Ethnomedicinal plants used in the local health care system: A survey of Parvati Valley, Kullu District, Himachal Pradesh, India

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Research

Abstract

Background: Ethnomedicinal plant knowledge remains fundamental to primary healthcare in the remote Western Himalaya. This study documented the medicinal plants used in the local healthcare practices of the Parvati Valley.

Methods: Ethnomedicinal data were collected during 2022-2024 from 74 informants, including traditional healers, using semi-structured interviews and focus group discussions after obtaining prior informed consent. Plant specimens were identified using standard regional floras and authenticated herbarium collections, and the data were analyzed using quantitative ethnobotanical methods.

Results: A total of 47 medicinal plant species belonging to 31 families were documented, with Asteraceae (8 species) and Lamiaceae (4 species) being the dominant families. Roots were the most frequently used plant part (34.04%), while decoctions (34.04%) and powders (31.91%) were the predominant modes of preparation. *Podophyllum hexandrum* exhibited the highest use value (UV = 1.15), whereas *Picrorhiza kurrooa* recorded the highest citation frequency (FC = 68; RFC = 0.92). Gastrointestinal, respiratory, and dermatological disorders were the most frequently treated ailments. Ethnomedicinal knowledge was predominantly retained by informants aged >50 years and was mainly transmitted through oral tradition (70.27%).

Conclusions: Traditional medicinal plant knowledge continues to play a vital role in primary healthcare in the Parvati Valley. The ethnomedicinal plant species documented in this study provide a scientific basis for biodiversity conservation, the sustainable utilisation of medicinal plant resources, and future phytochemical and pharmacological investigations.

Keywords: Traditional knowledge; Local healers; Ethnomedicinal plants; Use Value; Parvati Valley.

Background

Traditional Knowledge Systems (TKS) constitute an important component of primary healthcare worldwide, particularly in regions where geographical isolation, limited healthcare infrastructure, and socioeconomic constraints restrict access to modern medicine (World Health Organisation [WHO], 2019, Srikanth *et al.* 2017). In India, TKS encompass both codified medical systems, including Ayurveda, Siddha, Unani, and Sowa-Rigpa, and the largely uncodified Local Health Traditions (LHTs), which are transmitted orally across generations (Goel & Srikanth 2023). These community-based healthcare practices represent cumulative empirical knowledge of locally available biological resources and continue to provide affordable, culturally acceptable healthcare for rural and tribal populations (Sen & Chakraborty 2016).

The Indian Himalayan Region (IHR) is recognised as a global biodiversity hotspot owing to its exceptional floristic richness, high endemism, and cultural diversity (Myers *et al.* 2000, Samant *et al.* 1998). Himachal Pradesh, situated within the IHR, supports numerous indigenous and tribal communities, including the Gaddis, Gujjars, Kinnauras, Lahaulas, and Pangwalas, many of whom inhabit remote mountainous landscapes (Vidyarthi *et al.* 2013, Government of Himachal Pradesh 2018). Although public healthcare services have expanded under national initiatives, difficult terrain, seasonal isolation, landslides, and limited accessibility continue to restrict timely medical care in many high-altitude areas (Mishra *et al.* 2023, Kumar *et al.* 2025). Consequently, traditional healers, including Vaidyas, bonesetters, and pastoral practitioners, remain an integral part of primary healthcare by treating a wide range of ailments using locally available medicinal resources (Rana *et al.* 2014, Singh *et al.* 2017).

The ethnomedicinal knowledge possessed by these practitioners represents a valuable biocultural resource developed through long-term interactions with local ecosystems. However, this knowledge is increasingly threatened by modernisation, changing livelihoods, declining intergenerational transmission, and habitat degradation, resulting in rapid biocultural erosion (Vidyarthi *et al.* 2013, Singh *et al.* 2022). Recognising its scientific and cultural importance, the Central Council for Research in Ayurvedic Sciences (CCRAS) has emphasised the systematic documentation of Local Health Traditions using standardised protocols to facilitate knowledge preservation, safeguard intellectual property, and support future pharmacological investigations (Srikanth *et al.* 2017). Such documentation also provides a scientific basis for ethnopharmacological validation, sustainable utilisation of medicinal plant resources, and biodiversity conservation (Sen & Chakraborty 2015).

