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Revealing ethnomedical knowledge: perspectives from quantitative and sociodemographic data

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The paper examines the ethnomedical value of the wild flora in Muzaffargarh, Pakistan, and how it can be used to provide sustainable food resources and to support local health care. 29 ethnomedical plants in 20 botanical categories were recorded through semi-structured interviews with 534 individuals. Fabaceae and Amaranthaceae were the two most common families, with 11% each of the known flora, respectively. Use Value (UV), Fidelity Level (FL), Informant Consensus Factor (ICF), and the Jaccard Index (JI) are a few examples of the quantitative ethnobotanical indices that helped determine the cultural relevance, dependability, and consistency of the plant use. *Chenopodium album* and *Chenopodium murale* gave the highest values of UV (1.0), meaning that these two plants are highly therapeutically acceptable within the community. The health conditions that had the highest unanimity were lice infestation (ICF = 0.998) and arsenic toxicity (ICF = 0.996). *Lysimachia arvensis* was the highest FL (100) in the treatment of jaundice. On comparison of 45 ethnobotanical research published between 2015 and 2022, districts such as Jhang were not very overlapping (JI = 0.78), which demonstrates region-specific ethnomedical knowledge, and Faisalabad had the most similarities (JI = 13.9). It is interesting to mention that novel, unreported medicinal properties were mentioned in 19 plant species, including *Taraxacum officinale*, *Calotropis gigantea*, *Moringa oleifera*, and *Abutilon indicum*. All in all, the findings demonstrate the relative efficiency of the indigenous knowledge, the potential of such practice in the context of pharmaceutical benefit, and the importance of the preservation of such cultural heritage and the adequate inclusion of such information into modern healthcare and biodiversity management practices.

Keywords: Biodiversity conservation, Indigenous knowledge, Medicinal plants, Traditional medicine

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The rich ancestral knowledge is stored in ethnomedicine, encompassing centuries of human experience of natural resources and their medicinal properties. Many communities around the globe have discovered and preserved medically used plants, many of which remain unfamiliar to scientists[1]. This holistic form of treatment addresses the physical, psychological, as well as spiritual elements of health in a world where the use of synthetic drugs, increasing cases of antibiotic resistance, and the burden of chronic illnesses are increasing day by day[2].

The application of traditional knowledge that has always been oral is increasingly being endangered by the environment, rapid urbanization, globalization, and cultural decay[3]. However, as scientific study continues to validate and incorporate traditional cures into professional healthcare, ethnomedicine is becoming more and more recognized internationally[4]. Pharmaceutical research, sustainable healthcare practices, and deeply ingrained healing traditions are all supported by ethnomedicine[5].

Widely used medications like aspirin, which was first made from willow (Salix) bark, demonstrate the significance of this information on a worldwide scale[6]. These illustrations highlight the medicinal potential of plant-based treatments, many of which may have fewer adverse effects than pharmaceuticals. Ethnomedicine continues to be a vital source of physiologically active substances for creating novel medicines[7]. In this regard, ethnobotany-the scientific study of human-plant relationships-is essential to maintaining traditional knowledge, comprehending cultural significance, and directing conservation and pharmaceutical research[8].

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Nearly 88% of people in many developing nations, such as Pakistan, India, Thailand, Mexico, and Nigeria, still get their primary medical care from traditional medicinal herbs[9]. Strong sociocultural ties are reflected in the fact that women and children frequently gather these resources, which promote the health of both humans and animals. However, many species are in danger due to excessive harvesting, especially in regions rich in biodiversity like the Hindu Kush-Himalayan belt[10]. Significant medicinal plant diversity is preserved in Pakistan's nine biological zones thanks to millennia of traditional knowledge, but environmental change and socioeconomic pressures are putting this legacy in jeopardy[11,12].

Muzaffargarh district in Punjab is still relatively understudied, despite the growth of ethnomedicine research in Pakistan. This area has rich ethnomedical traditions that have not gotten much scholarly attention, owing to its low literacy rate, poor healthcare infrastructure, and economic hardship[12]. Muzaffargarh's indigenous plant knowledge is virtually unrecorded because most research has been concentrated in nearby districts or larger areas. This invaluable cultural and medical heritage is at risk of being lost unless it is recorded, a move that would strengthen local healthcare, in addition to its possible contribution to global medical research.

Therefore, through this form of community interaction, this study aims to record the ethnomedicinal practices in Muzaffargarh systematically. The objectives are: to determine the level of ethnomedical knowledge using quantitative ethnobotanical indices to compare with adjacent areas; document medicinal plant species used to treat different conditions, with special consideration to new or localized applications; and to aid conservation by providing base data in future ethnomedicinal, ecological, and cultural studies.

This work thus would help to sustain healthcare planning, maintain biodiversity, and even preserve indigenous knowledge in a region where the subject is poorly studied, although the area is rich in culture.

