A green pharmacy: quantifying medicinal plant use in the Sohagi Barwa Wildlife Sanctuary

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Research

Abstract

Background: Indigenous communities have a rich tradition of using plants for medicinal purposes, with this knowledge passed down through generations. However, habitat loss, unsustainable harvesting, and declining traditional knowledge threaten this valuable resource. Documentation of traditional practices practiced by the Indigenous communities helps to link modern medicine with traditional knowledge.

Methods: Eighty-six participants in the Sohagi Barwa Wildlife Sanctuary were interviewed. The collected data were analyzed to assess several indices, namely based on the Consensus Factor, Usage Value, Fidelity Level, Relative Frequency of Citation, and the Used Report. Indices based on these parameters' measures ethnomedicinal knowledge's importance, value, and comprehensiveness for all the documented plant species.

Results: The study identified 95 medicinal plant species across 39 families, with the Fabaceae family being the most represented. Almost one-third of the medicinal formulations were found to be derived from decoction methodology. Decoction was the most common method of preparation, accounting for 33% of formulations. Digestive diseases had the highest Informant Consensus Factor (ICF) of 0.95. Among the plants, *Senegalia catechu* (L.f.) P.J.H.Hurter & Mabb. stood out, having the highest Use Value (UV) of 1.28 and the highest Relative Frequency of Citation (RFC) at 0.98. Moreover, it also achieved a perfect Fidelity Level (FL) of 100% for treating mouth ulcers. These findings indicate that traditional medicinal plant use remains prevalent in research and largely unexplored.

Conclusions: Identifying and documenting medicinal plants is crucial in safeguarding cultural heritage, fostering scientific discovery, and promoting sustainable healthcare practices for future generations. Working together, indigenous communities, scientists, and conservationists can unveil the wealth of natural remedies.

Keywords: Ethnomedicine, Medicinal Plants, Traditional Knowledge, Biodiversity Conservation, Sustainable Healthcare, Sohagi Barwa, Sanctuary

Background

Plant-based medicines have been the backbone of community healthcare systems for time immemorial. From chamomile's soothing properties to turmeric's pain-relieving power, these natural wonders offer vast potential for human health (Srivastava *et al.* 2010, Gupta *et al.* 2013). However, this valuable resource is threatened by habitat loss, unsustainable harvesting, and a decline in traditional knowledge (Hamilton 2004). Documentation is needed to ensure the preservation of indigenous communities' knowledge. Recording this knowledge helps to link traditional and modern health care, further, proper documentation opens the avenues for scientific exploration (Balick & Cox 1996). By cataloguing plant species and their potential benefits, researchers can investigate their efficacy and develop new drugs. India, a global biodiversity hotspot and home to 37% of tropical moist deciduous forests (TMDFs) (Singh & Chaturvedi 2017), possesses immense potential for ethnomedicinal discoveries. These rich ecosystems harbor many medicinal plants crucial for traditional healthcare practices. However, alarming rates of deforestation and resource overexploitation threaten this valuable resource (Prajapati *et al.* 2018, Shanley & Luz 2003). The significance of TMDFs extends beyond biodiversity. An All India Coordinated Project study revealed that 40% of India's 16000 recorded flowering plants have ethno-medical values (Arora 1997). In the Indian subcontinent, 84% of the tribal population generates livelihood options from the forested areas (Kutty & Kothari 2001, Mehta & Shah 2003).

Globally, 85% of primary healthcare relies on plant-derived medicines, highlighting the critical role of traditional knowledge held by tribal societies (WHO 2002, Fabricant & Farnsworth 2001). This hands-on knowledge has been transmitted for generations (Maharjan *et al.* 2021) and faces threats from sociocultural change, migration, and limited transmission (Kunwar *et al.* 2016). Factors like geography, ethnicity, and education further influence the preservation of this knowledge (Joshi *et al.* 2020). Due to these reasons, ethnomedicinal research becomes crucial in this context. It fosters the sustainable cultivation of medicinal plants while safeguarding associated knowledge (Ford *et al.* 2020, Kumar *et al.* 2021). However, due to communication limitations, a significant portion of this information must be updated.

India, recognized as one of the 12 mega-diversity centers worldwide, boasts approximately eight percent of global biodiversity. India's population, comprising over 550 ethnic groups, with tribal communities covering 15% of her land area, further contributes to its rich ethnobotanical heritage (D'Rozario *et al.* 2004). India has been globally recognized for its indigenous traditional knowledge and practices, dating back to ancient times through Ayurveda, Siddha, and Unani systems (Fabricant & Farnsworth 2001). Preserving this wealth of knowledge is imperative for the sustainable development of future generations. India's healthcare system exhibits significant variation, catering to both urban and rural populations with a mix of modern and traditional medical practices (Aziz *et al.* 2018).

Traditional medicinal practices and unexplored medicinal flora from remote regions holds great potential in pharmaceuticals, necessitating their documentation. Detailed ethnomedicinal studies must be included, particularly in India's TMDFs like the Uttar Pradesh Terai region. Sohagibarwa Wildlife Sanctuary lies in the terai region of Maharajganj and Kushinagar districts of Uttar Pradesh, India (Behera *et al.* 2012). These protected zones act as repositories of both ecological and ethnobotanical diversity, making them indispensable for conserving traditional medicinal knowledge. Despite the flourishing market for plant-based medicines (Subramanyam *et al.* 2007), detailed ethnomedicinal studies in such sanctuaries remain limited. Here, we address this gap by quantifying the ethnomedicinal uses of plants within the Sohagi Barwa Wildlife Sanctuary.

This study aims to systematically document the indigenous knowledge of medicinal plants utilized in primary healthcare, with a specific focus on the preparation methods and modes of administration of herbal remedies. Employing numerical indices for data analysis, the findings were critically compared with prior studies to assess their uniqueness and contribution to the existing body of knowledge. The primary objective is to preserve the ethnobotanical wisdom of traditional healers, thereby establishing a foundation for advancing the understanding and broader application of traditional medicinal practices.

Materials and Methods

Study area

The present ethnobotanical survey was carried out at Sohagi Barwa Wildlife Sanctuary (SBWS) (Fig. 1). Its boundaries geographically fall between 26° 58' to 27° 25' N and 83° 23' to 84°10' E belonging to the terai region of Maharajganj and Kushinagar districts of Uttar Pradesh, India. It occupies a vast alluvial plain with mostly flat terrain. The sanctuary sits at a low elevation, 95 to 103 meters above mean sea level. Despite the flatness, hilly areas are visible to the north, roughly 20

kilometers away near the Indo-Nepal border. The underlying soil consists of alluvial formations, clay beds, silt, and sand. The climate is characterized by warm temperatures, ranging from 13.81°C to 40.3°C, and receives an average annual rainfall exceeding 1500 mm.

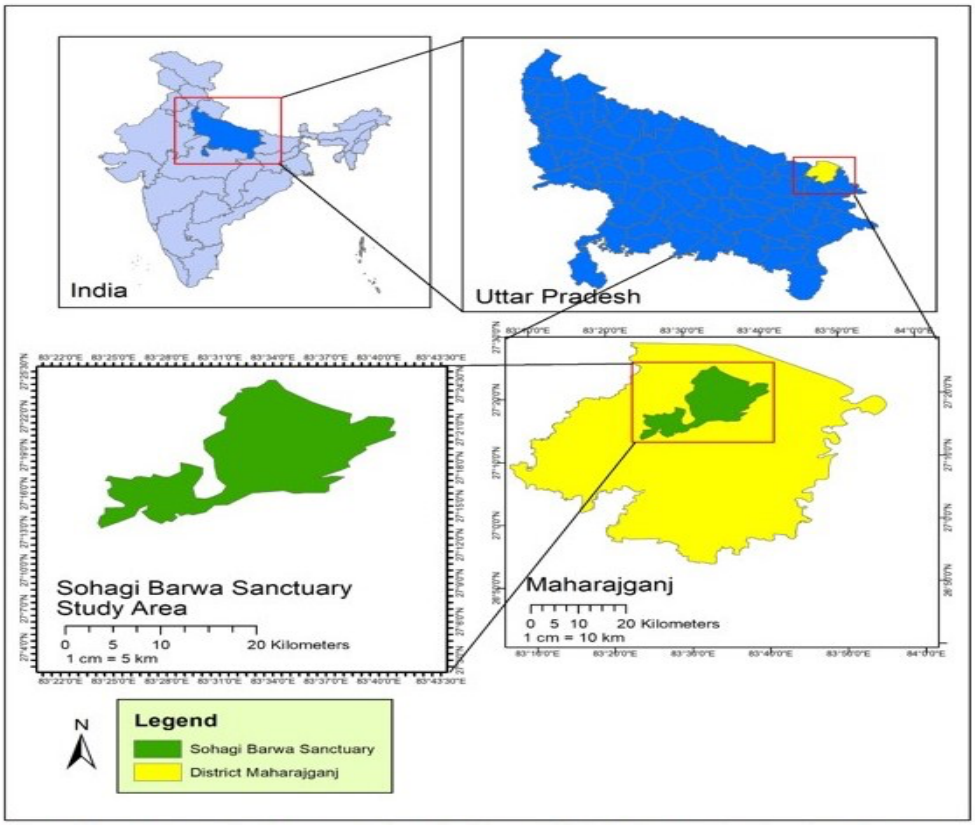

Figure 1. Study area for documentation of ethnomedicinal plants and collection of plant species Sohagi Barwa Wildlife Sanctuary, Uttar Pradesh, India

A significant portion of the population in this region reportedly lives below the poverty line, with small landholdings. Frequent floods and droughts create near-famine conditions in the district. Consequently, key conservation challenges for the forest include illegal logging, grazing, and increasing pressure from nearby cultivators. SBWS consists of seven forest ranges: Pakdi, Sheopur, Madhwaliya, Nichlaul, Laxmipur, North Chouk, and South Chouk. covering 39220.10 hectares along with an additional 3600 hectares of agricultural land. The Tharu and Mushar tribes reside near the forest, and over 300 villages are located within and around this protected area, with approximately 90% of the population being rural. The area also includes 12 Tangy villages and over 4500 Vantangiya families, spread across 18 villages in Maharajganj. The Vantangiya people, who were brought by the British from Burma about 100 years ago, played a key role in establishing plantations in the Gorakhpur and Maharajganj regions primarily belonging to sal and teak. The term 'Vantangiyas' was derived from the word 'Van,' meaning 'forest.' The literacy rate was 67.66 %, and the gender ratio was 943 females for 1000 males. The sanctuary houses diverse flora and fauna, including tigers.

Under the purview of the Forest Rights Act i.e. Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, the indigenous communities have been accorded land on lease by the Government. The primary occupation of the community residents is Agriculture.

Field survey and data collection

Voluntary verbal consents were obtained from the participants after explaining the purpose of the study, methodology, and nature. Participants were informed of their right to withdraw from the interview at any moment. This approach ensured informed consent and ethical data collection.

Ethnobotanical data was gathered in multiple visits on medicinal usage by performing interviews, both semi-structured as well as structured with fringe communities of Sohagi Barwa Wildlife Sanctuary. To collect data, we employed purposive sampling to interview 86 participants, with a majority (57) male and possessing traditional healing knowledge.

The research adhered to the International Society of Ethnobiology (ISE) Code of Ethics (2006) for ethnobotanical and ethnomedical research, ensuring no harm to the local community (The ISE Code of Ethics. 2006, Weckerle *et al.* 2017). Interviews focused on the local population's knowledge of indigenous medicinal plants for treating various ailments. Field investigations were conducted in collaboration with informants to document the plant species used in traditional medicine. To ensure taxonomic accuracy, plant identification in this study followed a systematic and rigorous approach under the supervision of a botanical taxonomic expert of Banaras Hindu University. Verified herbarium specimens were cross-checked with authoritative sources, including the National Herbarium, Flora of India (BSI) the https://about.worldforaonline.org/) and (https://powo.science.kew.org/). In most cases, the herbarium of plant twigs bearing voucher numbers was deposited in the Banaras Hindu University, Varanasi, India, for future reference.

