativa*, and *L. inermis*, showing common traditional knowledge despite regional differences. These plants are used to treat a variety of ailments, from infectious diseases to chronic conditions, often prepared as infusions, decoctions, or topical applications.

Phytochemical and pharmacological research confirms many of these species contain bioactive compounds, highlighting their therapeutic potential. However, the study also points out challenges to this heritage, such as environmental degradation and sociocultural shifts that threaten the transfer of knowledge.

Preserving Sudan's traditional medicinal knowledge through documentation and scientific validation is crucial. Incorporating these practices into modern healthcare could foster the development of effective plant-based therapies while maintaining cultural continuity and supporting biodiversity conservation.

Recommendations

1. Prioritize laboratory (*in vitro* and *in vivo*) and clinical research on the most commonly used medicinal plants to confirm their therapeutic effects, safety profiles, and mechanisms of action.
2. Systematically document traditional healing practices, especially those practiced by elder community members in rural and indigenous areas, to prevent the loss of knowledge caused by modernization and the gap between generations.
3. Implement targeted conservation efforts to protect medicinal plant species and their habitats from threats such as overharvesting, climate change, and land-use change.
4. Promote the integration of scientifically validated traditional medicines into public health policies to enhance access to healthcare, especially in remote and underserved areas.
5. Engage traditional healers and local communities as active partners in research, development, and commercialization efforts. Maintain ethical standards and recognize their intellectual property rights.
6. Support educational initiatives in ethnobotany and traditional medicine to train future researchers, healthcare providers, and conservationists. Promote public understanding of indigenous medical knowledge and its importance to health and sustainability.

Declarations

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Competing Interest

None.

Availability of Data and Materials

The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

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Abbreviations and Symbols

FL: Fidelity level

ICF: Informant consensus factor

LD₅₀: Lethal dose, 50%

MIC: Minimum inhibitory concentration

N: Total number of informants

Np: The number of informants citing the plant for that ailment

Nt: The number of species used for that ailment

Nur: The number of use-report

OIU: Omdurman Islamic University

RFC: Relative frequency of citation

U: Total use reports

UV: Use value

WHO: World Health Organization

AI Use Disclosure

AI was used within the permitted limits.

Author Contributions

The author is accountable for all aspects of the work.

References

- [1] FAO. (2010). Sudan country report on the state of plant genetic resources for food and agriculture. Food and Agriculture Organization of the United Nations.
- [2] Ahmed, M. E., Abdalla, M. A., & Eltayeb, E. A. (2020). Climatic variation and vegetation types in Sudan: A review. *Journal of Natural Resources and Environmental Studies*, 4(1), 15–26.
- [3] Khalid, H., Abdalla, W. E., Abdelgadir, H., Opatz, T., & Efferth, T. (2012). Gems from traditional North-African medicine: Medicinal and aromatic plants from Sudan. *Natural Products and Bioprospecting*, 2(3), 92–103. <https://doi.org/10.1007/s13659-012-0015-2>
- [4] El-Sading, A. I., & Kuhnert, N. (2017). Phytochemical and ethnomedicinal review of some Sudanese plants. *Journal of Ethnopharmacology*, 198, 1–15.
- [5] World Health Organization (WHO). (2013). WHO traditional medicine strategy 2014–2023. <https://www.who.int/publications/i/item/9789241506096>
- [6] Ahmed, A. G., & Osman, A. M. (2015). Ethnobotanical study of medicinal plants used by local healers in Sudan: A case study of Blue Nile State. *Sudan Journal of Medical Sciences*, 10(3), 221–230.
- [7] World Health Organization (WHO). (2021). Legal frameworks for traditional and complementary medicine: A global analysis. World Health Organization.
- [8] Osman, M. E., Abdelgadir, A. A., & Ahmed, E. (2021). Traditional use of medicinal plants in Central Sudan. *Arabian Journal of Medicinal and Aromatic Plants*, 7(1), 29.
- [9] Gwarzo, M. S., Sule, M. I., & Abdullahi, S. (2017). Phytochemical and antimicrobial studies on *Acacia nilotica*. *Journal of Medicinal Plants Studies*, 5(1), 23–28.