Material and Methods

Study area

The Muzaffargarh District (70.537°E–71.726°E; 29.016°N–30.765°N; Fig. 1) is in southern Punjab, Pakistan. The climate is dry, with the seasonal changes in temperature being extreme during summer, when the temperatures rise to nearly 54°C, and during winter, the temperatures drop to nearly 1°C. The rainfall is just 127 mm /year. These difficult environmental conditions affect the diversity and availability of therapeutic flora. The region, being in the midst of the

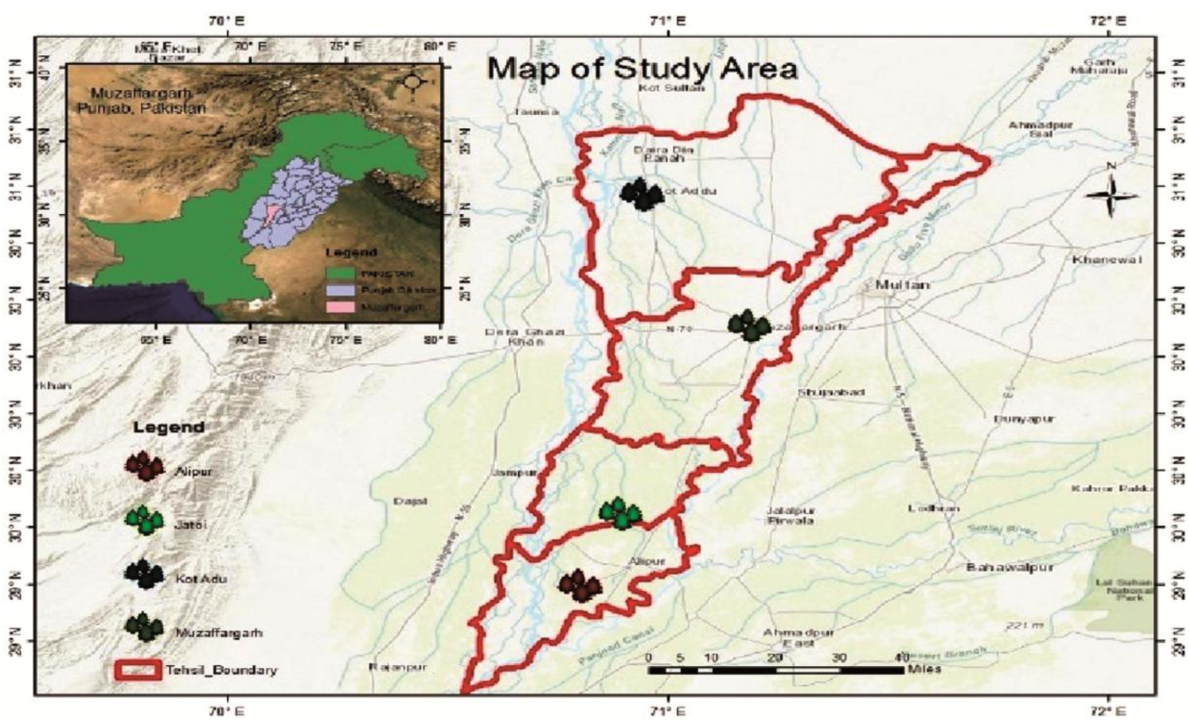

Fig. 1 — Locations of study sites in Muzaffargarh, Punjab, Pakistan [developed using QGIS software version 3.28.4 (QGIS Development Team, Open-Source: Geospatial Foundation Project, USA)

Chenab and Indus Rivers, boasts of unique wild vegetation that remains a critical aspect of healthcare to the communities. There is a high level of cultural continuity in this economically hard-stricken region as traditional plant knowledge is maintained and taught by farmers, herbalists, and the elderly.

Ethnobotanical data collection and ethics

Participatory Rural Appraisal (PRA) methods and structured questionnaires were used to collect ethnomedical knowledge. Using snowball sampling, 534 traditional healers and informants- 86 of whom were women- were chosen. Participants gave information about plant IDs, colloquial names, medicinal applications, plant parts used, and preparation techniques.

Verbal informed consent was acquired before interviews. Participants were guaranteed anonymity, confidentiality, and voluntary participation, and the study's aims were described in the local tongue. In order to ensure cultural respect, community rights, and responsible treatment of indigenous knowledge, the study adhered to the International Society of Ethnobiology's (ISE) Code of Ethics.

Plant identification

Voucher specimens were collected, dried, stored, and mounted on herbarium sheets with relevant botanical and ecological information. To ensure correctness and future reference reliability, species were identified using standard taxonomic literature, and nomenclature was verified using Plants of the World Online (POWO), Royal Botanic Gardens, Kew[13].

Informant Consensus Factor (ICF)

ICF was used to gauge informant agreement on the use of plants for specific disease categories. Stronger cultural consensus and possibly more therapeutic dependability are indicated by higher ICF values.

$$ICF = \frac{Nur - Nt}{Nt - 1}$$

Where Nur = number of use reports for an ailment category and Nt = number of species used for that category[14].