Demography of Informants

The informants were chosen using the "snowball" method, where the first informant in the village is selected randomly, and subsequent informants are identified through referrals from the initial contact. This technique allows researchers to explore the lifestyles and attitudes of hard-to-reach social groups often excluded from traditional sociological studies. The study area's population belongs to various ethnic groups and religions, and the region's official language is Hindi. The predominant ethnic group among the surveyed population is the Mushar community, comprising 41 individuals (47.67%), followed by the Tharu community with 33 individuals (38.37%) and the Vantangiya community with 12(13.95%) individuals. Regarding linguistic diversity, all respondents are proficient in Hindi, while 35 individuals (40.69%) also speak Bhojpuri, and 26 individuals (30.23 %) can also communicate in Tharu.

All the participants were permanent residents of the field of study and were representatives of both genders, aged 25 to 75 years with most interviewees falling between the age bracket of 36 to 60 years (58.13%) (Table 1). Along with the gender data, information on age, literacy level, and occupation of all the respondents were also documented. We collected knowledge about the traditional use of medicinal plants from farmers, homemakers, medicinal plant pickers, and traditional healers.

Table 1. Demographic features of the local informants in the study area (n = 86)

Demographic features (%)	Abundance	Relative Abundance (%)
Gender		
Male	57	66.27
Female	29	33.78
Age group		
25-35	25	29.06
36-60	50	58.13
61-75	11	12.79
Education		
Illiterate	07	8.13
Literate	23	26.74
Primary level	21	24.41
Secondary level	26	30.23
Graduation	09	10.46
Healing experience		
Key informants	27	31.39
General informants	59	68.60

Data Analysis

Following reports, data were processed and organized using MS Excel. The data for each plant reference included voucher numbers, scientific and local names, growth habits (e.g. tree, herb), medicinally used plant parts, drug preparation, and reported ethnomedicinal uses. These attributes were organized and analyzed using SPSS software, and chord diagrams were drawn using R software.

Use value (UV)

Quantitative indices UV was used to find out the relative importance of the medicinal plants (Phillips & Gentry 1993) and calculated by the indices formula:

$$UV = Ui/N,$$

Where,

Ui indicates the frequency of mentions, bibliographic citations, or use reports for a particular genus.

N represents the sum of participants. Lower N indicates fewer mentions/citations, while higher values indicate more reports/citations. Each citation was accorded a value of one.

Relative frequency of citation (RFC)

RFC values were utilized to reflect the plant species significance concerning frequency of references or mentions by participants acting as informants. This metric is computed as:

$$RFC = FC/N,$$

In this formula, FC represents the informants number who cited a specific plant, while N denotes the sum of informants (Treyvaud *et al.* 2005). Higher values (closer to one) indicate a greater informant consensus on the medicinal usage of a plant species for a specific illness.

Informant consensus factor (ICF)

ICF metric indicates consensus or agreement among the participants or informants' knowledge about medicinal plants. ICF is calculated by using the formula:

$$ICF= (Nur-Nt)/ Nur -1$$

In this context, Nur refers to citations or use reports pertaining to each illness group and the plant species used to treat a specific illness category. Nt represents the numerical count of species employed in treating a particular illness category (Heinrich *et al.* 1998). This formula enables the assessment of the level of consensus among participant about the application of medicinal plants for various health conditions.

Fidelity level (FL)

Fidelity level (FL), a metric to assess informant consensus about a plant's most valued use for a particular condition, was calculated using formula:

$$FL (\%) = Np/N\times100$$

Np represents the percentage of healers mentioning a medicinal plant for a specific ailment, while N indicates the number of healers discussing the plant for use (Friedman *et al.* 1986). Reported medicinal plants with a high-Fidelity Level (FL) is likely to have numerous citations and be the most commonly used species for treating a particular condition.

Results

Demographic characteristics

Eighty-six informants were interviewed to explore using indigenous medicinal plants for various ailments (Table 1 and Fig. 2a). Of this number, 27 were Vaidhyas and Daai (Traditional Healers) and the key informants for this study. Men made up 66.27% of the informants, while women accounted for 33.74%. The informants were divided into different age groups ranging from 25 to 75 years. The majority (58.13%) were between 35 - 60 years old, followed by 29.06% who were aged between 25 and 34. In this study, informants over the age of 35 were able to identify and mention more medicinal plants compared to those aged 35 and below (Fig. 2b). Regression analysis indicated a significant positive correlation between respondents' age and their knowledge of medicinal plant identification ($R^2 = 0.5823$). However, a curvilinear relationship was observed between age and the number of plant species identified, suggesting that middle-aged individuals exhibited the highest level of botanical knowledge (Fig. 2c). The informants also came from diverse educational backgrounds, the majority (30.23%) were educated up to the secondary level, but some informants (8.13 %) were illiterate. Almost all illiterates were > 60 years old.

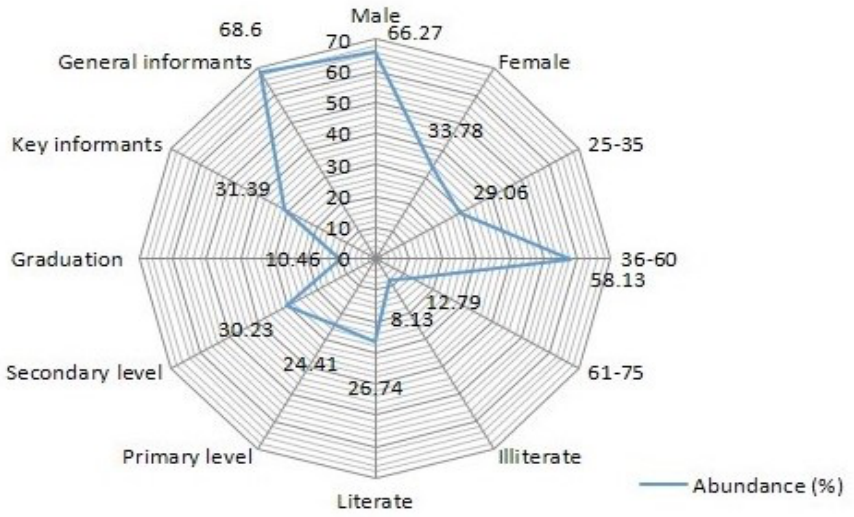

Figure 2a. Relationship between demographic features and their abundance amongst the local informants in the study area.

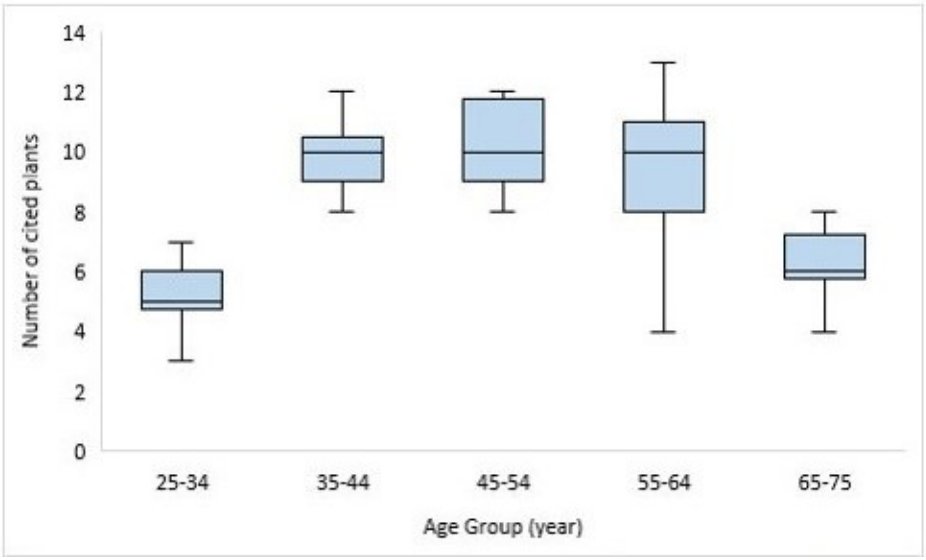

Figure 2b. Average number of medicinal plants reported by informants of different age group

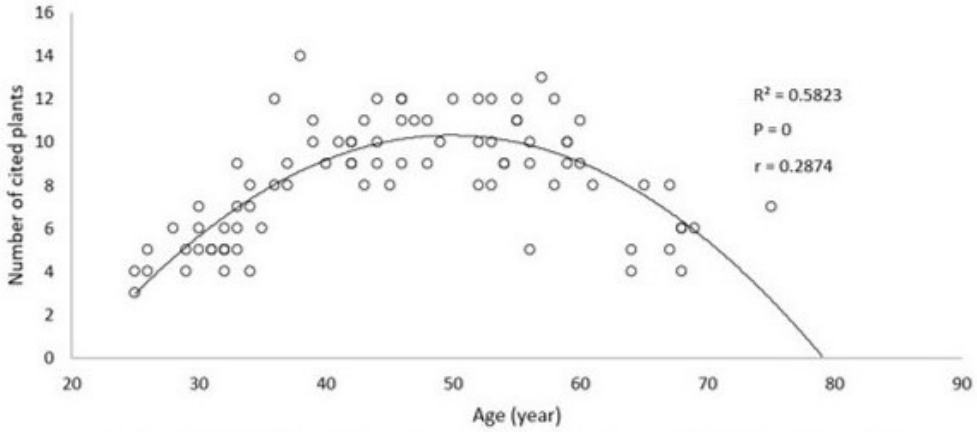

Figure 2c. Correlation between the respondent's knowledge of medicinal plant citation and his or her age

Taxonomic identification

Here, we considered 95 medicinal plant species from 39 families for treating various ailments, with Fabaceae turning out to be the most prominent family with 22 plant species, Poaceae with six plants, and Combretaceae with five plant species. Four species each among Moraceae, Euphorbiaceae, and Apocynaceae. Anacardiaceae, Lamiaceae, Malvaceae, Rubiaceae, Rutaceae, Tiliaceae, and Verbenaceae are with three species each, while Boraginaceae, Lythraceae, Menispermaceae represent two species each, and the remaining 23 families represent one species each (Table 2). The high number of usage reports for this large family, such as Fabaceae, Poaceae, and Combretaceae, occupied 23.24%, 7.33%, and 7.14 % of the total used report, respectively, suggesting the use of plants readily available and abundant around the local population (Table 2).

Table 2. Name of plant families with number of species and used report

Family Name	Number of medicinal plants	Number of used reports
Alangiaceae	1	33
Amaryllidaceae	1	36
Anacardiaceae	3	142
Apocynaceae	4	161
Arecaceae	1	13
Asclepiadaceae	1	86
Bignoniaceae	1	24
Bombacaceae	1	75
Boraginaceae	2	53
Burseraceae	1	26
Cannabaceae	1	21
Combretaceae	5	300
Dilleniaceae	1	35
Dipterocarpaceae	1	98
Ebenaceae	1	45
Euphorbiaceae	4	147
Fabaceae	22	976
Lamiaceae	3	127
Lecythidaceae	1	65
Liliaceae	1	21
Lythraceae	2	108
Malvaceae	3	57
Meliaceae	1	24
Menispermaceae	2	101
Moraceae	4	194
Myrtaceae	1	98
Phyllanthaceae	1	31
Poaceae	6	308
Rhamnaceae	1	27
Rubiaceae	3	85
Rutaceae	3	175
Sapindaceae	1	55
Sapotaceae	1	76
Smilacaceae	1	11
Sterculiaceae	1	27
Tiliaceae	3	142
Typhaceae	1	68
Ulmaceae	1	46
Verbenaceae	3	81

Growth form of medicinal plants

Various growth forms were found among the medicinal plants' species in the study area, including herbs, shrubs, trees, climbers, and lianas. With 57 species (60.00%), the trees occupied the highest percentage of all plant growth forms used for making herbal medicine, followed by 29 species (30.62%) of herbs and shrubs, eight species (8.42%) of climbers, and one species (1.05%) of lianas (Fig. 3 and Fig. 7).