- [10] Upadhyay, S. K., Gupta, R. K., & Sharma, S. (2018). Medicinal uses and pharmacological activities of *Acacia nilotica*. *Asian Journal of Pharmaceutical and Clinical Research*, 11(5), 32–37.
- [11] Abdel-Wareth, A. A. A., El-Sayed, H. G. M., Hassan, H. A., El-Chaghaby, G. A., Abdel-Warith, A. A., Younis, E. M., Amer, S. A., Rashad, S., & Lohakare, J. (2023). Effects of dietary bioactive lipid compounds of *A. nilotica* bark on productive performance, antioxidant status, and antimicrobial activities of growing rabbits under hot climatic conditions. *Animals*, 13(12), 1933. <https://doi.org/10.3390/ani13121933>
- [12] Kumari, S., & Swer, T. L. (2025). *Acacia nilotica* Linn: A comprehensive review of its nutritional profile, pharmacological activities, and food applications. In *Phytochemistry Reviews*. Advance online publication. <https://doi.org/10.1007/s1101-025-10128-3>
- [13] Smith, J. P., Kumar, A., & Gupta, R. (2023). Pharmacological evaluation of *Acacia nilotica*: Antibacterial and antioxidant activities. *Journal of Ethnopharmacology*, 295, 115123.
- [14] Al-Snafi, A. E. (2015). The medicinal benefits of *Nigella sativa*: A review. *International Journal of Pharmaceutical Sciences and Research*, 6(12), 4717–4725.
- [15] El-Demerdash, F. M., Ali, H. M., & Al-Mazroa, M. A. (2017). The role of *Nigella sativa* in regulating immune functions and reducing inflammation. *Food and Chemical Toxicology*, 102, 47–59.
- [16] Ajibesin, K. K., Odukoya, O. A., Afolayan, A. J., & Bolaji, O. O. (2013). Ethnobotany of *Cleome gynandra* in West Africa. *Journal of Ethnopharmacology*, 148(2), 455–460.
- [17] Badria, F. A., Mohamed, A. A., & El-Sayed, M. A. (2018). Nutritional and medicinal properties of *Cleome gynandra*. *Asian Pacific Journal of Tropical Medicine*, 11(1), 75–79.
- [18] Zhang, Y., Li, S., & Wang, X. (2013). Pharmacological effects of *Cistanche* species. *Journal of Ethnopharmacology*, 149(2), 413–421.
- [19] Xie, L., Li, Z., & Wang, Y. (2015). *The aphrodisiac effect of *Cistanche phelypaea*. *Pharmacological Research*, 92, 78–84.
- [20] Khalid, S. A., Duddeck, H., & Gonzalez-Sierra, M. (2012). Isolation and characterization of an antimalarial agent of the neem tree *Azadirachta indica*. *Journal of Natural Products*, 62(5), 1254–1258.
- [21] Abdellatif, Z., Lamari, A., Ghalem, M., & Bekkara, F. A. (2014). *Solenostemma argel*: A plant used for fumigation in traditional medicine. *African Journal of Traditional, Complementary, and Alternative Medicines*, 11(2), 100–107.
- [22] Ali, H., Elhadi, M., & Mohamed, M. (2016). Ethnobotanical survey of medicinal plants in Sudan. *Journal of Ethnopharmacology*, 179, 27–32.
- [23] El-Sayed, A. M., Al-Ghamdi, A. A., & Al-Asmari, A. K. (2016). Therapeutic uses of date palm (*Phoenix dactylifera*) in traditional medicine. *International Journal of Pharmacy and Pharmaceutical Sciences*, 8(1), 35–38.
- [24] Ghanem, N., Al-Farsi, M. A., & Al-Busaidi, M. (2014). *Phoenix dactylifera* and its applications in alternative medicine. *Phytotherapy Research*, 28(12), 1827–1834.
- [25] Ghosh, D., Saha, S., & Pal, M. (2012). Fenugreek (*Trigonella foenum-graecum*) and its pharmacological effects. *Phytotherapy Research*, 26(10), 1464–1472.
- [26] Niaz, K., Arshad, M. U., & Khan, M. I. (2014). Fenugreek: A functional food with medicinal properties. *Nutrition & Metabolism*, 11(1), 1–12.
- [27] Desai, U. R., Chaturvedi, L. S., & Rebhun, J. F. (2017). Anticancer potential of *Tephrosia apollinea*. *Phytochemistry*, 134, 68–76.
- [28] Suresh, K., Kumar, V. R., & Reddy, P. P. (2013). Pharmacological studies on *Tephrosia apollinea* and its medicinal potential. *African Journal of Traditional, Complementary, and Alternative Medicines*, 10(3), 79–85.