Use Value (UV)

Use Value quantified the cultural significance and frequency of citation for each plant species:

$$UV = \frac{\sum Ui}{N}$$

Where Ui = number of uses reported per species and N = number of informants[15].

Fidelity Level (FL)

Fidelity Level estimated the specificity of plant use for particular ailments:

$$FL\% = \frac{Np}{N} \times 100$$

Where Np = number of informants citing a plant for a specific ailment and N = total informants reporting its use[16,17].

Jaccard Index (JI)

The Jaccard Index compared plant similarity between the study area and previously published regional studies:

$$JI = \frac{c \times 100}{(a+b)-c}$$

Where a = number of species in this study, b = species in the comparison region, and c = shared species[11].

Results and Discussion

Socio-demographic data of informants

The gender ratio of the 534 participants, comprising 448 males and 86 females, is also a mirror image of the social restrictions on women in terms of their involvement in public life. There was profound experiential knowledge among female respondents, though they were underrepresented, particularly when childcare, reproductive health, and domestic treatment were being discussed (Table 1). Future research should employ gender-inclusive methods, as they would be more representative of the knowledge of women.

Table 1 — Socio-demographic data of informants

Variable	Demographic categories	Numbers	Percentage
Gender	Male	448	83.9
	Female	86	16.1
Profession	Farmer	170	31.8
	Herbalist	150	28.1
	Pansars (traditional drug sellers)	129	24.2
	Other	85	15.9
Age groups	31-40	94	17.6
	41-50	250	46.8
	51-60	88	16.5
	Above 60	102	19.1
Education	Uneducated	89	16.6
	Primary	202	37.8
	Middle	78	14.6
	Matric	115	21.5
	Above Matric	50	9.5

As the participants were split into three age categories (<40, 40-60, and >60), we could see that the older generation, especially those older than 60, possesses much more knowledge in the field of ethnomedicine. The younger generations were less familiar, which means that there was an increase in reliance on modern healthcare services and a decrease in information transfers.

Educational status also affected knowledge retention. Because of the close connection to rural life and greater dependence on traditional medicines, uneducated people stated that they possessed a more complete understanding of ethnomedicine. Formally educated people, in their turn, were more inclined to rely on allopathic medicine, which is an indicator of the changing social attitudes.

The traditional healers (Hakeems) and the midwives became valuable carriers of specialized knowledge. Midwives had extensive knowledge of the health of women, but Hakeems had centralized knowledge on Tibb-e-Unani. These trends indicate that information retention is sensitive as well as necessary, and this highlights the necessity of having a system of recording.

Plant families, life forms, and medicinal significance

Twenty families were found to have thirty species. The two most represented families were Amaranthaceae and Fabaceae, which is consistent with previous studies that linked the families with the abundance of alkaloids, saponins, and flavonoids. Other significant families included Moraceae, Solanaceae, Asteraceae, Polygonaceae, Poaceae, and Zygophyllaceae (Fig. 2a).