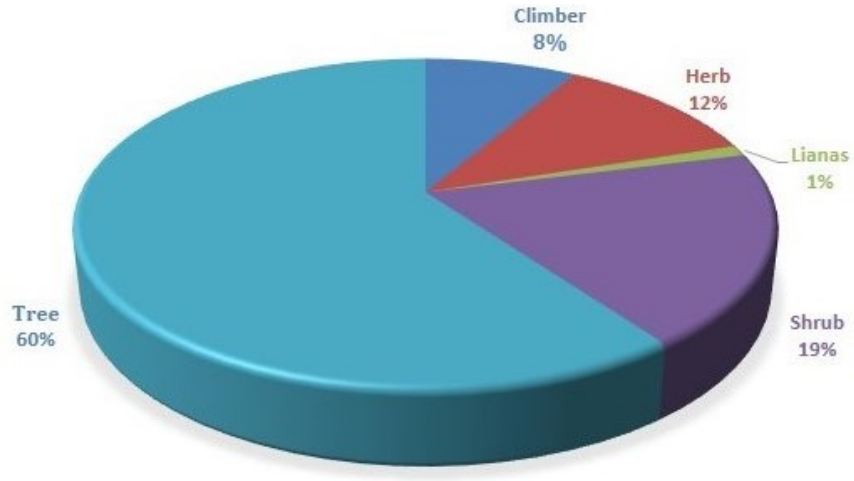

Figure 3. Growth forms of medicinal plants.

Mode of preparation and administration

The trend observed in herbal formulations preparation and administration reflected decoction (33%), followed by powder (18%), extract and juice (16%), paste (15%), raw (7%), oil (4%), poultice (3%), and others like latex and oleoresin (2%) (Fig. 4).

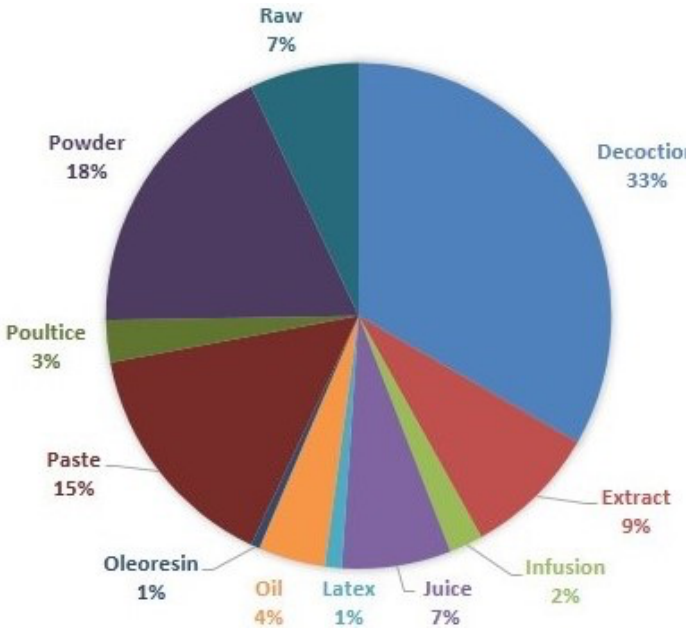

Figure 4. Preparation methods of traditional medicine

Frequency of usage of parts of plants

Flowers, bark, rhizomes, grains, fruits, tubers, stems, seeds, leaves, roots, and whole plants were found to be utilized in traditional medicine (Table 4, Figure 7). From the trends observed, it was inferred that most of the plant parts used were the foliage from, bark from 29 species, roots from 37 species, and fruit and seed from 18 species each (Fig. 5a, Fig. 5b and

Fig.7). 7).

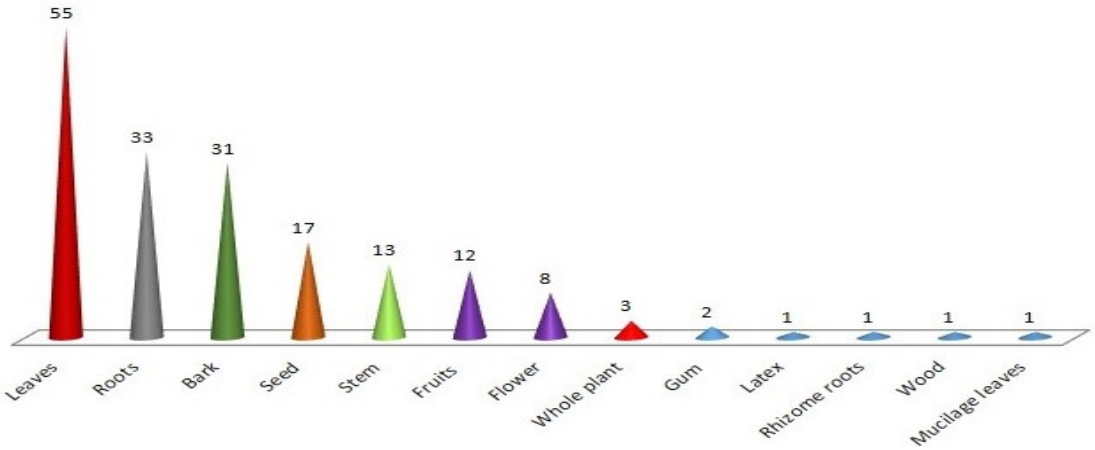

Figure 5a. The most frequently used plant parts in the ethnomedicine of the study area.

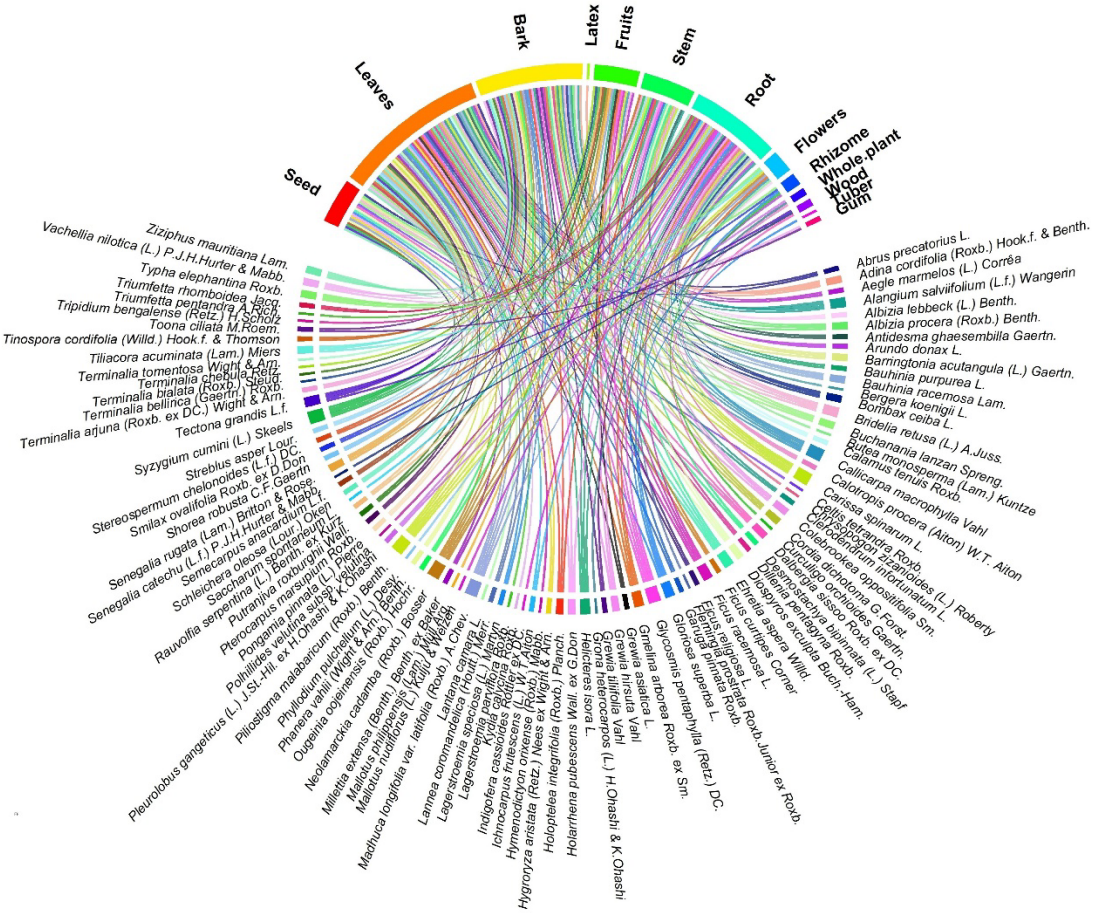

Figure 5b. Chord diagram showing different parts of the documented species for traditional medicinal plants**.**

Use value (UV) and relative frequency of citation (RFC)

We employed a "use value" (UV) metric to assess the relative importance of medicinal plants documented within the study area. This UV value was calculated based on how often plants were mentioned for medicinal purposes (use reports, UR). Table 4 presents these findings, highlighting the favorite medicinal plants among the local people. *Senegalia catechu* (L.f.)

P.J.H.Hurter & Mabb. emerged as the most preferred species with the highest UV (1.28), followed closely by *Vachellia nilotica* (L.) P.J.H.Hurter & Mabb. and *Syzygium cumini* (L.) Skeels (both with a UV of 1.14). Other plants with noteworthy UVs included Shorea robusta C.F.Gaertn. (1.13), *Aegle marmelos* (L.) Correa (1.08), *Senegalia rugata* (Lam.) Britton & Rose. (1.07), and *Calotropis procera* (Aiton) W.T. Aiton (1.0). Conversely, *Polhillides velutina* subsp. *velutina* received the lowest UV (0.06), indicating its minimal reported use for medicinal purposes in this region. To further analyze the significance of these plants, researchers employed another metric called the "relative frequency of citation" (RFC). Similar to UV, higher RFC values indicate greater reported use of a specific plant for medicinal purposes. Among the documented plants, *Senegalia catechu* (L.f.) P.J.H.Hurter & Mabb. (0.98), *Aegle marmelos* (L.) Correa (0.95), and *Syzygium cumini* (L.) Skeels (0.94) possessed the highest RFC values.

A significantly positive correlation was found between UV and RFC. This correlation, with a Pearson coefficient of 0.939 ($p < 0.00001$), suggests a close association between the relative importance of a plant's medicinal use and its local recognition within the community. In simpler terms, plants with higher use reports (UV) also tended to be more frequently cited (higher RFC) by the local inhabitants for their medicinal properties.

Fidelity level (FL)

We evaluated the relative importance of medicinal plants for each ailment category using the Fidelity Level (FL). The highest FL values were *Senegalia catechu* (L.f.) P.J.H.Hurter & Mabb. (100%) and *Senegalia rugata* (Lam.) Britton & Rose. (99%). *Senegalia catechu* (L.f.) P.J.H.Hurter & Mabb. turned out to be the most frequently prescribed medicinal plant for treating mouth ulcers. *Senegalia rugata* (Lam.) Britton & Rose. is the most frequently chosen species for treating hair-related problems. Other medicinal plants with high fidelity levels are *Aegle marmelos*(L.) Correa (95%) for dysentery, *Tinospora cordifolia* (Willd.) Hook.f. & Thomson. (91%) for Dengue Fever, and *Syzygium cumini* (L.) Skeels (95%) for diabetes (Fig. 6).