Although previously many studies have carried out in Western Himalaya (Singh, 1999, Sharma & Lal, 2003,2005, Uniyal, 2003, Sharma *et al.* 2004, Rana & Samant, 2011, Vidyarthi *et al.* 2014, Kumari *et al.* 2016, Sharma & Samant, 2017, Gupta *et al.* 2017, Shashni *et al.* 2019, Rathore *et al.* 2023, Nisha *et al*. 2024, Nisha & Lata, 2024, Singh *et al.* 2024, Arya *et al.* 2026, Raturi *et al*. 2026), further integration of detailed ethnomedicinal documentation with quantitative assessment is warranted. The present study documents plant parts used, preparation and administration methods, reported dosages, and therapeutic applications, and evaluates medicinal plant use through frequency of citation (FC), relative frequency of citation (RFC), total use reports (ΣURs), and use value (UV).

Materials and Methods

Study Area

The study was conducted in the Parvati Valley (31°58′41″-32°05′51″ N; 77°14′23″-77°27′08″ E) of Kullu district, Himachal Pradesh, India, covering approximately 1,766 km² (Figure 1). The valley extends from about 1,100 m at Bhuntar to approximately 4,100 m at Mantalai Lake and exhibits pronounced altitudinal gradients supporting subtropical, temperate, subalpine, and alpine vegetation (Sharma & Samant 2017). The Parvati River, with major tributaries including the Malana, Tosh, and Grahan nallahs, forms the valley's principal drainage system. Owing to its diverse topography and climatic heterogeneity, the region harbours rich medicinal plant diversity and a range of traditional healthcare practices. Details of villages surveyed are presented in table 1.

Table 1. List of villages surveyed with population, literacy and geo-coordinates

S. No.	Village	Population	Literacy Rate (%)	Latitude (N)	Longitude (E)
1	Jari	1850	82	31.9912	77.2764
2	Kasol	1240	84	32.0098	77.3149
3	Chalal	410	75.8	32.0135	77.3211
4	Chojh (Choj)	360	76.4	32.0211	77.3325
5	Katagla	290	76.9	31.9985	77.3014

6	Manikaran	2100	84	32.0264	77.3478
7	Rudra Nag	65	69.2	32.0395	77.4122
8	Barshaini	820	77	32.0425	77.4215
9	Kalga	190	72.6	32.0381	77.4285
10	Pulga	490	73.9	32.0342	77.4411
11	Tulga	160	71.3	32.0355	77.4332
12	Tosh	680	74	32.0584	77.4498
13	Nakthan	540	71.9	32.0315	77.4642
14	Kutla	50	68	32.0691	77.4521
15	Grahan	430	73.3	31.9942	77.3495
16	Suma Ropa	180	78.3	32.0022	77.3112
17	Tikkar	240	75.8	31.9845	77.2915
18	Pini	980	74	31.9614	77.2412
19	Bladhi	130	75.4	31.9821	77.2514
20	Bradha	340	75.9	31.9795	77.2645
21	Malana	1720	59	32.0611	77.2648
22	Rasol	390	68.2	32.0298	77.2885
23	Shilha	310	72.9	32.0312	77.3641
24	Shipuri	150	71.3	32.0452	77.3712