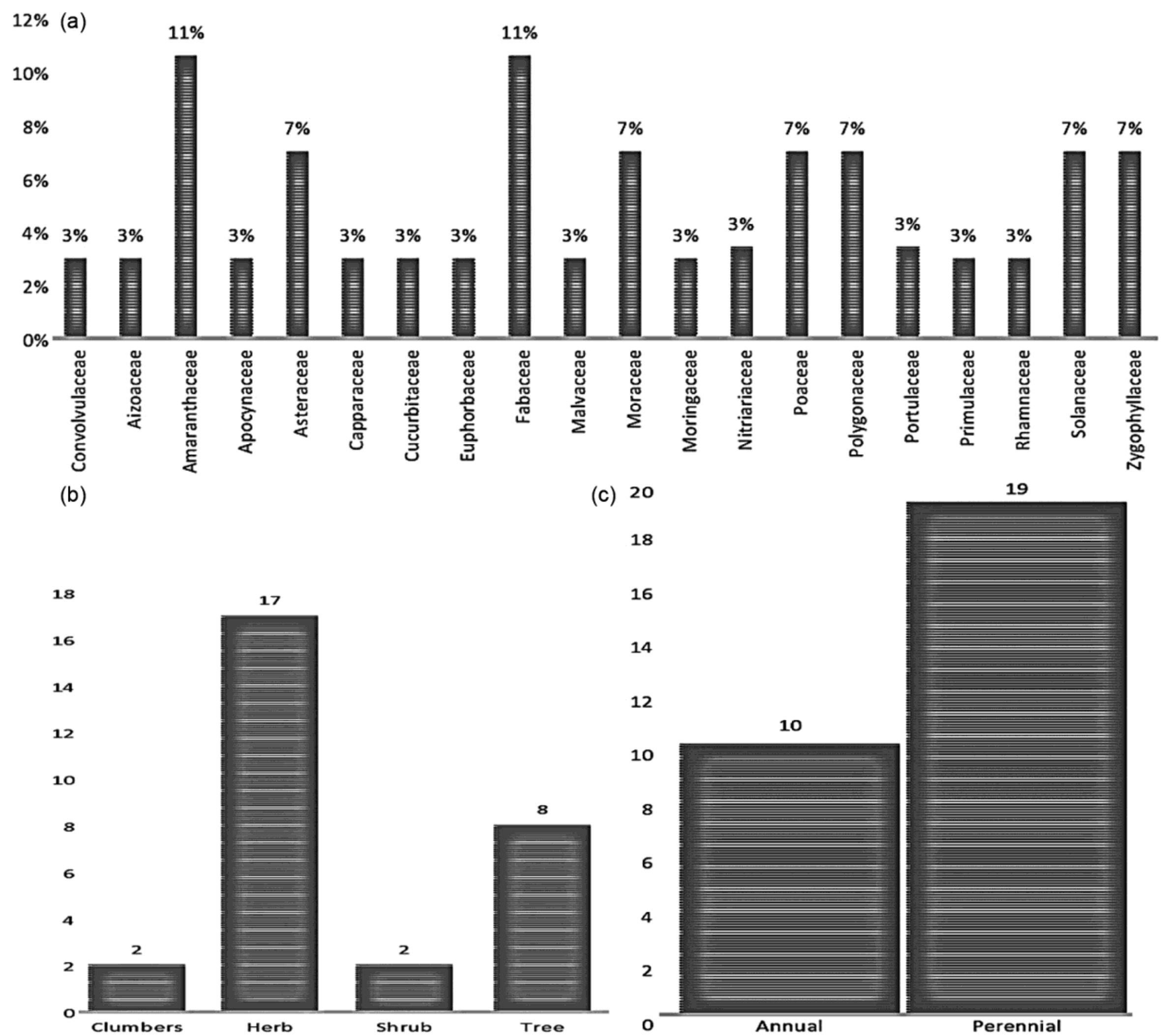

Fig. 2 — Distribution of plant families in Muzaffargarh (a) Plant families (b) Life forms of ethnomedicinal flora (c) Life Span of ethnomedicinal flora

The vegetation was mainly herbaceous (17 species) and tree (8), shrub (2), and climber (2) species (Fig. 2b-c). Sixty-eight percent of the plants were perennial plants, which provided medicinal supplies all year round and sustainably. The research studies in Lahore, Bahawalpur, and Khyber Pakhtunkhwa show that these families dominate to the same extent.

Generation differences in dependence further underscore the need to conserve and transfer information in order to ensure that there is a sustainable ethnomedical legacy.

Plant parts used

Some of the plant parts used included leaves, roots, bark, fruits, seeds, latex, and rhizomes. Whole plants (23%), then leaves (20%), fruits (18%), roots (15%), and seeds (9) were the most commonly used parts of plants (Fig. 3).

The past researches indicate that the leaves were preferred, as they were readily accessible, easy to collect, and the phytochemical content of leaves was high. The need for sustainable methods is explained by the fact that excessive harvesting of plants and roots may compromise the regeneration of the species.

Methods of preparation

The most popular preparations were decoctions (21.4%), followed by pastes (19%), juices (17.85%), powders (14.66%), and infusions (10.71%) (Fig. 4). Although combinations occasionally improved strength or specificity, remedies were primarily focused on single plants. Cooling juices were favored in hot