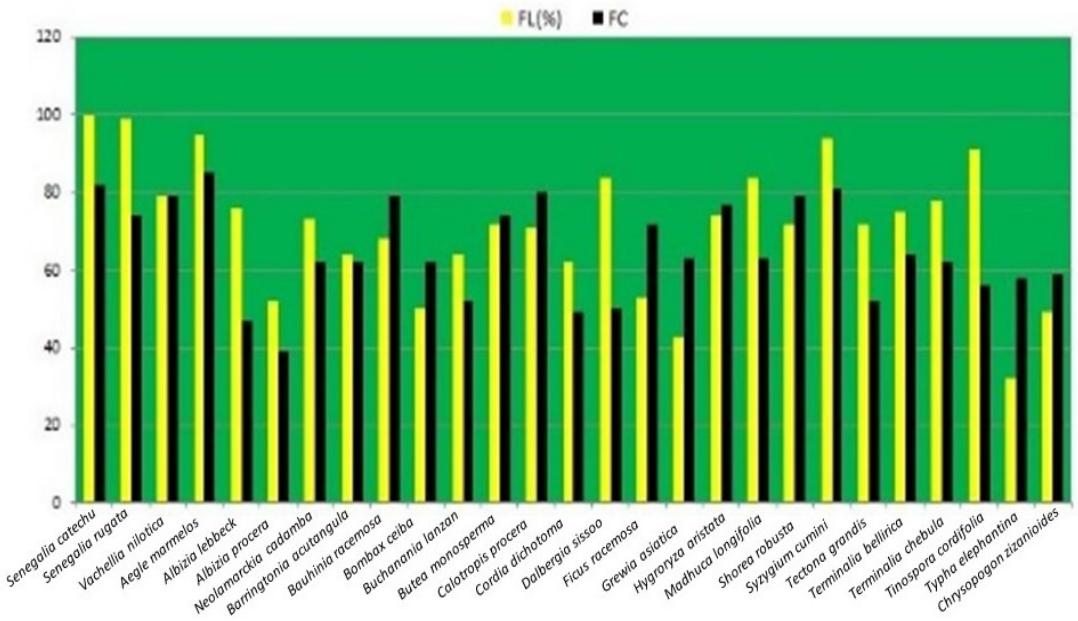

Figure 6. FC and FL (%) of wild medicinal plants having use value (> 0.70).

Informant Consensus Factor (ICF)

The Informant Consensus Factor (ICF) evaluates culturally significant medicinal plants employed by various healers to treat the similar conditions or ailments. In this study, diseases treated by medicinal plants were classified into 16 categories (Table 3). The digestive disease category received the highest ICF score of 0.95, whereas genitourinary, blood, and nervous system disorders recorded the lowest ICF score of 0.90.

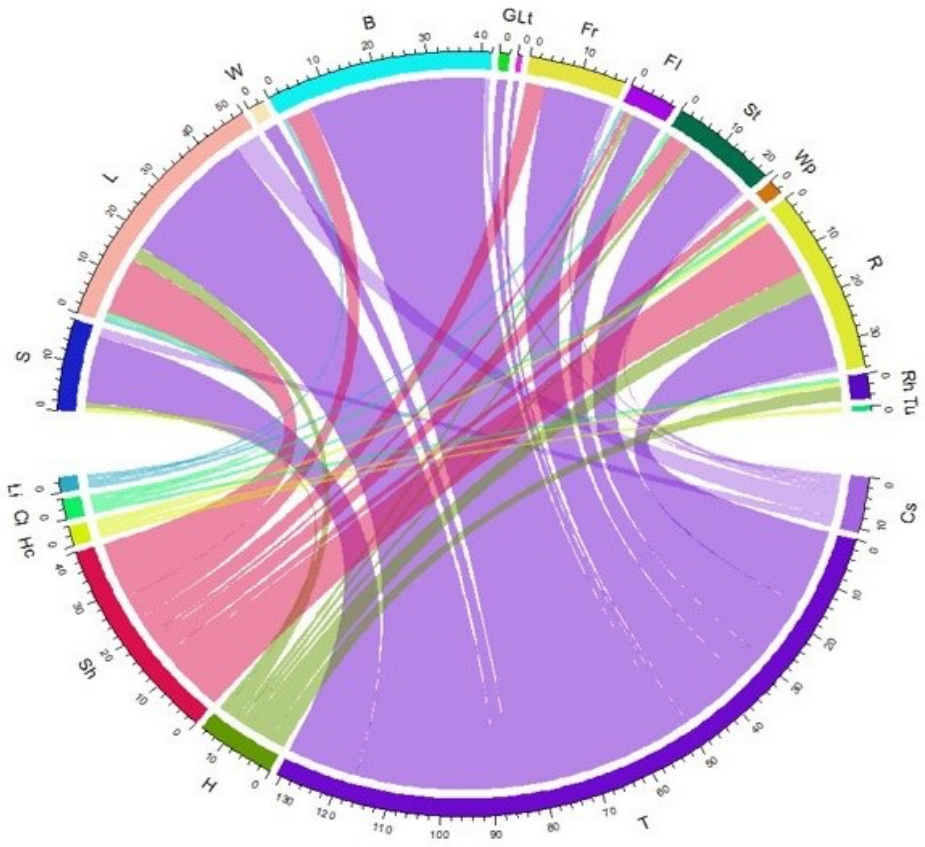

Figure 7. Habit-wise parts of the plant used to treat diseases (where S = Seed, L = Leaves, W = Wood, B = Bark, G = Gum, Lt = Latex, Fr = Fruits, Fl = Flowers, St = Stem, Wp = Whole plant, R = Root, Rh = Rhizome, Tu = Tuber, Cs = Climber Shrub, T = Tree, H = Herb, Sh = Shrub, Hc = Herbaceous Climber.

Table 3. Informant Consensus Factor (ICF) by disease category in the study

Ailment category	Disease under each category	Number of plants used	Use report	ICF
Infectious diseases	measles, malaria, tuberculosis, dengue, typhoid, rabies, cholera, dysentery	22	281	0.93
Neoplasms	cancer, tumor	4	33	0.91
Blood diseases	anemia, blood purification, hemorrhaged	10	91	0.90
Metabolic diseases	diabetes	13	171	0.93
Nervous system disorder	headache, epilepsy, paralysis, vertigo, migraine, mental illness	11	102	0.90
Cardiovascular diseases	heart disease and hypertension anxiety	7	73	0.92
Respiratory diseases	asthma, cough, lung problem, pneumonia, tonsillitis, catarrh, bronchitis, throat infection	26	442	0.94
Digestive diseases	abdominal pain, stomachache, constipation, diarrhea, nausea, hepatitis, indigestion, dyspepsia, liver disease, piles, stomach ulcer, hemorrhoids enlarge spleen, toothache, mouth ulcer gingivitis and jaundice	46	824	0.95
Skin diseases	rash skin eruptions, leukoderma scabies, boils, Scars leprosy, pimples, & other skin problems	35	511	0.93
Genitourinary diseases	kidney stone and urinary tract problem	12	112	0.90
Connective diseases	muscle swelling, sprain, rheumatoid, arthritis, gout	20	303	0.94

General symptoms	body pain, inflammation, nose bleeding, dandruff, Allergies, Heat stroke, and fever	30	411	0.93
Injury	burns, cuts, wounds, and fracture	33	502	0.94
Poisonous bites	Snake, Scorpio, rabbit, rat, dog, insect bites	11	108	0.91
Gynaecological disorders	enhancing lactation, menstrual disorders, leucorrhea	8	84	0.92
Ear and Eye related diseases	ear pain burning of the eyes conjunctivitis	7	103	0.94

Conservation Status

In summary, based on the feedback from local inhabitants, the availability of medicinal plants appears to be decreasing in the study area (SBWS). An analysis of the International Union for Conservation of Nature (IUCN) Red List for 95 medicinal plants revealed that a significant portion (72.63%, or 69 species) are listed as Least Concern (LC). However, a cause for concern is the presence of endangered (EN) and critically endangered species (4.21%, or four species each) and near-threatened (NT) species (another 4.21%) (Table 4). The remaining species either need more data or have not been evaluated (IUCN 2023).

Discussion

Demographic Characteristics and traditional knowledge

Traditional societies may prioritize passing down their strongly guarded knowledge of medicinal plants within families and close circles, potentially explaining the predominance of male healers in this study. (Etkin 2002). Similarly, other studies have also documented a majority of male practitioners in the field of traditional medicine, reflecting gendered patterns of knowledge transmission (Quinlan & Quinlan 2007). Many studies have documented differences in medicinal plant knowledge across age and gender groups (Appiah *et al.* 2018, Hu *et al.* 2020, Tumoro & Maryo 2016). Informants' ability to mention more medicinal plant species also varied according to their age. We found that most participants were 35 to 75 years old (71%), while the remaining informants were below 35 years old. The ability of informants to recall and identify a greater number of medicinal plant species has been observed to vary with age, with older individuals often demonstrating more extensive knowledge (Phillips & Gentry 1993, Reyes-García *et al.* 2005). This disparity may be attributed to the older generation's greater awareness of medicinal plants compared to the younger generation. Several studies have extensively documented differences in medicinal plant knowledge across various age groups. (Laldingliani *et al.* 2022, Lalfakzuala *et al.* 2007). Middle-aged individuals exhibited the highest ethnobotanical knowledge, indicating a curvilinear relationship between age and plant knowledge, with a peak in midlife followed by a decline (Ayantunde *et al.*, 2008). Similarly, Arowosegbe *et al.* (2015) reported that traditional healers in Ekiti State, Nigeria, aged 61 and above cited the fewest medicinal plants. Khakurel *et al.*(2022) found similar observation where individuals aged 45–65 citing the highest number of medicinal plant species. This aligns with the findings of Silva *et al.* (2011), which indicate that informants belonging to the 49–58 age group were more knowledgeable about medicinal plants and their uses. However, elderly healers were secretive, often withholding information due to economic incentives and concerns about diminishing efficacy, leading to lower reported knowledge despite their expertise. In summary, while age-related memory decline can influence the number of plants cited by elderly individuals in ethnomedicinal research, their extensive experiential knowledge remains a crucial resource. There is no significant difference in the use of medicine derived from plants among individuals with varying educational levels (Oreagba *et al.* 2011). Additionally, previous research has shown that key informants tend to possess greater knowledge compared to general informants (Giday *et al.* 2009, Ralte *et al.* 2024). The effectiveness of these healers might stem from their deep knowledge and careful selection of medicinal plants.

Taxonomic diversity and growth form of medicinal plants

Most medicinal plants belong to the families of Fabaceae, Poaceae, Combretaceae, Moraceae, Euphorbiaceae, and Apocynaceae. Other studies have reported the broader use of medicinal plant species in herbal medicines in these families (Appiah *et al.* 2018, Asfaw & Abebe 2021, Boadu & Asase 2017, Dery *et al.* 2023). Previous studies have frequently highlighted the use of woody trees for treating various ailments (Appiah *et al.* 2018, Boadu & Asase 2017, Dery *et al.* 2023, Tugume & Nyakoojo 2019). Similarly, our findings show that perennial plant species were the main source of plant-based medicines in the study area. This widespread use of woody plants for therapeutic purposes could be due to their local abundance and the timing of the study.

Table 4. Medicinal plant recorded with Family, scientific name, habit, parts used, mode of use, UV (use value) and RFC (relative frequency citation) and IUCN status in the Sohagi Barwa Wild Life Sanctuary.