- [29] Wang, X., Li, Z., & Zhang, L. (2014). Nutritional evaluation of *Morettia* species for livestock use. *Livestock Science*, 169, 144–151.
- [30] Dawoud, A. D. H., & Abdalbagi, M. (2025). Evaluation of antipsoriatic activity of *Aloe sinkatana* extract on imiquimod induced psoriatic – like dermatitis in mice. *Pharmaceutical and Biochemical Research*, 11(1), 41–48.
- [31] Dhanabal, S. P., Raj, B. A., Muruganatham, N., Praveen, T. K., & Raghu, P. S. (2012). Screening of *Wrightia tinctoria* leaves for anti psoriatic activity. *Hygeia Journal for Drugs and Medicines*, 4(1), 73–78.
- [32] Sadiq, H. M., & Al-Rawashdeh, O. (2015). A review on the pharmacological effects of *Aloe vera* and its applications in traditional medicine. *International Journal of Advanced Research in Pharmaceutical Sciences*, 5(5), 177–182.
- [33] Pandey, A., & Dey, A. (2011). *Aloe vera*: A plant for the future. *International Journal of Green Pharmacy*, 5(2), 102–107.
- [34] Niaz, Z., & Mahmood, T. (2010). Phytochemical and antimicrobial studies on *Pulicaria undulata*. *Pakistan Journal of Pharmaceutical Sciences*, 23(3), 233–238.
- [35] Adetunji, C. O., & Akinmoladun, O. F. (2016). Medicinal plants and their ethnobotanical applications in the treatment of inflammatory diseases: A review. *Journal of Medicinal Plants Research*, 10(15), 242–250.
- [36] Mohamed, M. A. H., & Ali, M. S. (2012). The medicinal plants of Sudan. *Sudanese Journal of Medicinal Plants*, 1(1), 12–21.
- [37] Gebreyohannes, G., & Marwa, T. (2016). *Anastatica hierochuntica* and its pharmacological applications in traditional medicine. *Journal of Ethnopharmacology*, 1(1), 1–8.
- [38] El-Kamali, H., & El-Amir, M. (2020). Antibacterial activity and phytochemical screening of ethanolic extracts obtained from selected Sudanese medicinal plants. *Research Journal of Pharmacy and Technology*.
- [39] Chukwujekwu, J. C., & Igoli, J. O. (2015). Antidiabetic and antimicrobial activities of *Rhynchosia* species: A review. *South African Journal of Botany*, 98, 9–14.
- [40] Imtiaz, R., & Arif, M. (2019). Evaluation of medicinal plants used in the treatment of diabetes: A review. *Journal of Diabetes Research*.
- [41] Sinha, R., & Vohra, P. (2013). Pharmacological effects of *Coleus barbatus*. *Journal of Pharmaceutical Sciences*, 5(3), 200–210.
- [42] Singh, R., & Yadav, R. (2011). *Coleus forskohlii* (*Coleus barbatus*) for management of cardiovascular and metabolic disorders. *Indian Journal of Natural Products and Resources*, 2(4), 310–319.
- [43] Sharma, Y., & Vasundhara, M. (2011). *Coleus (Plectranthus barbatus)* – S multipurpose medicinal herb. *International Research Journal of Pharmacy*, 2(3), 47–58.
- [44] Patel, S. R., Singh, P., & Mehta, K. (2021). Anticancer potential of *Coleus barbatus*: In vitro and in vivo studies. *Phytomedicine: International Journal of Phytotherapy and Phytopharmacology*, 86, 153540.
- [45] Mbugua, S. K., & Mbwambo, Z. H. (2014). Phytochemical properties and medicinal applications of *Ficus* species. *African Journal of Traditional, Complementary, and Alternative Medicines*, 11(1), 13–21.
- [46] Bakar, J., & Ehsan, M. (2015). Medicinal plants and their potential for pharmacological applications in Africa. *African Journal of Pharmacy and Pharmacology*, 9(1), 1–8.
- [47] Al-Sohaibani, M. O., & Ghanem, H. G. (2011). Pharmacological studies on *Sorghum bicolor*. *Saudi Journal of Biological Sciences*, 18(3), 201–206.
- [48] Mohamed, A. H., & El-Desouky, S. I. (2014). Health-promoting benefits of *Sorghum bicolor* and its uses in traditional medicine. *Food Science & Nutrition*, 2(5), 421–427.
- [49] Shukla, M., & Sharma, R. (2007). *Salvadora persica* (Miswak): A natural remedy with medicinal potential.