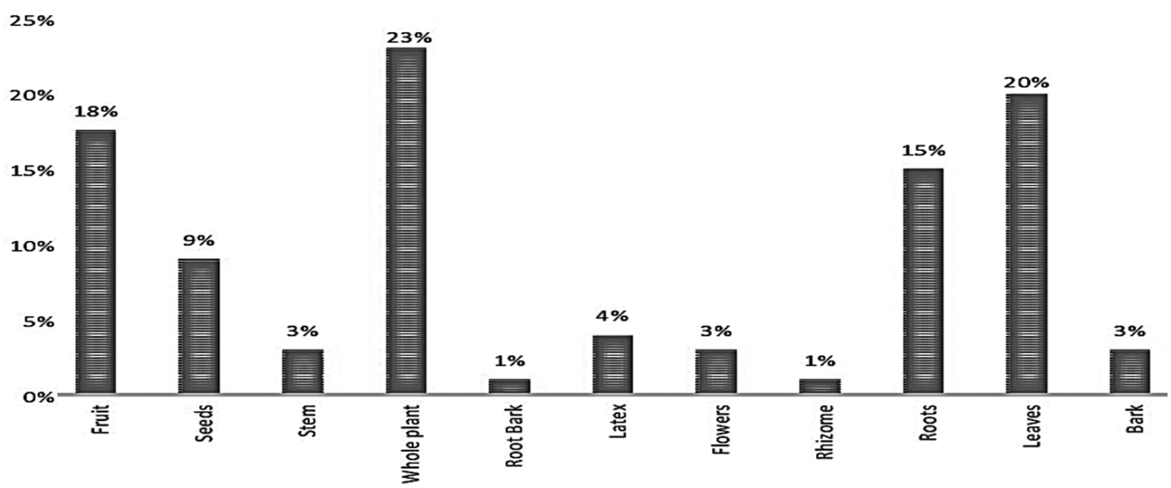

Fig. 3 — Plant part used in ethnomedicinal remedies

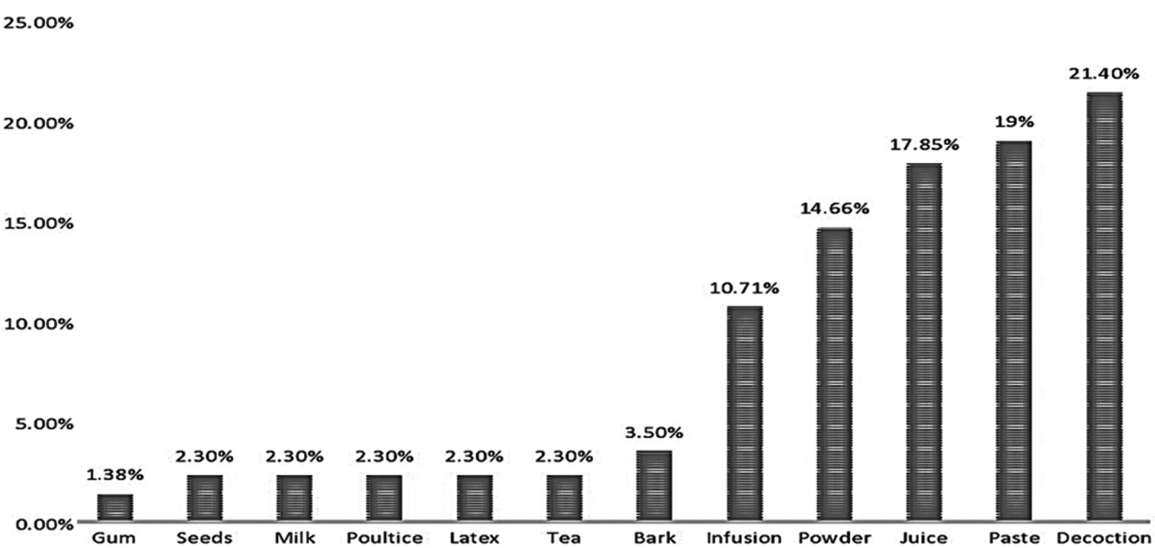

Fig. 4 — Methods of preparation of ethnomedicinal remedies

weather and decoctions in colder weather, reflecting cultural customs and climate[18-20].

Quantitative ethno-medicinal data

Informant consensus factor (ICF)

The highest consensus was found for inflammation, arsenic poisoning, hemorrhoids, and skin problems (ICF ranged from 0.838 to 0.998), which are probably caused by poor water quality and environmental circumstances after infrastructure destruction. *Convolvulus arvensis*, *Solanum nigrum*, *Moringa oleifera*, and *Nicotiana plumbaginifolia* were important plants (Table 2). Regional variance caused by ecological and cultural factors was found in Chitral and Moroccan studies[23-23].

Use value (UV)

The variation of UV was 0.04-1.0 (Table 3). *Chenopodium murale* and *Chenopodium album* (UV = 1.0) showed the most significant meaning, which shows accessibility and adaptability. Species such as *Vachellia nilotica*, *Achyranthes aspera*, and *Abutilon indicum* were also found to be strongly community-dependent. *Calotropis gigantea* (0.04) has less UV, indicating the possibility of being toxic or a lack of knowledge. Muzaffargarh is more dependent than its neighbors, and this implies that the cultural integration is more profound.

Fidelity level (FL)

The FL values ranged between 10% and 100 (Table 4). Whereas the *V. nilotica* (42) and *Calotropis gigantea* (46) were preferred in terms of fever and wound healing, *Abutilon indicum* (70) had excellent specificity in terms of treating skin cancer. Lower FL values indicate a broader scope of application or rivalry with other therapies. Regional comparisons bring to focus ecological and cultural differences in the preferences of treatment.

Jaccard index (JI)

The mean similarity of JI was found to vary between 0.78 and 13.66 compared to 45 studies in the region, which were conducted between 2015 and 2022; South Punjab and Jhang[24] showed the least similarity, and Layyah[25] the highest (Table 5). Some of the common species included *Achyranthes aspera*, *Citrullus colocynthis*, *Convolvulus arvensis*, *Moringa oleifera* and *Tribulus terrestris* indicative of their high-regarded medicinal values. A particular example of regional development which is important is *Asplenium dalhousiae* against snakebite.