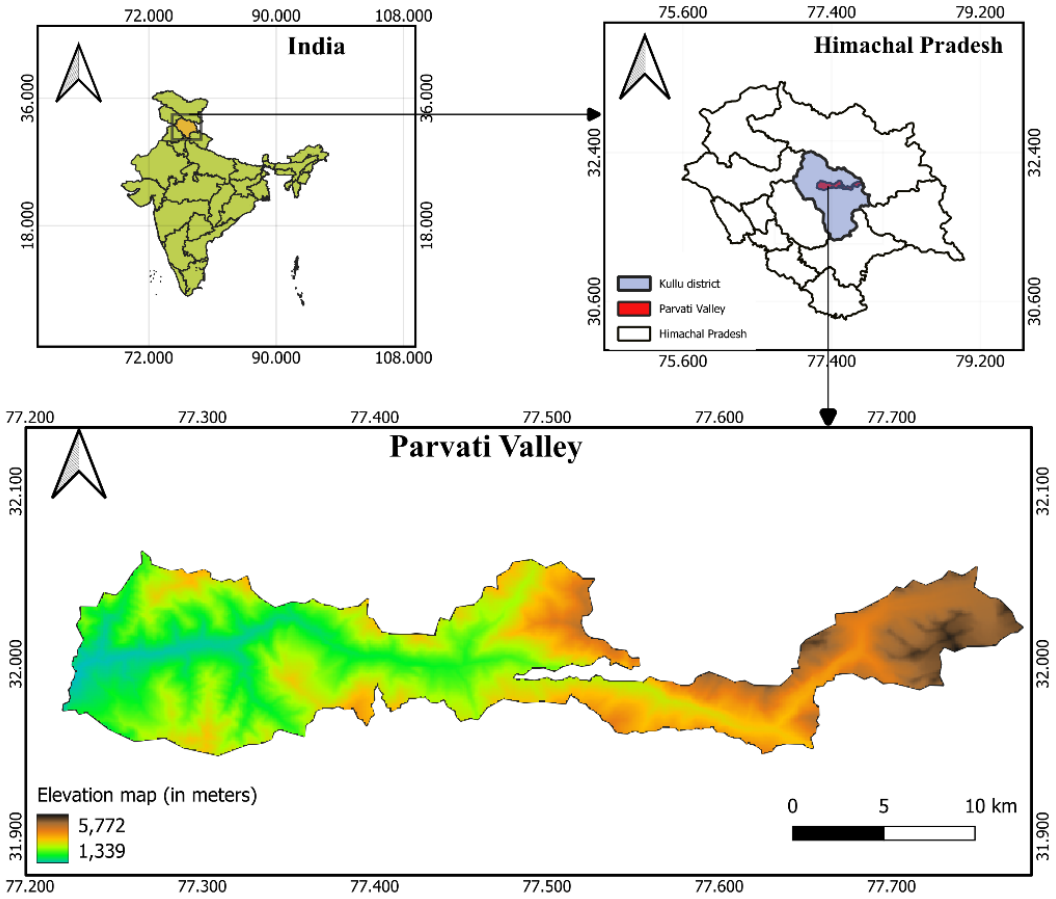


Figure 1. Map of Kullu District of Himachal Pradesh, India, showing the study area (Parvati Valley)

Data collection

A survey was conducted in the Parvati Valley, Himachal Pradesh, in the Western Himalaya, India, during 2022-2024. Ethnomedicinal knowledge and socio-demographic information were documented through semi-structured questionnaires, face-to-face interviews, and focused group discussions with local inhabitants and traditional healers

(Vaidyas). Informants were selected based on their knowledge of traditional medicinal practices, and prior informed consent (PIC) was obtained from each participant before data collection. In total, 74 informants were interviewed. Field surveys were conducted with the active participation of local healers and key informants, who assisted in locating, identifying, and collecting medicinal plant species in their natural habitats.

Collected plant specimens were processed following standard herbarium techniques, including pressing, drying, poisoning, and mounting on herbarium sheets. Voucher specimens were prepared and assigned unique collection numbers for future reference. Taxonomic identification was carried out using regional and national floras, the Kew Herbarium Catalogue, and by comparison with authenticated herbarium specimens housed at the Northern Circle of the Botanical Survey of India (BSD), Dehradun, and the Regional Ayurveda Research Institute (RARIM), Mandi. The nomenclature of all recorded taxa was verified and updated according to currently accepted botanical names using internationally recognized databases, including Plants of the World Online (POWO) and Tropicos.

Demographic profile of the informants

During the study, 74 people were interviewed in the Parvati Valley in Western Himalaya, India. Among the 74 informants, 54 (72.97%) were men and 20 (27.03%) were women. A majority of informants were in the 50-69 age group (56.76%), and the minimum (5) was in the 30-39 age group (6.76%). Among the informants, primary education was predominant (55.41%), followed by illiteracy (28.38%) and matric (16.22%). Among the 74 informants, 19 were traditional practitioners (15 men and 4 women). The majority of participants learned their ethnomedicinal knowledge from their elders (70.27%); however, 29.73% obtained it through self-experimentation (Table 2).