Scientific name	Local name	Family	Habit	Parts used	Mode of use	Ailments treated	UV	RFC	IUCN status
Alangium salviifolium (L.f.) Wangerin	**Akol**	Alangiaceae	tree	roots, leaves, stem and bark	Raw, extract	Skin diseases, leprosy, scabies rheumatism hemorrhages, snake/scorpion, rabbit, rat, dog bites	0.38	0.24	LC
Curculigo orchioides Gaertn.	**Kali Musli**	Amaryllidaceae	Herbs	rhizomes	Juice, powder	Arthritis immunomodulator jaundice, asthma, cuts and wounds	0.41	0.29	Endangered
Buchanania lanzan Spreng.	**Chironji**	Anacardiaceae	Tree	roots, leaves, seeds	Oil, powder	Diarrhea, coughs and asthma skin diseases	0.73	0.59	DD
Lannea coromandelica (Houtt.) Merr.	**Mohin**	Anacardiaceae	Tree	Leaves, bark	Decoction, paste	Swellings and body pains cuts, wounds, gout	0.54	0.36	LC
Semecarpus anacardium L.f.	**Bhilwa**	Anacardiaceae	Tree	fruits, seeds	Oil, powder	Skin diseases, tumors, constipations, healing of wounds rheumatic disorders	0.37	0.24	LC
Carissa spinarum L.	**Garna**	Apocynaceae	Shrub	roots, leaves, fruits, stems root and stem bark	Extract, decoction, raw	Fever, jaundice, cardiac diseases, diabetes, malaria, pneumonia , chronic joint pain snake bites	0.28	0.15	LC
Holarrhena pubescens Wall. ex G.Don	**Kutaj,**	Apocynaceae	Tree	Bark, Root, Seeds	Decoction	Gastric problems. Dysentery, diarrhea. anemia, epilepsy	0.36	0.27	LC
Ichnocarpus frutescens (L.) W.T.Aiton	**Kali-dudhi**	Apocynaceae	Climbing shrub,	Roots, leaf	Decoction	Blood purifier, jaundice, fever gout, rheumatism, skin diseases	0.39	0.26	NE
Rauvolfia serpentina (L.) Benth. ex Kurz	**Sarpagandha**	Apocynaceae	Shrub	Root, leaves	powder	Hypertension, anxiety, asthma headaches, snake bites	0.83	0.76	Endangered
Calamus tenuis Roxb.	**Cane palm**	Arecaceae	Shrub	young stems leaf	extracts	Fevers, piles, bacterial infections, wounds diabetes inflammation	0.15	0.81	LC
Calotropis procera (Aiton) W.T. Aiton	**Aak**	Asclepiadaceae	Shrub	Whole plant, root	Latex, powder	Fever, rheumatism, indigestion, cold, eczema and diarrhea. Boils, jaundice toothache	1.00	0.92	LC
Stereospermum chelonoides (L.f.) DC.	**Patala**	Bignoniaceae	Tree	Bark, root	Extract powder	Fever, inflammation, and digestive problems	0.28	0.20	LC
Bombax ceiba L.	**Semal**	Bombacaceae.	Tree	Leaves, root bark	Extract, powder	Blood purification, Leucorrhea skin blemish and pigmentation Wounds	0.87	0.71	LC

Cordia dichotoma G.Forst.	**Leshora,**	Boraginaceae	Tree	Leaves and stem bark	Decoction paste	Common cold ,catarrh, cough, fever respiratory disease, leprosy	0.78	0.56	LC
Ehretia aspera Willd.	**Chamror**	Boraginaceae	Tree	leaves, stems barks, seeds	Paste, decoction	Cuts and wounds, fractures, toothache, diabetes mellitus	0.34	0.24	DD
Garuga pinnata Roxb.	**Kharpat/ Ramasin**	Burseraceae.	Tree	Stem, leaves	juice	Opacity of conjunctiva, asthma	0.30	0.22	LC
Celtis tetrandra Roxb.	**Khirk**	Cannabaceae	Tree	seed	juice	indigestion	0.24	0.24	LC
Terminalia arjuna (Roxb. ex DC.) Wight & Arn.	**Arjuna**	Combretaceae	Tree	Stem bark	Powder, decoction	Cardiotonic in heart failure, ischemic, cardiomyopathy, fractures, ulcers, hepatic	0.67	0.56	LC
Terminalia bellirica (Gaertn.) Roxb.	**Behera**	Combretaceae	Tree	unripe fruit	powder	Hepatitis, bronchitis, asthma, piles, diarrhea, coughs, eye diseases	0.84	0.74	LC
Terminalia bialata (Roxb.) Steud.	**Indian silver greywood**	Combretaceae	Tree	bark	Juice, powder	iarrhea, cuts and wounds	0.62	0.48	NE
Terminalia chebula Retz.	**Harard**	Combretaceae	Tree	unripe fruit	Decoction, powder	vomiting, dysentery and diarrhea, gout and joints pain, wound	0.86	0.71	LC
Terminalia tomentosa Wight & Arn.	**Saaj**	Combretaceae	Tree	bark	Decoction, paste	Ulcers, fractures, bronchitis, and diarrhea	0.50	0.44	NE
Dillenia pentagyna Roxb.	**Kallai**	Dilleniaceae	Trees	Bark, leaf	Decoction, paste	Body pain, diabetes, cut and wounds	0.41	0.24	Critically Endangered
Shorea robusta C.F.Gaertn	**Sal**	Dipterocarpaceae	Tree	leaves bark	Powder, extract, oleoresin	Inflammation, fever, wounds, ulcers, leprosy, cough, earache, burning of the eyes	1.13	0.91	LC
Diospyros exculpta Buch.-Ham.	**Tendu**	Ebenaceae	Tree	Stem bark, seed	Paste, oil, decoction	Boils, diabetes, abscess	0.52	0.39	NE
Antidesma ghaesembilla Gaertn.	**Binayuyo**	Euphorbiaceae	Tree	Leaves stem	decoction	Headache menstrual flow	0.29	0.19	LC
Mallotus nudiflorus (L.) Kulju & Welzen	**Gutel,**	Euphorbiaceae	Tree	root	Poultice, decoction	Gout and rheumatism, swellings	0.45	0.24	LC
Mallotus philippensis (Lam.) Müll.Arg.	**Kamala**	Euphorbiaceae	Tree	fruits hairs and glands	powder	Anthelmintic, ulcers and wounds scabies	0.41	0.28	LC
Putranjiva roxburghii Wall.	**Jivputrak**	Euphorbiaceae	Tree	Fruit, leaves	Powder, decoction	Catarrh, fever, hemorrhoids, cold, fever, rheumatism, spermatogenic	0.56	0.48	LC

Abrus precatorius L.	**Ratti**	Fabaceae	Climber shrub	Seed, leaves	Powder, paste	Leucorrhea, Mouth ulcer, dog biting, malaria	0.17	0.13	NT
Albizia lebbeck (L.) Benth.	**Siris**	Fabaceae	Tree	Bark, flower	Powder, decoction	Skin eruptions, boils diarrhea, dysentery and piles	0.83	o.54	LC
Albizia procera (Roxb.) Benth.	**Safed Siris**	Fabaceae	Tree	bark Seeds leaves	decoction powdered poultice	Rheumatism, hemorrhaged, hemorrhoids, skin diseases, stomach-ache amoebiasis ulcers	0.75	0.45	LC
Bauhinia purpurea L.	**Kaniar**	Fabaceae	Tree	Bark, leaves	Decoction juice	Diarrhea, dropsy, pain, rheumatism	0.47	0.37	LC
Bauhinia racemosa Lam.	**Katmauli**	Fabaceae	Tree	Bark, leaves, root	Decoction paste	Headache, fever, skin diseases, blood diseases, dysentery, and diarrhea, ulcers diabetes, malaria, Epilepsy	0.94	0.91	LC
Butea monosperma (Lam.) Kuntze	**Palas**	Fabaceae	Tree.	flower	Infusion, juice	leprosy, gout, skin diseases inflammation, leucorrhea eye diseases	0.92	0.86	LC
Dalbergia sissoo Roxb. ex DC.	**Shisham**	Fabaceae	Tree	seed wood leaves	Oil powder	Skin ailments and wounds	0.76	0.57	LC
Flemingia prostrata Roxb.Junior ex Roxb.	**Chauna**	Fabaceae	Herb	roots	paste	Rheumatism and associated inflammatory ailments	0.09	0.09	LC
Grona heterocarpos (L.) H.Ohashi & K.Ohashi	**Asian Tick Trefoil**	Fabaceae	Herb	whole plant	decoction	Fever, strains	0.16	0.08	LC
Indigofera cassioides Rottler ex DC.	**Hakanu**	Fabaceae	Shrub	roots	decoction	Coughs	0.11	0.06	NE
Millettia extensa (Benth.) Benth. ex Baker	**Garari**	Fabaceae	Climbers	leaves, stem	Decoction	Toothache	0.07	0.07	NE
Ougeinia oojeinensis (Roxb.) Hochr.	**Sandan**	Fabaceae	Tree	Stem bark	paste	Cuts and wounds diarrhea, dysentery, fever leukoderma	0.27	0.18	NT
Phanera vahlii (Wight & Arn.) Benth.	**Malu,**	Fabaceae	Climbing shrub	Seeds, leaves	Powder, decoction	Diabetes, tonic	0.11	0.07	LC
Phyllodium pulchellum (L.) Desv.	**Jatsalpan,**	Fabaceae	Shrub	root	powder	Abdominal and chest burning discomforts	0.16	0.13	LC
Piliostigma malabaricum (Roxb.) Benth.	**Amli**	Fabaceae	Tree	Flower Stem and root bark, leaves	decoction Infusion, raw	Jaundice, wound healing, diuretic, dysentery, fever	0.51	0.36	LC

Pleurolobus gangeticus (L.) J.St.-Hil. ex H.Ohashi & K.Ohashi	**Salparni.**	Fabaceae	Shrub,	Roots and whole plant	Extract, decoction	Fever, respiratory problems, bronchitis, nervine tonic, vomiting,	0.48	0.30	LC
Polhillides velutina subsp. velutina	**Jagru**	Fabaceae	Shrub	roots	raw	Toothache	0.06	0.06	LC
Pongamia pinnata (L.) Pierre	**Karanj**	Fabaceae	Tree	Leaves, bark	Paste, decoction	Piles, skin diseases, ulcers bronchitis, asthma	0.51	0.37	LC
Pterocarpus marsupium Roxb.	**Bija**	Fabaceae	Tree	Bark leaves	Decoction, paste	Fractures, constipation, hemorrhages, cholera, neurological problems.	0.42	0.36	NT
Senegalia catechu (L.f.) P.J.H.Hurter & Mabb.	**Khair**	Fabaceae	Tree	heartwood	Extract decoction	Cold and cough, diarrhea, piles, body pains fever, mouth ulcer, boils, skin eruptions and on gums as disinfectant	1.28	0.98	LC
Senegalia rugata (Lam.) Britton & Rose.	**Shikakai**	Fabaceae	Climbing shrub	leaves, bark and pods	Extract decoction paste	Hair fall, dandruff, diabetes wound healing, prevents constipation, jaundice, scabies	1.07	0.86	LC
Vachellia nilotica (L.) P.J.H.Hurter & Mabb.	**Babul**	Fabaceae	Tree	Bark, Gum, leaves	Decoction raw, paste	Nausea, burns and wounds, stomachache, diarrhea, immunity booster	1.14	0.92	LC
Gmelina arborea Roxb. ex Sm.	**Gambhara,**	Lamiaceae	Tree	Root, fruit, flower, leaves	Raw, powder, decoction	Pulmonary and nervine tonic digestion, fever, thirst, heart diseases, nervous disorders, piles	0.31	0.24	LC
Tectona grandis L.f.	**Teak**	Lamiaceae	Tree	Leaves, seeds, heartwood, bark	Decoction, paste, powder	Piles, dysentery, leukoderma, anti-inflammatory, bronchitis, urinary and liver related troubles	0.79	0.60	EN
Colebrookea oppositifolia Sm.	**Bhaman**	Lamiaceae,	Shrub	roots, leaves and stem	decoction and dry powder	Headache, fever, dysentery, peptic ulcer, dermatitis, wounds, epilepsy	0.37	0.29	LC
Barringtonia acutangula (L.) Gaertn.	**Hijjal,**	Lecythidaceae	Tree	Seed, leaves, root	Powder, paste, decoction	Cold, diarrhea, scorpion bite, skin diseases	0.76	0.71	LC
Gloriosa superba L.	**Kalihari**	Liliaceae	Herbaceous climber	Tuber root rhizome and seeds	Paste , powder	Arthritis, reduces pain, inflammation, ulcers, bleeding piles, skin diseases, leprosy, and snakebites	0.24	0.19	LC
Lagerstroemia parviflora Roxb.	**Senia**	Lythraceae	Tree	leaves	Decoction	Coughs, fevers, asthma, and bronchitis	0.66	0.50	LC
Lagerstroemia speciosa (L.) Martyn	**Jarul**	Lythraceae	Tree	Bark leaves	Decoction	Fever, diabetes	0.59	0.48	LC