Novelty index

Nineteen wild plant species, such as *Abutilon indicum*, *Vachellia nilotica*, *Calotropis gigantea*, and *Capparis decidua*, are highlighted in this study for their ethnomedical uses. The 10 most commonly

Table 2 — Informant Consensus Factor (ICF)

Diseases	ICF	Diseases	ICF
Against arsenic toxicity	0.998	Skin Cancer	0.966
Kill Lice	0.996	Eye Problem	0.958
Piles treatment	0.994	Anti-inflammatory	0.956
Typhoid	0.994	Dysentery	0.955
Stomach disease	0.99	Jaundice	0.941
Reduce Inflammation	0.988	Asthma	0.938
Facilitate abortion	0.986	Antidote for spider bite	0.928
Headache	0.985	Fever	0.925
Eye Kajal	0.983	Cough	0.897
Burns	0.981	Diabetes	0.867
Acne	0.975	Wounds	0.854
Skin problems	0.968	Wounds	0.838

*Min Informant Consensus Factor (ICF)= 0.838, Max Informant Consensus Factor (ICF)=0.998

Table 3 — Use Value (UV)

Plant	Family	UV
Nicotiana plumbaginifolia	Solanaceae	0.04
Calotropis gigantea	Apocynaceae	0.04
Moringa oliefera	Moringaceae	0.13
Capparis decidua.	*Capparaceae*	0.13
Dactyloctenium aegyptium	Poaceae	0.13
Tribulus terrestris	Zygophyllaceae	0.15
Ziziphus spina-chrwasti	Rhamnaceae	0.26
Capparis decidua	Capparaceae	0.26
Ficus benghalensis	Moraceae	0.36
Vachellia nilotica	Fabaceae	0.36
Ficus religiosa	Moraceae	0.4
Anagallwas arvensis	Primulaceae	0.41
Portulaca oleracea	Portulaceae	0.41
Lysimachia arvensis	Primulaceae	0.42
Euphorbia chamaesyce	Euphorbaceae	0.42
Leucaena leucocephala	Fabaceae	0.42
Zaleya pentandra	Aizoaceae	0.45
Solanum nigrum	Solanaceae	0.47
Persicaria maculosa	Polygonaceae	0.52
Achyranthes aspera	Amaranthaceae	0.58
Convolvulus arvensis	Convolvulaceae	0.64
Cirsium arvense	Asteraceae	0.66
Rumex obtusifolius	Polygonaceae	0.66
Taraxacum officinale	Asteraceae	0.66
Abutilon indicum	Malvaceae	0.7
Penganum hermala	Nitriariaceae	0.8
Chenopodium album	Chenopodiaceae	1
Chenopodium murale	Chenopodiaceae	1
Citrullus colocynthis	Cucurbitaceae	1
Cynodon dactylon	Poaceae	1

*Min use value (UV)=0.04, Max use value (UV)=1 referenced or pharmacologically relevant species are included in (Table 6), and (Supplementary Table S1) has the full dataset of all 29 known plants.

The originality of local knowledge in Muzaffargarh is highlighted by several species that exhibit distinct departures from previously documented ethnomedicinal applications. For instance, this study reports using *Abutilon indicum* to treat typhoid and skin cancer, although previous research mostly linked it to cough and asthma[26]. Similarly, although previous research mostly associated *Leucaena leucocephala* with asthma, the present findings link it to the treatment of jaundice. In contrast to earlier research that highlighted their medicinal usefulness in skin illnesses and diabetes[27], both species of *Vachellia nilotica* were mostly cited for fever treatment. Similarly, *Achyranthes aspera* and *Calotropis gigantea* were claimed to treat fever and asthma, respectively, while *Citrullus colocynthis* was reported to treat asthma, departing from its previously known use in relieving constipation[28]. In comparison to previous studies, other plants, such as *Convolvulus arvensis*, *Cynodon dactylon*, and *Dactyloctenium aegyptium*, also showed new ethnomedicinal activities. The bark and latex of *Ficus religiosa* were mentioned for asthma and diabetes, showing the changing character of ethnomedical traditions, whereas *Euphorbia prostrata* was emphasized mostly for wound healing rather than its previously reported link with diabetes and jaundice[29].

The ethnobotanical data presented for Muzaffargarh indicate the presence of a well-established and actively utilized traditional medical system. The Use Values (UV) of *Chenopodium album* and *C. murale* are especially high at 1.0 each, which demonstrates that they play a critical role in the treatment of such conditions as weariness, fever, and liver issues. This significance can be better seen when compared to the values found in the surrounding regions, such as Vehari, where the reported UV values of these species were considerably less (0.50 and 0.69, respectively). This variance could be due to stronger cultural dependency, better species availability, or better

Table 4 — Fidelity Level (FL)

Plant	Disease	FL
Cynodon dactylon	Headache	10
Taraxacum officinale	Antidote for spider bite	36
Tribulus terrestris	Fever	36
Vachellia nilotica	Wounds	36
Convolvulus arvensis	Cough	40
Penganum hermala	Headache	41
Vachellia nilotica	Fever	42
Chenopodium murale	Asthma	42
Dactyloctenium aegyptium	Eye problem	42
Ficus religiosa	Facilitate abortion	42
Zaleya pentandra	Cough	45
Calotropis gigantean	Wounds	46
Persicaria maculosa	Eye problem	52
Capparis decidua	Dysentery	53
Capparis decidua	Wounds	53
Ficus benghalensis	Stomach disease	57
Achyranthes aspera	Cough	58
Moringa oliefera.	Wounds	60
Euphorbia prostrata	Anti-inflammatory	63
Cirsium arvense	Antidote for spider bite	64
Citrullus colocynthis	Diabetes	64
Chenopodium album	Cough	66
Solanum nigrum	Acne	66
Abutilon indicum	Skin Cancer	70
Ziziphus spina-chrwasti	Diabetes	73
Portulaca oleracea	Fever	73
Rumex obtusifolius	Wounds	73
Leucaena leucocephala	Diabetes	80
Nicotiana plumbaginifolia	Asthma	80
Lysimachia arvensis	Jaundice	100