Table 2. Demographic features of informants

Demographic feature	Categories	Number	Percentage (%)
Informants (Non-Healers)	Local inhabitant male	39	52.7
	Local inhabitant female	16	21.62
Traditional Healers	Local healer male	15	20.27
	Local healer female	4	5.41
	Total Informants	74	100
Age group (years)	30 - 39	5	6.76
	40 - 49	13	17.57
	50 - 59	21	28.38
	60 - 69	21	28.38
	> 70	14	18.92
Education	Illiterate	21	28.38
	Primary	41	55.41
	Matric	12	16.22
Source of knowledge	Self-experience / Experimentation	22	29.73
	Parents / Ancestral (Oral transmission)	52	70.27

Plant Collection and Identification

Medicinal plants reported by the informants were collected during field surveys, processed according to standard herbarium procedures, and authenticated using regional floras and herbarium specimens housed at the Regional Ayurveda Research Institute, Mandi (RARIM). Botanical nomenclature and family classification were verified using the World Flora Online (WFO) and Plants of the World Online (POWO) databases.

Data Analysis

Ethnomedicinal data were compiled, organized, and analyzed in Microsoft Excel. Descriptive statistical analyses were performed to summarize the socio-demographic characteristics of the informants. Quantitative ethnobotanical analyses were subsequently carried out using standard ethnobotanical indices:

Frequency of Citation (FC) was calculated as the total number of informants who mentioned a particular plant species:

$$FC = \sum_{i=1}^{N} I_i$$

Where i = 1 if informant i mentions the plant, and 0 otherwise (Tardío & Pardo-de-Santayana 2008).

Relative Frequency of Citation (RFC) was calculated as:

$$RFC = \frac{FC}{N}$$

Where FC is the frequency of citation and N is the total number of informants (Tardío & Pardo-de-Santayana 2008).

Use Reports (ΣUR) was determined as:

$$\sum U = \sum_{p=1}^{FC} U_p$$

Where Up is the number of distinct therapeutics uses reported by informant p (Cook 1995, Tardío & Pardo-de-Santayana 2008).

Use Value (UV), which reflects the relative importance of each medicinal plant species, was calculated using the following equation:

$$UV = \frac{\Sigma U}{N}$$

Where ∑U is the total use-reports for a species, and N is the total number of informants (Phillips & Gentry 1993).

Results

The present study documented 47 ethnomedicinal plant species belonging to 31 families that are traditionally used for the management of diverse human ailments. The recorded taxa exhibited considerable taxonomic diversity, with Asteraceae as the dominant family (8 species), followed by Lamiaceae (4 species). Apiaceae, Berberidaceae, Polygonaceae, Rubiaceae, Ranunculaceae, Violaceae, Zingiberaceae, Asparagaceae, and Amaryllidaceae were represented by 2 species each. The remaining families were represented by a single species.

A total of eleven different plant parts were recorded in the ethnomedicinal formulations documented from the Parvati Valley. Among the individual plant parts, roots were the most frequently utilized, accounting for 34.04% (16 species) of all recorded uses, followed by leaves (14.89%; 7 species). Whole plants constituted 19.15% (9 species) of the documented formulations, reflecting their widespread use in traditional healthcare practices. Rhizomes (8.51%; 4 species), tubers (6.38%; 3 species), seeds (4.26%; 2 species), and bulbs (4.26%; 2 species) were used less frequently. The least utilized plant parts included aerial parts, flowering shoots, galls, and kernels, each representing 2.13% (1 species) of the recorded ethnomedicinal formulations (Figure 2).