Kydia calycina Roxb.	**Pula**	Malvaceae	Tree	leaves	Paste, decoction poultices	jaundice, skin diseases, wounds, cuts, and boils	0.28	0.15	LC
Triumfetta pentandra A.Rich.	**Fivestamen burbark**	Malvaceae	Herb	root	poultice	Sores, small wounds	0.13	0.10	NE
Triumfetta rhomboidea Jacq.	**Paroquet Bur**	Malvaceae	Shrub	Root, leaves	decoction	Diarrhea, dysentery, internal haemorrhages leprosy	0.25	0.16	NE
Toona ciliata M.Roem.	**Tuni**	Meliaceae	Tree	Bark, gum	powder	Dysentery and wounds, boils	0.28	0.24	LC
Tiliacora acuminata (Lam.) Miers	**Bagmushda**	Menispermaceae	lianas	Leaves, bark, and flowers	Decoction, extract, paste	Wounds, snake bites, skin infections, jaundice, piles, ulcer, diabetes	0.31	0.19	DD
Tinospora cordifolia (Willd.) Hook.f. & Thomson	**Giloy**	Menispermaceae	Climbing shrubs	Stem, leaves	Decoction, juice	Dengue Fever, diabetes, upset stomach,	0.86	0.65	LC
Ficus curtipes Corner	**Kabaipipal**	Moraceae	Tree	Leaves, Bark	Juice	Kill worms, asthma, snakebite,	0.38	0.32	NE
Ficus racemosa L.	**Gular**	Moraceae	Tree	Root bark leaves fruits	Powder, paste, decoction	Antidiuretic gynecological disorders, leprosy, leucorrhea, burns, dry cough, bronchitis, piles	0.94	0.83	LC
Ficus religiosa L.	**Peepal**	Moraceae	Tree	Bark, leaves	Juice, powder	Antibacterial, skin diseases. antivenom activity, regulates the menstrual cycle, paralysis, bone fractures, cough, asthma, diarrhea, ear pain, toothache	0.67	0.59	LC
Streblus asper Lour.	**Khoi,**	Moraceae	Tree	Stem, leaves	Decoction, raw	Leprosy, toothache, diarrhea, dysentery and cancer.	0.26	0.22	LC
Syzygium cumini (L.) Skeels	**Jamun**	Myrtaceae	Tree	Fruit,leave, seeds, stem bark	Raw, powder, decoction	Cough, diabetes, dysentery, inflammation Bleeding gums wounds ulcers leucorrhea,	1.14	0.94	LC
Bridelia retusa (L.) A.Juss.	**Kasi**	Phyllanthaceae	Tree	leaves fruits and seeds bark	Extract decoction	Wound, urinary tract infection, dysentery, and diarrhea. earache, indigestion snakebite	0.36	0.30	LC
Arundo donax L.	**Kasa**	Poaceae	Herb	rhizome roots	decoction	Dysuria, fever, enhancing lactation, menstrual, disorders, bone fracture, cancer	0.36	0.17	LC
Chrysopogon zizanioides (L.) Roberty	**Khus**	Poaceae	Herb	root	Powder, decoction, oil	Blood purifier, digestive problem, cough, asthma, vertigo, skin problem	0.88	0.68	LC

Desmostachya bipinnata (L.) Stapf	**Kusha**	Poaceae	Herb	Leaves and stem	Decoction	Dysentery, diarrhea, dysuria, skin diseases	0.63	0.50	LC
*Hygroryza aristata (*Retz.) Nees ex Wight & Arn.	**Tini**	Poaceae	Herb	Leaves and seed	decoction	Diuretic, diarrhea, fatigue, general weakness	0.90	0.88	NE
Saccharum spontaneum L.	**Kasa**	Poaceae	Herb	Root	decoction	Burning sensations, dyspepsia, urinary tract infection,	0.31	0.28	LC
Tripidium bengalense (Retz.) H.Scholz	**Sarkanda**	Poaceae	Herb	Root	Powder, decoction	Dysuria, giddiness and vertigo, bleeding wounds	0.49	0.39	LC
Ziziphus mauritiana Lam.	**Ber**	Rhamnaceae	Shrub	Leaves, root ,seed	Paste, extract, decoction	Fever, asthma, depression anxiety, wound healer	0.31	0.24	LC
Adina cordifolia (Roxb.) Hook.f. & Benth.	**Haldu**	Rubiaceae	Tree	Bark and leaves, latex	Juice, decoction, raw, paste	Stomachache, cholera, cold cough, fever, headache, scars urine complaints, pain and swelling, aching tooth, conjunctivitis, boils, rheumatism eczema	0.52	0.42	LC
Hymenodictyon orixense (Roxb.) Mabb.	**Bhurkur**	Rubiaceae	Tree	leaves	powder	Wound healing, anti-inflammatory	0.14	0.13	NE
Neolamarckia cadamba (Roxb.) Bosser	**Kadam**	Rubiaceae	Tree	root, bark and leaves, flower fruits	Decoction juice, paste, powder infusion	Fever, uterine complaints, blood diseases, skin diseases, tumor, anemia, eye inflammation and diarrheas, sour throat, cough,	0.87	0.71	LC
Aegle marmelos (L.) Corrêa	**Bael,**	Rutaceae	Tree	fruits and leaves	Raw, extract, decoction	Dysentery, dyspepsia, mal-absorption, vomiting, and rheumatism	1.08	0.95	NT
Bergera koenigii L.	**Katnims**	Rutaceae	Shrub	leaves	Decoction raw, paste, oil	Diabetes, skin inflammation strengthening the bones	0.62	0.49	LC
Glycosmis pentaphylla (Retz.) DC.	**Bannimbu**	Rutaceae	Shrub	leaves, stems, barks, fruits, and roots	Decoction, paste	Cough, fever, bronchitis, inflammation, rheumatism, boils, eczema, fractures	0.33	0.20	LC
Schleichera oleosa (Lour.) Oken	**Kusum**	Sapindaceae	Tree	Leaves, bark	Juice, powder	Blood purification, skin disease	0.64	0.5	LC
Madhuca longifolia var. latifolia (Roxb.) A.Chev.	**Mahua**	Sapotaceae	Tree	Bark, leaves, flower, fruit, Seed	Raw, Decoction paste, oil	Fracture, swelling, itching, snake bite, wounds, leprosy, eczema, hemorrhoids, skin disease, headache, rheumatism	0.88	0.72	NE
Smilax ovalifolia Roxb. ex D.Don	**Kumarika**	Smilacaceae	Climber	Root, rhizome	Powder, extract	Syphilis, Gout, muscular sprain,	0.13	0.08	NE

Helicteres isora L.	**Marorphal**	Sterculiaceae	Tree	Root, Stem bark, fruit	Decoction	Diarrhea, dysentery, abdominal pain	0.31	0.26	NE
Grewia asiatica L.	**Phalsa**	Tiliaceae	Shrub	unripe phalsa fruits leaves	raw	Inflammation, applied on skin eruptions	0.87	0.72	LC
Grewia hirsuta Vahl	**Nagabala/ Kakarundah**	Tiliaceae	Shrub	mucilage leaves, stems and roots	infusion or decoction poultice	Diarrhea and dysentery, wounds, cuts, ulcers, splenic enlargement, piles, rheumatism	0.38	0.31	LC
Grewia tiliifolia Vahl	**Dhaman**	Tiliaceae	Tree	bark and roots	paste	Fractures, diarrhea wounds, urinary infection and skin diseases.	0.39	0.31	NE
Typha elephantina Roxb.	**Elephant grass,**	Typhaceae	Herb	Flower, rhizome leaves	Paste, decoction extract	Boils, wounds, burns Leprosy, diuretic	0.79	0.67	LC
Holoptelea integrifolia (Roxb.) Planch.	**Chilbil,**	Ulmaceae	Tree,	leaves and stem bark	Decoction, paste	Rheumatic swellings, inflammation of lymph glands, leukoderma. wound healing	0.53	0.36	LC
Callicarpa macrophylla Vahl	**Priyangu**	Verbenaceae	Shrub,	Root, Bark, Leaves, Flowers, Fruits.	Extract , oil, decoction	Tumor, diarrhea, dysentery, diabetes, pneumonia , and rheumatic pain sores and gingivitis	0.20	0.13	LC
Clerodendrum infortunatum L.	**Bharangi**	Verbenaceae	Shrub	bark leaf	juice	Cough and cold, itching, leprosy, scorpion sting	0.22	0.09	LC
Lantana camara L.	**Raimuniya**	Verbenaceae	Shrub	leaves	Decoction	Wound healing, fever, cough, malaria	0.52	0.39	LC

Taxonomic diversity and growth form of medicinal plants

Most medicinal plants belong to the families of Fabaceae, Poaceae, Combretaceae, Moraceae, Euphorbiaceae, and Apocynaceae. Other studies have reported the broader use of medicinal plant species in herbal medicines in these families (Appiah *et al.* 2018, Asfaw & Abebe 2021, Boadu & Asase 2017, Dery *et al.* 2023). Previous studies have frequently highlighted the use of woody trees for treating various ailments (Appiah *et al.* 2018, Boadu & Asase 2017, Dery *et al.* 2023, Tugume & Nyakoojo 2019). Similarly, our findings show that perennial plant species were the main source of plant-based medicines in the study area. This widespread use of woody plants for therapeutic purposes could be due to their local abundance and the timing of the study.

Part(s) used, phytomedicine formulation and administration mode

Among the various plant parts available, leaves were identified as the predominant components utilized in traditional medicine preparation, consistent with previous reports (Ampomah *et al.* 2017, Faruque *et al.* 2018, Iyamah & Idu 2015). This preference may be due presence of high number of bioactive compounds in leaves (Tugume & Nyakoojo 2019) and their rapid regeneration capabilities. Additionally, the widespread utilization of leaves can be attributed to their ease of harvesting and processing into herbal products.

Surveys revealed decoction as the preferred method for preparing herbal remedies, followed by powders and pastes. Previous reports indicate that decoction is the most typical mode of preparation for herbal medicines (Boadu & Asase 2017, Ssenku *et al.* 2022, Tugume & Nyakoojo 2019)). To prepare a decoction, the plant tissue was cleaned, washed and boiled, leading to oral administration of the extract. In contrast, the plant material was applied topically after being crushed or rubbed within palms.

Shade dried plant parts were used to make powder. The most common application modes were oral and topical routes (Appiah *et al.* 2018, Dery *et al.* 2023).

Use Value and Relative Frequency of Citation

The medicinal plants with a high citation frequency also have high RFC values. Plants showing the highest RFC were the most popular (Abidin *et al.* 2023). RFC value indicate the importance of every therapeutic plant within local people to evaluate its therapeutic significance (Khajuria *et al.* 2021). Medicinal plants with higher RFC value are the ones that are used more frequently for treating various ailments. These medicinal plants are well known by the indigenous people and show a wide distribution range, easy availability, and easy access. Medicinal plants with high RFC values should undergo phytochemical analysis and be subjected to biological assays to assess their toxicology and efficacy, contributing to future drug discovery (Kayani *et al.* 2015).

This study found a positive correlation between a plant's FC value and UV. Plants with more citations (FC) tended to have higher use values (UV), suggesting greater reported use by the community. Conversely, plants with fewer use reports (URs) from informants typically had lower UVs. This implies that plants with broader recognition and higher UVs might possess more potent biological activity and be used more frequently in traditional medicine (Kayani *et al.* 2015, Mootoosamy & Fawzi Mahomoodally 2014). A higher UV value signifies a greater level of agreement and sharing of medicinal plant knowledge and practices among the informants (Jadid *et al.* 2020, Parthiban *et al.* 2016).