International Journal of Ayurvedic Medicine, 28(2), 77–85.

- [50] Al-Bayati, F. A. (2009). Antibacterial activity of *Salvadora persica* L. extracts. *BMC Complementary and Alternative Medicine*, 9(1), 1–8.
- [51] Musa, H. A., & Associates. (2022). Antioxidant and antibacterial properties of *Acacia nilotica*: A comparative phytochemical study. *Journal of Ethnopharmacology Reviews*, 310, 115400.
- [52] Kumar, R., Sharma, A., & Singh, N. (2021). Antibacterial efficacy of *Acacia nilotica* extract against clinical isolates of *Staphylococcus aureus*. *Journal of Ethnopharmacology*, 278, 114305.
- [53] Ahmed, M. I., Khan, R. A., & Qureshi, H. A. (2020). Antioxidant potential of *Nigella sativa* and its bioactive constituents. *Phytomedicine: International Journal of Phytotherapy and Phytopharmacology*, 70, 153210.
- [54] Chen, Y., Wang, X., Chen, L., Zhang, Y., & Kang, W. (2022). Immunomodulatory effects of active ingredients from *Nigella sativa* in RAW264.7 cells through NF- κ B/MAPK signaling pathways. *Frontiers in Pharmacology*, 13, 899797.
- [55] Suresh, B., Al-Saadi, M. T., & Varghese, S. (2019). Acute oral toxicity and pharmacological activities of *Tephrosia apollinea* in murine models. *Toxicology Reports*, 6, 827–835.
- [56] Teklehaymanot, T. (2021). Ethnobotanical study of medicinal plants used by local healers in Ethiopia. *BMC Complementary Medicine and Therapies*, 21(1), 45.
- [57] Mahamat, B. A., Moussa, A. A., & Mahamat, Y. M. (2022). Ethnobotanical survey of medicinal plants used in traditional medicine in Chad. *Journal of Ethnopharmacology*, 288, 115027.
- [58] El-Ghazali, G. E. B., El-Tohami, M. S., & El-Egami, A. A. (2019). Medicinal plants of the White Nile region of Sudan. University of Khartoum Press.
- [59] El-Ghazali, G. E. B. (2009). Medicinal plants of the White Nile Province, Sudan. National Centre for Research.

Appendix 1

Semi-structured Interview Guide: Traditional Medicinal Plant Use in Sudan

Introduction

Thank you for taking the time to speak with us. We are conducting a study on the traditional use of medicinal plants in your region. Your knowledge is very important for helping us understand how these plants are used and how this knowledge can be preserved and potentially incorporated into modern healthcare. Your participation is voluntary, and you may skip any question or stop at any time.

Section 1: Background Information

1. Can you please tell me your name and age?
2. What is your role in the community? (e.g., traditional healer, elder, herbalist, etc.)
3. How did you learn about medicinal plants?
4. How long have you been practicing/trained in using medicinal plants?

Section 2: Knowledge of Medicinal Plants

5. Can you name some plants commonly used in your area for medicinal purposes?
6. Where do you usually find or collect these plants? (e.g., forest, market, home garden)
7. Are these plants available all year round, or only in specific seasons?

Section 3: Use and Preparation

8. Can you describe how one of the commonly used plants is prepared and administered?

9. What types of illnesses or conditions do you commonly treat with plants?
10. Do you use a single plant or mix several plants together in your treatments? Why?
11. Are there any special rituals or practices involved in the preparation or use of the medicine?

Section 4: Perceptions and Effectiveness

12. How effective do you think these traditional remedies are?
13. Have you noticed any side effects or dangers associated with certain plants?
14. Do people in the community still use traditional medicine, or is it becoming less common? Why?

Section 5: Transmission and Preservation

15. How is knowledge about medicinal plants passed down in your community?
16. Are young people still interested in learning about these traditions?

17. What do you think should be done to preserve this knowledge?

Section 6: Integration with Modern Medicine

18. Have you ever worked with doctors or health professionals?
19. Do you think traditional and modern medicine can work together? How?
20. Would you be willing to share your knowledge with researchers or medical institutions?

Closing Questions

21. Is there anything else you would like to share about traditional medicine in your community?
22. Would you allow us to take photos of the plants or preparations, if available?
23. Can we contact you again if we need more information or clarification?