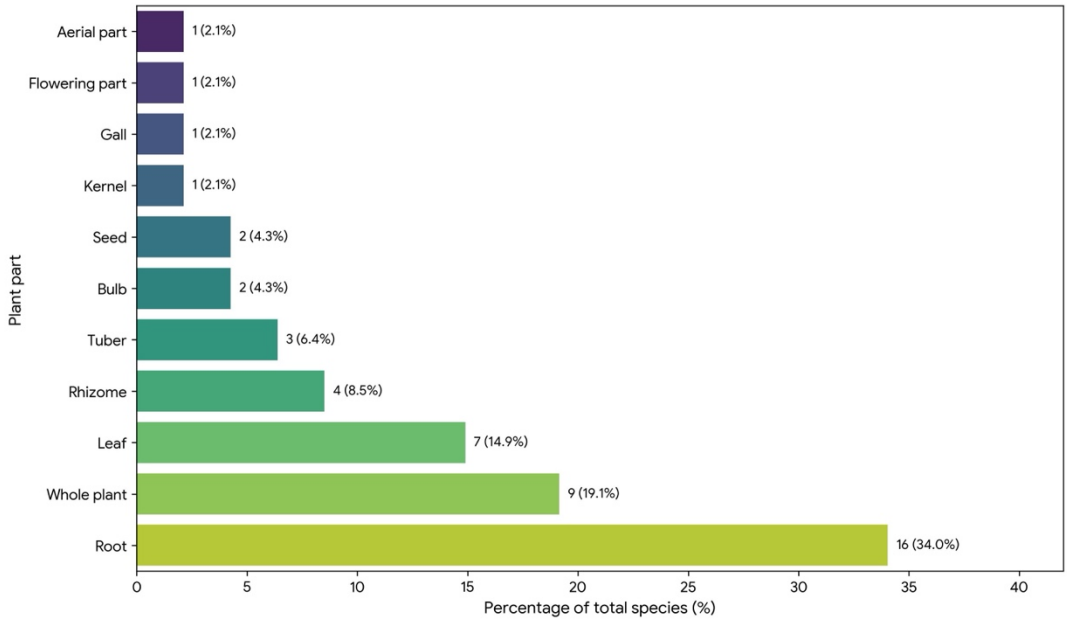


Figure 2. Percentage of different plant parts used in formulation

A total of five modes of drug preparation were documented in the present study (Table 3 and Figure 3). Among these, decoction was the most frequently employed method, accounting for 34.04% (16 species), followed by powder (31.91%; 15 species), paste (25.53%; 12 species), juice (6.38%; 3 species), and dietary formulation (2.13%; 1 species). Decoctions were generally prepared by boiling plant materials in water and were administered orally for the treatment of various ailments. Powder formulations were prepared from dried plant materials and consumed with water or milk. Paste preparations were obtained by crushing fresh plant parts and were primarily applied externally for the management of wounds, fractures, skin infections, and other localized conditions. Fresh juices were extracted from succulent plant parts and administered orally, whereas dietary formulations involved preparing medicated foods, such as porridge made from processed kernels of *Aesculus indica*, for restorative purposes.

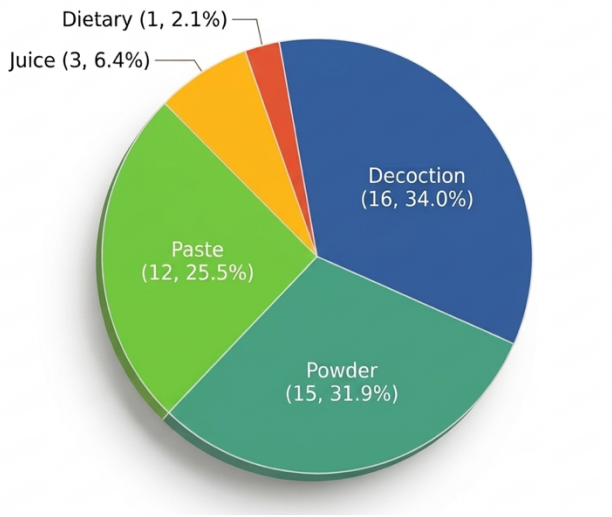


Figure 3. Mode of preparation used

Quantitative analysis was performed and recorded values indicated considerable variation in FC, UR, and UV of the documented taxa (Table 3).

Among the recorded species, *Picrorhiza kurrooa* exhibited the highest ethnobotanical significance, with an FC of 68, RFC of 0.92, UR of 78, and UV of 1.05. This species was predominantly cited for the treatment of abdominal pain and constipation. Similarly, *Dactylorhiza hatagirea* recorded high citation values (FC = 65; RFC = 0.88; UR = 65; UV = 0.88) and was primarily used as an aphrodisiac. *Valeriana jatamansi* (FC = 63; RFC = 0.85; UR = 76; UV = 1.03) and *Aconitum heterophyllum* (FC = 62; RFC = 0.84; UR = 74; UV = 1.00) also showed high levels of citation and use, indicating their prominent role in the traditional healthcare system of the study area (Figure 4).

Several medicinal plants exhibited higher numbers of use reports than frequency of citation values, reflecting their utilization for multiple therapeutic purposes. *Podophyllum hexandrum* recorded the highest use value (UV = 1.15), with 85 use reports generated from 58 citations, and was employed for the treatment of chronic constipation, liver disorders, and respiratory ailments. Likewise, *Thymus linearis* (FC = 53; UR = 72; UV = 0.97) and *Dolomiaea costus* (FC = 52; UR = 70; UV = 0.95) were reported for the management of a broad range of ailments, including respiratory disorders, fever, abdominal pain, and rheumatism.