Analysis of documented medicinal plants revealed that *Senegalia catechu* (L.f.) P.J.H.Hurter & Mabb. possesses the highest use value and RFC values. This suggests that *Senegalia catechu* (L.f.) P.J.H.Hurter & Mabb. is the most sought after and frequently used for treating different ailments across various categories. The heartwood of this plant, known as kattha, is a potent medicinal product with a broad range of applications in therapeutic arena. *Senegalia catechu* (L.f.) P.J.H.Hurter & Mabb. contains catechin, a phytochemical compound with diverse biological activities like an antioxidant, antibacterial agent, anti-inflammatory, and promoting wound healing (Kumari *et al.* 2022).

The leaves, bark, pods, and gums of *Vachellia nilotica* (L.) P.J.H.Hurter & Mabb. are used for treating respiratory issues, gastrointestinal disorders, and skin problems (Saeedi *et al.* 2022). *Vachellia nilotica* (L.) P.J.H.Hurter & Mabb. exhibits diverse pharmacological properties, including anti-inflammatory, antioxidant, antiproliferative, antibacterial, antifungal, antiviral, glucose-lowering, lipid-lowering, antiulcer, antidiuretic, and antidiarrheal activities. Its polyphenolic constituents, quercetin, rutin, kaempferol, naringenin, catechin, epicatechin, gallic acid and ellagic acid, proved to be those most likely responsible for its therapeutic activities (Hafez *et al.* 2024)

A successful clinical study confirmed that use of *Syzygium cumini* (L.) Skeels seeds, seed kernels or fruit can reduce blood sugar levels by about 30% (Helmstaedter 2008). The presence of bioactive compounds such as quercetin, rutin, myricetin, ellagic and gallic acids contributes to its role in glucose metabolism regulation and liver protection (Chagas *et al.* 2015). *Aegle marmelos* (L.) Correa is used for treating gastrointestinal disorders, diabetes, and respiratory conditions (Mujeeb *et al.* 2025). *Aegle marmelos* (L.) Correa is rich in alkaloids, coumarins, and flavonoids, showing antimicrobial, antioxidant,and hepatoprotective activity (Amoussa *et al.* 2020). The raw fruit and fruit powder of *Aegle marmelos* (L.) Correa are effectively used in treatment of constipation, chronic dysentery, and diarrhea (Kalaichelvi 2019).

Ethnobotanical data, including metrics like use value (UV) and relative frequency citation (RFC), can be valuable in identifying plants with potential for further pharmacological investigation. This approach can inform drug discovery and development by identifying promising candidates. Furthermore, it can highlight underutilized species that traditional knowledge holders may overlook, potentially leading to the loss of valuable medicinal knowledge (Chaudhary *et al.* 2006). Furthermore, understanding the value of plant usage is crucial for pharmacological studies, as it enhances their convenience and reliability (Cakilcioglu & Turkoglu 2010).

Fidelity Level and Informant Consensus Factor (ICF)

Medicinal plants most commonly used in specific areas have a maximum FL; the higher the FL value, the higher the plant's usage (Farooq *et al.* 2019, Farnsworth 1988). A high FL may indicate prioritizing species for pharmacological, phytochemical, and clinical studies (Islam *et al.* 2014).

Our study identified 16 disease clusters, with gut related disorders having the highest ICF value of 0.95. This reflects concurrence among participants on the medicinal plants' usage for digestive ailments. These findings align with previous research, where digestive system disorders also reported the highest Informant Consensus Factor (ICF) values in ethnobotanical studies (Dery *et al.* 2023, Sutjaritjai *et al.*, 2022). Exposure to contaminated water sources due to flood often cause a higher rate of incidence to the impacted population and is one of the leading causes of gastrointestinal morbidity (Uttar Pradesh - National Centre for Disease Control 2022). Gastrointestinal disorders are common across all age groups (Neamsuvan *et al.* 2017), and remedies for such conditions are often passed down through generations, reinforcing their use and increasing informant agreement. Additionally, other disorders with high ICF in the region, such as respiratory disorders which may be due to prevalence of moist conditions (Kayani *et al.* 2014). High ICF value of diabetes may also have association with environmental and lifestyle factors (International Diabetes Federation, 2019). The widespread use of plants for these ailments results in high consensus among informants within communities and is crucial in the selection of plants for pharmacological studies (Heirich *et al.* 1998)

Generally, the majority of the informants claimed that many plants like *Senegalia catechu* (L.f.) P.J.H.Hurter & Mabb. (mouth ulcer), *Senegalia rugata* (Lam.) Britton & Rose. (hair fall, dandruff), *Vachellia nilotica* (L.) P.J.H.Hurter & Mabb. (immunity booster), *Aegle marmelos* (L.) Correa (dysentery, mal-absorption), *Buchanania lanzan* Spreng. (coughs and asthma) were effective without any side effect such as vomiting, headache, allergic immune responses.

Data suggest that more studies are needed to discover bioactive compounds from medicinal plants. (Kanwal & Ali Sherazi 2017, Petrakou *et al.* 2020, Usman *et al.* 2021). Many medicinal plants grow wild and are susceptible to habitat destruction. Creating protected areas and promoting sustainable harvesting practices are crucial. Cultivating these plants can also ensure a steady supply and reduce pressure on wild populations. Preserving medicinal plants has numerous benefits. They provide affordable healthcare options, particularly in regions with limited access to modern medicine. Furthermore, these plants can serve as a source of new drugs, potentially leading to breakthroughs in treating various ailments.

Conclusion

Traditional medicine has a vast amount of untapped knowledge. Advanced cultivation techniques combined with genetic analysis of medicinal plants could unlock their potential for regenerating tissue and possibly reversing diseases. Pharmacological studies of most utilized ethnomedicinal plants enable discoveries of plant-based drugs. Key medicinal species can be identified and prioritized for conservation after scientific analysis of ethnomedicinal plants. It also established sustainable community-based healthcare solutions and encouraged to cultivate these species for medicinal purposes, which could enhance their livelihoods through sustainable harvesting and value-added products. By preserving this "treasure trove" of natural remedies, a bright future for humanity is possible where healthcare is not just affordable and accessible but personalized and transformative.

Declarations

List of abbreviations:
SBWS: Sohagi Barwa Wildlife Sanctuary; TMDFs: Tropical moist deciduous forests; UV: Use value; RFC: Relative frequency citation; ISE: International Society of Ethnobiology; WFO: World Flora Online; JI: Jaccard index; FL: Fidelity level; ICF: Informant consensus factor.

Ethics approval and consent to participate: Data was obtained from the participants on voluntary basis, maintaining their identity anonymous. Informants were verbally apprised about the purpose of the study, the data collection methods, and their use. No personal data was collected from any informant.

Consent for publication: All the authors approve the data presented in this manuscript

Availability of data and materials: Freely available, on request

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Literature cited

Abidin S, Khan R, Ahmad M, Cuerrier A, Zafar M, Ullah A, Khan J, Saeed A, Al-Qahtani W, Kazi M. 2023. Wild Edible Fruits as a Source of Food and Medicine: A Study among Tribal Communities of Southern Khyber Pakhtunkhwa. Plants 13:39-42.

Amoussa AMO, Sanni A, Lagnika L. 2020. Chemical diversity and pharmacological properties of genus Acacia. Asian Journal of Applied Sciences 13:40–59.

Ampomah P, Yankson K, Akotoye HK, Oforiameyaw E. 2017. An Ethnomedicinal Survey of Plants Used to Treat Malaria in the Central Region of Ghana. The Journal of Phytopharmacology 6(2):107–114.

Appiah KS, Oppong CP, Mardani HK, Omari RA, Kpabitey S, Amoatey CA, Onwona-Agyeman S, Oikawa Y, Katsura K, Fujii Y. 2018. Medicinal Plants Used in the Ejisu-Juaben Municipality, Southern Ghana: An Ethnobotanical Study. Medicines (Basel, Switzerland) 6(1):1.

Arora RK. 1997. Ethnobotany and its role in the conservation and use of plant genetic resources in India. Ethnobotany 9(1-2): 6-15.

Arowosegbe S, Olanipekun MK, Kayode J. 2015. Ethnobotanical survey of medicinal plants used for the treatment of diabetes mellitus in Ekiti South Senatorial District, Nigeria. European Journal of Botany, Plant Sciences and Phytology 2: 1-8.

Asfaw MM, Abebe FB. 2021. Traditional Medicinal Plant Species Belonging to Fabaceae Family in Ethiopia: A Systematic Review. International Journal of Plant Biology 12(1):1.

Ayantunde AA, Briejer M, Hiernaux P, Udo HMJ, Tabo R. 2008. Botanical knowledge and its differentiation by age, gender, and ethnicity in Southwestern Niger. Human Ecology 36:881–889.

Aziz M, Adnan M, Khan A, Shahat A, Al-Said M, Ullah R. 2018. Traditional uses of medicinal plants practiced by the indigenous communities at Mohmand agency, FATA. Journal of Ethnobiology and Ethnomedicine 14(2): 2-16.

Balick MJ, Cox PA. 1996. Plants, People, and Culture: The Science of Ethnobotany. Scientific American Library. New York.

Behera SK, Mishra AK, Sahu N. 2012. The study of microclimate in response to different plant community association in tropical moist deciduous forest from northern India. Biodiversity & Conservation 21: 1159–1176.

Boadu AA, Asase A. 2017. Documentation of Herbal Medicines Used for the Treatment and Management of Human Diseases by Some Communities in Southern Ghana. Evidence-Based Complementary and Alternative Medicine: eCAM 2017:3043061.

Cakilcioglu U, Turkoglu I. 2010. An ethnobotanical survey of medicinal plants in Sivrice (Elazığ-Turkey). Journal of Ethnopharmacology 132(1):165-175.

Chagas VT, França LM, Malik S, Paes AM. 2015. *Syzygium cumini* (L.) Skeels: A prominent source of bioactive molecules against cardiometabolic diseases. Frontiers in Pharmacology 6:259.

Chaudhary MI, He Q, Cheng YY, Xiao PG. 2006. Ethnobotany of medicinal plants from Tian Mu Shan biosphere reserve, Zhejiang-Province, China. Asian Journal of Plant Science 5:646–653.

D'Rozario A, Bera S, Mukherji D. 2004. A Handbook of Ethnobotany. 1st edn, Kalyani Publishers, New Delhi.

Dery G, Dzitse S, Tom-Dery D. 2023. Ethnobotanical survey of medicinal plants in Sissala East municipality of the upper West region, Ghana. Phytomedicine Plus 3(3):100461.

Etkin NL. 2002. Local knowledge of biotic diversity and its conservation in rural Hausaland, Northern Nigeria. Economic Botany 56(1): 73-88.

Fabricant DS, Farnsworth NR. 2001. The value of plants used in traditional medicine for drug discovery. Environmental Health Perspectives 109(Suppl 1): 69-75.

Farnsworth NR. 1988. Screening plants for new medicines. In: Wilson EO, Peter FM. (eds). Biodiversity. The National Academies Press: Washington, DC, USA. Pp. 83-97.

Farooq A, Amjad MS, Ahmad K, Altaf M, Umair M, Abbasi AM. 2019. Ethnomedicinal knowledge of the rural communities of Dhirkot, Azad Jammu and Kashmir, Pakistan. Journal of Ethnobiology and Ethnomedicine 15(1):45.

Faruque MO, Uddin SB, Barlow JW, Hu S, Dong S, Cai Q, Li X, Hu X. 2018. Quantitative Ethnobotany of Medicinal Plants Used by Indigenous Communities in the Bandarban District of Bangladesh. Frontiers in Pharmacology 9:40.

Ford JD, King N, Galappaththi EK, Pearce T, McDowell G, Harper SL. 2020. The Resilience of Indigenous Peoples to Environmental Change. One Earth 2(6):532-543.

Friedman J, Yaniv Z, Dafni A, Palewitch D. 1986. A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev desert, Israel. Journal of Ethnopharmacology 16(2-3): 275-287.

Giday M, Asfaw Z, Woldu Z, Teklehaymanot T. 2009. Medicinal plant knowledge of the Bench ethnic group of Ethiopia: An ethnobotanical investigation. Journal of Ethnobiology and Ethnomedicine 5(1): 34.