*Min fidelity level (FL) = 10, Max fidelity level (FL) = 100

Table 5 — Jaccard Index

Area	SY	TRSs	NPSU	NPSDU	PPSU	PPDU	TSCBA	JI	C
Faisalabad	2015	40	6	6	15	15	12	13.9	29
Layyah	2014	125	2	10	1.6	8	12	13.66	25
Rawalpindi	2014	87	4	0	4.59	6.89	4	8.69	24
Bahawalnagar	2015	63	2	5	3.17	7.93	7	6.15	25
Lahore	2016	80	3	6	3.75	7.5	9	4.76	2
Lodhran	2014	47	1	2	0.21	4.25	3	4.41	12
India	2022	41	2	4	2.34	3.58	5	4.32	22
Sheikhupura	2017	96	3	3	3.16	3.156	6	4.13	28
Toba Tek Singh	2020	47	1	0	0.21	0	1	2.08	26
Attock	2015	10	0	0	0	0	0	0.98	4
Jhang	2017	46	0	1	0	2.17	1	0.78	14

Key: SY. study year, NRSP. The number of reported plant species, TSCBA. Total species common in both areas, NPSU. The number of plants with similar uses, NPDU. The number of plants with dissimilar uses PPSU. Percentage of plants with similar uses, PPDU. Percentage of plants with dissimilar uses, JI. Jaccard index, C. Citations

Table 6 — Novelty index and ethnobotanical profile of key plants from the study area

Botanical Name	Voucher #	Local Name	Family	Life Span	Plant Habit	PU	Rec.	App.	N
Abutilon indicum (L.) Sweet	201/Botany	Peeliboti	Malvaceae	Perennial	Shrub	Leaves, Roots, Seeds	Powder, Paste	Used to cure skin cancer and typhoid	6
Leucaena leucocephala (Lam.) de Wit	232/Botany	Jumbey, keekar	Fabaceae	Perennial	Legume	Seeds, Leaves	Powder, Paste	Used to cure diabetes and urinary disorders	8
Vachellia nilotica (L.) P.J.H. Hurter & Mabb.	233/Botany	Babul, Keekar	Fabaceae Amaranthaceae	Perennial	Tree	Roots, Fruit, Bark, Seeds	Decoction, Gum	Used to cure fever and wounds	5
Achyranthes aspera L.	204/Botany	Puthkanda		Perennial	Herb	Whole plant, Stem	Decoction, Paste	Used to cure asthma and cough	8
Calotropis gigantea (L.) Dryand.	205/Botany	Ak	Apocynaceae	Perennial	Shrub	Leaves, Root bark, Stem	Milk, Juice, Paste	Used to cure wounds and inflammation	6
Capparis decidua (Forssk.) Edgew.	206/Botany	Karir	Capparaceae Chenopodiaceae	Perennial	Tree	Fruit, Whole plant	Paste	Used to cure wounds, dysentery, and asthma	9
Chenopodium album L.	242/Botany	Bathu		Annual	Weed	Whole plant	Decoction, Juice	Used to cure asthma and liver disorders	3
Moringa oleifera Lam.	218/Botany	Sohanjna	Moringaceae	Perennial	Tree	Flowers, Leaves, Fruit	Decoction, Juice, Powder	Used to cure fever, diabetes, and inflammation	8
Cynodon dactylon (L.) Pers.	251/Botany	Khabal, Bahm grass	Poaceae Primulaceae	Perennial	Creeping herb	Roots, Rhizome	Decoction, Juice, Paste	Used to cure cough and headaches	9
Lysimachia arvensis (L.) U. Manns & Anderb.	240/Botany	Bili booti		Annual	Herb	Leaves	Decoction, Juice, Infusion	Used to cure jaundice and skin problems	7

*Abbreviations: PU. Part used, Rec. Recipe, App. Mode of application, UV. Use value, N. Absolute number of informants

preservation of traditional knowledge in Muzaffargarh. In the same way, *Abutilon indicum* with a UV of 0.7 and Fidelity Level (FL) of 70 is commonly used to treat skin cancer- a practice that is hardly recorded in other areas, suggesting special therapeutic perceptions in the region.