In contrast, comparatively lower citation and use values were observed for *Tribulus terrestris* (FC = 12; RFC = 0.16; UR = 12; UV = 0.16) and *Rhododendron campanulatum* (FC = 14; RFC = 0.19; UR = 14; UV = 0.19), suggesting relatively limited documentation and use among the surveyed informants.

The documented medicinal plants were used to treat a wide range of ailments, with the majority of species being employed for gastrointestinal disorders, respiratory diseases and fever, dermatological conditions and wound healing, hepatobiliary and renal disorders, and musculoskeletal ailments. Gastrointestinal disorders constituted the most frequently reported therapeutic category and included highly cited species such as *Picrorhiza kurrooa*, *Aconitum heterophyllum*, *Podophyllum hexandrum*, and *Valeriana jatamansi*. Respiratory ailments and fever were commonly treated using *Thymus linearis, Ajuga bracteosa*, *Taxus contorta*, and *Dolomiaea costus*. Dermatological disorders and wound

management primarily involved *Arnebia benthamii*, *Rumex nepalensis*, and *Galium aparine*, whereas hepatobiliary and renal disorders were treated using *Bergenia ciliata*, *Berberis aristata*, and *Thalictrum foliolosum*. Musculoskeletal disorders, including rheumatism, were mainly managed with *Dolomiaea costus* and *Hypericum perforatum*.

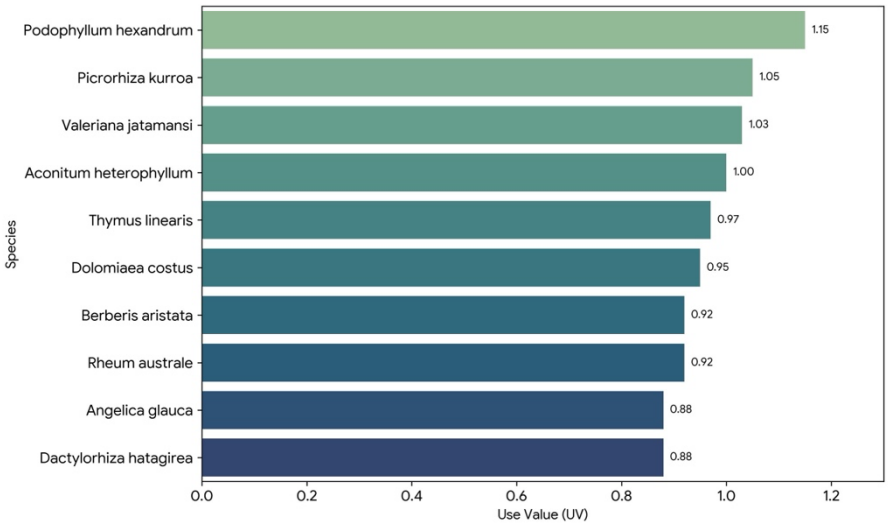


Figure 4. Presentation of top 10 species with high use value

Table 3. Ethnomedicinal plants with their traditional uses and quantitative ethnobotanical indices.