Gupta SC, Sung B, Kim JH, Prasad S, Li S, Aggarwal BB. 2013. Multitargeting by turmeric, the golden spice: From kitchen to clinic. Molecular Nutrition & Food Research 57(9): 1510-1528.

Hafez LO, Brito-Casillas Y, Abdelmageed N, Alemán-Cabrera IM, Morad SAF, Abdel-Raheem MH, Wägner AM. 2024. The *Acacia* (*Vachellia nilotica* (L.) P.J.H. Hurter & Mabb.): Traditional uses and recent advances on its pharmacological attributes and potential activities. Nutrients 16(24):4278.

Hamilton AC. 2004. Medicinal plants, conservation, and livelihoods. Biodiversity and Conservation 13(8): 1477-1517.

Heinrich M, Ankli A, Frei B, Weimann C, Sticher O. 1998. Medicinal plants in Mexico: Healers' consensus and cultural importance. Social Science & Medicine 47(11):1859-1871.

Helmstaedter A. 2008. *Syzygium cumini* (L.) Skeels (Myrtaceae) against diabetes—125 years of research. Pharmazie 63(2):91-101.

Hu R, Lin C, Xu W, Liu Y, Long C. 2020. Ethnobotanical study on medicinal plants used by Mulam people in Guangxi, China. Journal of Ethnobiology and Ethnomedicine 16(1):40.

International Diabetes Federation. 2019. IDF Diabetes Atlas. 9th ed. Brussels, Belgium: International Diabetes Federation.

Islam MK, Saha S, Mahmud I, Mohamad K, Awang K, Jamal Uddin S, Rahman MM, Shilpi JA. 2014. An ethnobotanical study of medicinal plants used by tribal and native people of Madhupur forest area, Bangladesh. Journal of Ethnopharmacology 151(2):921-930.

Iyamah P C, Idu M. 2015. Ethnomedicinal survey of plants used in the treatment of malaria in Southern Nigeria. Journal of Ethnopharmacology 173:287-302.

Jadid N, Kurniawan E, Himayani CES, Andriyani, Prasetyowati I, Purwani KI, Muslihatin W, Hidayati D, Tjahjaningrum ITD. 2020. An ethnobotanical study of medicinal plants used by the Tengger tribe in Ngadisari village, Indonesia. PLOS ONE 15(7):e0235886.

Joshi N, Ghorbani A, Siwakoti M, Kehlenbeck K. 2020. Utilization pattern and indigenous knowledge of wild medicinal plants among three ethnic groups in Makawanpur district, Central Nepal. Journal of Ethnopharmacology 262:113219.

Kalaichelvi R. 2019. A review of anti-diarrheal activity of *Aegle marmelos*. Journal of Complementary and Alternative Medical Research 7:1-10.

Kanwal H, Ali Sherazi B. 2017. Herbal medicine: Trend of practice, perspective, and limitations in Pakistan. Asian Pacific Journal of Health Sciences 4:6-8.

Kayani S, Ahmad M, Sultana S, Khan Shinwari Z, Zafar M, Yaseen G, Hussain M, Bibi T. 2015. Ethnobotany of medicinal plants among the communities of Alpine and Sub-alpine regions of Pakistan. Journal of Ethnopharmacology 164:186-202.

Kayani S, Ahmad M, Zafar M, Sultana S, Khan MPZ, Ashraf MA, Hussain J, Yaseen G. 2014. Ethnobotanical uses of medicinal plants for respiratory disorders among the inhabitants of Gallies–Abbottabad, Northern Pakistan. Journal of Ethnopharmacology 156:47–60.

Khajuria AK, Manhas RK, Kumar H, Bisht NS. 2021. Ethnobotanical study of traditionally used medicinal plants of Pauri district of Uttarakhand, India. Journal of Ethnopharmacology 276:114204.

Khakurel D, Uprety Y, Ahn G, Cha JY, Kim WY, Lee SH, Rajbhandary S. 2022. Diversity, distribution, and sustainability of traditional medicinal plants in Kaski district, western Nepal. Frontiers in Pharmacology 13:1076351.

Kumar M, Radha Devi H, Prakash S, Rathore S, Thakur M, Puri S, Pundir A, Bangar SP, Changan S, Ilakiya T. 2021.Ethnomedicinal plants used in the health care system: survey of the mid hills of Solan district, Himachal Pradesh, India. Plants 10(9):1842.

Kumari M, Radha, Kumar M, Zhang B, Amarowicz R, Puri S, Pundir A, Rathour S, Kumari N, Chandran D, Dey A, Sharma N, Rajalingam S, Mohankumar P, Sandhu S, Pant N, Ravichandran RP, Subramani M, Pandi K, Lorenzo JM. 2022. Acacia catechu (L.f.) Willd.: A Review on Bioactive Compounds and Their Health Promoting Functionalities. Plants 11(22):3091.

Kunwar RM, Baral K, Paudel P, Acharya RP, Thapa-Magar KB, Cameron M, Bussmann RW. 2016. Land-Use and Socioeconomic Change, Medicinal Plant Selection and Biodiversity Resilience in Far Western Nepal. PLOS ONE 11(12):e0167812.

Kutty R, A Kothari. 2001. Protected Areas in India: A Profile. Kalpavriksh Publications, New Delhi, India.

Laldingliani TBC, Thangjam NM, Zomuanawma R, Bawitlung L, Pal A, Kumar A. 2022. Ethnomedicinal study of medicinal plants used by Mizo tribes in Champhai district of Mizoram, India. Journal of Ethnobiology and Ethnomedicine 18(1):22.

Lalfakzuala R, Lalramnghinglova H, Kayang H. 2007. Ethnobotanical usage of plants in western Mizoram. Indian Journal of Traditional Knowledge 6(3):486-493.

Maharjan R, Thapa R, Nagarkoti S, Sapkota P. 2021. Ethnobotanical uses of home garden species around Lalitpur district, Nepal. Asian Journal of Pharmacognosy 4(2):10-22.

Mehta AK, Shah A. 2003. Chronic Poverty in India: Incidence, Causes and Policies. World Development 31(3):491-511.

Mootoosamy A, Fawzi Mahomoodally M. 2014. Ethnomedicinal application of native remedies used against diabetes and related complications in Mauritius. Journal of Ethnopharmacology 151(1):413-444.

Mujeeb F, Khan AF, Pandey VK, Sinha A, Barwant MM, Rustagi S, Kovács B, Shaikh AM. 2025. Significance, pharmacological properties, and industrial applications of bael (*Aegle marmelos*): A review of current knowledge. Journal of Agriculture and Food Research 19:101631.

National Centre for Disease Control. 2022. Uttar Pradesh - National Centre for Disease Control. Available from: https://ncdc.mohfw.gov.in/uploads/2024/05.

Neamsuvan O, Ruangrit T. 2017. A survey of herbal weeds that are used to treat gastrointestinal disorders from Southern Thailand: Krabi and Songkhla provinces. Journal of Ethnopharmacology 196:84–93.

Oreagba IA, Oshikoya KA, Amachree M. 2011. Herbal medicine use among urban residents in Lagos, Nigeria. BMC Complementary and Alternative Medicine 11:117.

Parthiban R, Vijayakumar S, Prabhu S, Gnanaselvam J, Yabesh EM. 2016. Quantitative traditional knowledge of medicinal plants used to treat livestock diseases from Kudavasal taluk of Thiruvarur district, Tamil Nadu, India. Revista Brasileira de Farmacognosia 26:109-121.

Petrakou K, Gregoris I, Lamari F. 2020. Ethnopharmacological survey of medicinal plants traded in herbal markets in the Peloponnisos, Greece. Journal of Herbal Medicine 19:100305.

Phillips O, Gentry A. 1993. The useful plants of Tambopata, Peru: I. Statistical Hypothesis tests with a new quantitative technique. Economic Botany 47:15-32.

Prajapati SK, Sharma K, Singh PK. 2018. Plant diversity in tropical dry deciduous forests of Jashpur, Chhattisgarh with special reference to their ethnomedicinal uses. Tropical Ecology 59(3):505-514.

Quinlan MB, Quinlan RJ. 2007. Modernization and medicinal plant knowledge in a Caribbean horticultural village. Medical Anthropology Quarterly 21(2): 169-192.

Ralte L, Sailo H, Singh YT. 2024. Ethnobotanical study of medicinal plants used by the indigenous community of the western region of Mizoram, India. Journal of Ethnobiology and Ethnomedicine 20(1): 2.

Reyes-García V, Vadez V, Huanca T, Leonard W, Wilkie D. 2005. Knowledge and consumption of wild plants: A comparative study in two Tsimane' villages in the Bolivian Amazon. Ethnobotany Research and Applications 3: 201-207.

Saeedi R, Sultana A, Raheman K. 2020. Medicinal properties of different parts of Acacia nilotica Linn (Babul), its phytoconstituents and diverse pharmacological activities. International Journal of Pharmacy and Pharmaceutical Sciences. 12(2): 8=14.

Shanley P, Luz L, 2003. The Impacts of Forest Degradation on Medicinal Plant Use and Implications for Health Care in Eastern Amazonia. BioScience 53(6):573-584.

Silva FS, Ramos MA, Hanazaki N, Albuquerque UPA. 2011. Dynamics of traditional knowledge of medicinal plants in a rural community in the Brazilian semi-arid region. Revista Brasileira de Farmacognosia 21(3):382-391.

Singh JS, Chaturvedi R. 2017. Diversity of Ecosystem Types in India: A Review. Proceedings of the Indian National Science Academy 83:569-594.

Srivastava JK, Shankar E, Gupta S. 2010. Chamomile: A herbal medicine of the past with bright future. Molecular Medicine Reports 3(6): 895-901.

Ssenku JE, Okurut SA, Namuli A, Kudamba A, Tugume, P, Matovu P, Wasige G, Kafeero HM, Walusansa, A. 2022. Medicinal plant use, conservation, and the associated traditional knowledge in rural communities in Eastern Uganda. Tropical Medicine and Health 50(1):39.

Subramanyam R, Newmaster SG, Paliyath G, Newmaster CB. 2007. Exploring Ethnobiological Classifications for Novel Alternative Medicine: A case study of Cardiospermum halicacabum L. (Modakathon, Balloon Vine) as a traditional herb for treating rheumatoid arthritis. Ethnobotany 19(1):1-16.

Sutjaritjai N, Panyadee P, Phumthum M, Inta A, Balslev H. 2022. High Diversity of Medicinal Uses of Thai Legumes (Fabaceae) and Their Potential in Public Herbal Medicine. Diversity (Basel) 14(8):588.

The ISE code of ethics, international society of ethnobiology 2006.

Treyvaud AV, Arnason JT, Maquin P, Cal V, Vindas PS, Poveda L. 2005. A consensus ethnobotany of the Q'eqchi' Maya of southern Belize. Economic Botany 59:29-42.

Tugume P, Nyakoojo C. 2019. Ethno-pharmacological survey of herbal remedies used in the treatment of paediatric diseases in Buhunga parish, Rukungiri District, Uganda. BMC Complementary and Alternative Medicine 19(1):353.

Tumoro G, Maryo M. 2016. Determination of informant consensus factor and fidelity level of ethnomedicinal plants used in Misha Woreda, Hadiya Zone, Southern Ethiopia. International Journal of Biodiversity and Conservation 8(12):351-364.

Usman M, Ditta A, Ibrahim FH, Murtaza G, Rajpar MN, Mehmood S, Saleh MNB, Imtiaz M, Akram S, Khan WR. 2021. Quantitative Ethnobotanical Analysis of Medicinal Plants of High-Temperature Areas of Southern Punjab, Pakistan. Plants 10(10):1974.

Weckerle C, de Boer H, Puri R, Andel T, Bussmann R, Leonti M. 2017. Recommended standards for conducting and reporting ethnopharmacological field studies. Journal of Ethnopharmacology 210:125-132.

WHO. 2002. Traditional Medicine Strategy 2002–2005. World Health Organization.