The additional contextualization of these results is provided by the regional comparison with the help of the Jaccard Index (JI). The most similarity with Layyah (JI = 13.66) was observed when 45 ethnobotanical studies that were published in the period between 2015 and 2022 were compared, showing a strong similarity in plant species and therapeutic applications. Conversely, the district of Jhang had the lowest similarity (JI = 0.78), implying that there were major differences between the dependence on plants and cultural practices. These inconsistencies are probably due to the historical practices, the diversity of the society, the availability of the plant resources, and the environmental differences. Plants that were regularly referred to, including: *Achyranthes aspera*, *Convolvulus arvensis*, *Tribulus terrestris*, and *Citrullus colocynthis*, always recurred across the region and emphasize their more general therapeutic importance. The uniqueness of local systems of knowledge is further demonstrated by the new applications spotted in Muzaffargarh, e.g., snake bite (*Asplenium dalhousiae*) and kidney issues (*Cynoglossum lanceolatum*).

These approaches pose serious problems of sustainability besides portraying an affluent ethnopharmacological heritage. Numerous of the commonly used species are harvested uncontrollably, straight from the wild. Excessive exploitation of such plants as *Chenopodium album, Achyranthes aspera,* and *Abutilon indicum* increases the risk of overexploitation that might also pose a threat to the native populations and ecological balance. The areas where uncontrolled harvesting is carried out may be facing danger in terms of the long-term supply of medicinal plants and biodiversity. Especially among the frequently used species, such as *Chenopodium album* and *Abutilon indicum*, the local communities indicated that conservation efforts, such as community-run herbal nurseries and seed banks, were necessary. These participatory approaches, when coupled with awareness campaigns, would ensure sustainable use of resources and also facilitate the local livelihoods.

The implications of the study findings on modern-day pharmacology are immense. Good potentials in phytochemical and pharmacological research are those with high FL value, as in the case of *Cynoglossum lanceolatum* in the prevention of kidney diseases and *Abutilon indicum* in skin cancer treatment. Their seeming effectiveness and frequent reference speak in favor of the presence of powerful bioactive compounds that should be scientifically proven. Conversely, there are examples of useful but underutilized medicinal flora, such as *Calotropis gigantea*, with a pharmacological potential known to be useful but having a low UV (0.04). In the case of limited resources, scientific research on both popular and less-popular species ought to be extended to provide additional therapeutic options.

Therefore, it is important to conserve this knowledge. The traditional plant knowledge is rather localized and, to a large extent, transmitted orally to the present, as can be seen in the geographical differences represented in JI values. But it is now endangered by urbanization and urban migration, modernization, and loss of intergenerational knowledge transfer. The community participation, comprehensive records, and educational systems are urgently required to preserve this invaluable heritage. Another way to conserve the cultural identity is by creating ethnobotanical archives, promoting intergenerational knowledge-sharing projects, and encouraging community-based conservation projects, which will foster global healthcare innovation and biodiversity conservation.

Conclusion

This is an ethnobotanical study that documents the past and present medical practices of the local populations in the year 2021 to 2022 to document the rich biocultural history of the Muzaffargarh district. The study contributes to the body of knowledge by uncovering previously unknown ethnomedical applications, such as the use of *Leucaena leucocephala* in the treatment of jaundice and the use of Abutilon indicum in the management of skin cancer. These findings not only add to the medicinal importance of these plants but also provide promising prospects in further pharmacological studies. Quantitative analyses also support the strength of local knowledge. *Chenopodium album* and *C. murale* showed the highest Use Values (UV = 1), which indicated their wide usage in the community. Similarly, issues such as lice infestation and arsenic toxicity exhibited the highest Informant Consensus Factor (ICF), which reveals that informants were in strong agreement regarding the list of plants to use in such situations. In addition to the scientific importance of the study, the issue of the urgency to preserve the traditional knowledge systems as opposed to unsustainable practices in harvesting them, cultural changes, and environmental loss is highlighted. Habitats and overuse of wild medicinal plants are threatening both the biodiversity and the survival of traditional medical practices. Consequently, conservation strategies should be closely associated with community participation and scientific validation. This research not only maintains valuable indigenous knowledge and develops a model of developing plant-based medicine, but also combines traditional knowledge and modern science. The future studies can focus on screening phytochemicals by focusing on the phytochemical purification of the natural resources, pharmacological screening, clinical screening, and policy development to facilitate the sustainable utilization and conservation of ethnomedicinal resources.

Supplementary Data

Supplementary data associated with this article is available in the electronic form at https://nopr.niscpr.res.in/jinfo/ijtk/IJTK_25(3)(2026) 245-255_SupplData.pdf

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Author Contributions

WL, TL: research design, validation, software, resource, statistical analysis; TA, HQ, RR; supervision, methodology experimentation, drafting, data curation.

Conflict of Interest

The authors declare no conflict of interest.

Ethics Statement

The study was conducted respecting local knowledge, confidentiality, and ethical guidelines.

Informed Consent

Written informed consent was obtained from all participants. For illiterate participants, consent was explained in their native language and documented. All methods followed institutional, national, and international guidelines, including the International Society of Ethnobiology Code of Ethics, the Convention on Biological Diversity, and the Nagoya Protocol. Participation was voluntary and confidential.

Data Availability

The author confirms that all data generated or analyzed during this study are included in this published article.

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