Botanical Name (Family)	Vernacular Name	Part(s)	Preparation, Administration, Dosage and Therapeutic Use	FC	RFC	ΣURs	UV
Achillea millefolium L. (Asteraceae)	**gandana**	L	Crushed leaves are used to relieve toothache, dysentery and urinary tract infections.	32	0.43	42	0.57
Achyranthes bidentata Blume (Amaranthaceae)	**—**	Sd	Seeds are boiled in 250 mL water, and the decoction is taken orally 1-2 times daily for cold, cough, mouth ulcers and whooping cough	18	0.24	22	0.30
Aconitum heterophyllum Wall. ex Royle (Ranunculaceae)	**—**	Tb	½ teaspoon powder of dried tuber is taken orally with lukewarm water twice daily for the treatment of fever and stomachache.	62	0.84	74	1.00
Aesculus indica (Wall. ex Cambess.) Hook. (Sapindaceae)	**khanor/khnor**	Kn	Processed kernel flour is cooked into porridge and consumed once daily as a restorative tonic for women after delivery.	35	0.47	35	0.47
Ainsliaea aptera DC. (Asteraceae)	**kadvi-booti**	R	Approximately 2 g root powder is taken with lukewarm water as a single dose for stomachache, while the same dose is administered twice daily for 2-3 days against diarrhea and intestinal worms.	25	0.34	32	0.43
Ajuga bracteosa Wall. ex Benth. (Lamiaceae)	**neelkanthi**	L	1 teaspoon dried leaf powder is taken with a glass of water morning and evening for 3-4 days against fever.	48	0.65	52	0.70
Allium humile Kunt (Amaryllidaceae)	**—**	L	½ teaspoon dried leaf powder is taken with lukewarm water in the evening for 3-4 days against fever and high blood pressure.	22	0.30	28	0.38
Angelica glauca Edgew. (Apiaceae)	**chura**	R	1-2 g dried root powder is taken with warm water twice daily after meals to relieve gastritis and hyperacidity.	58	0.78	65	0.88
Arnebia benthamii (Wall. ex G. Don) Johnst. (Boraginaceae)	**—**	R	Fresh or dried root paste is applied externally on cuts and wounds until healing occurs.	40	0.54	40	0.54
Asparagus adscendens Roxb. (Asparagaceae)	**—**	R	3-5 g dried root powder is taken with warm milk once daily, preferably at bedtime, for leucorrhea and female reproductive disorders.	30	0.41	34	0.46
Berberis aristata DC. (Berberidaceae)	**kashmal**	R	1-2 g Rasount (root extract) dissolved in warm water or milk is taken twice daily for 7-10 days to treat eye and skin diseases and jaundice.	55	0.74	68	0.92
Berberis lycium Royle (Berberidaceae)	**—**	R	One glass of root decoction is taken orally once daily for 3-5 days against jaundice.	45	0.61	48	0.65
Bergenia ciliata (Haw.) Sternb. (Saxifragaceae)	**pashanbheda**	R	One glass polyherbal decoction containing the rhizome is taken orally once daily for 7-10 days in the management of renal stones.	60	0.81	60	0.81
Dactylorhiza hatagirea (D.Don) Soó (Orchidaceae)	**salam panja**	Tb	1 teaspoon powder of dried tuber is taken orally with lukewarm milk or water once daily as an aphrodisiac.	65	0.88	65	0.88
Dolomiaea costus (Falc.) Kasana & A.K. Pandey (Asteraceae)	**—**	R	1-2 teaspoons powder of dried root is taken with lukewarm water twice daily for 2-3 days against fever and abdominal pain, and for 10-15 days against rheumatism.	52	0.70	70	0.95

Fritillaria cirrhosa D.Don (Liliaceae)	**hadjod**	B	Thick paste of fresh bulbs is applied externally on fractured bones and changed periodically until recovery.	28	0.38	28	0.38
Galium aparine L. (Rubiaceae)	**kususu ghaas**	WP	Fresh plant juice is applied externally several times daily on cuts and wounds to promote healing and prevent pus formation.	15	0.20	15	0.20
Geranium wallichianum D.Don ex Sweet (Geraniaceae)		R	A cotton pellet soaked in root extract or paste is applied directly to the affected tooth for 10-15 minutes to relieve toothache.	24	0.32	24	0.32
Hedychium spicatum Sm. (Zingiberaceae)	—	Rh	Fresh rhizome paste is applied externally 1-2 times daily for joint pain, burns, boils, cuts and wounds.	33	0.45	45	0.61
Hymenidium brunonis (DC.) Lindl. (Apiaceae)	**nesar, losar**	FS	5-10 g powdered flowering shoots mixed with fresh cow's butter are massaged over the body 1-2 times daily during high body temperature to reduce fever.	20	0.27	20	0.27
Hypericum perforatum L. (Hypericaceae)	—	WP	2-3 g dried whole plant powder is taken with water twice daily after meals for 3-4 weeks to treat rheumatism and chronic joint pain.	31	0.42	36	0.49
Inula grandiflora Willd. (Asteraceae)	**poshkar**	R	About 10 g root powder is taken orally with lukewarm water twice daily for 3-5 days against cough, cold, and throat irritation.	18	0.24	24	0.32
Jurinea macrocephala (Royle) Aswal ex Goel (Asteraceae)	**dhoop**	R	About ½ teaspoon powder of dried root is taken orally with water three times daily for 2-3 days to reduce fever.	44	0.60	44	0.60
Origanum vulgare L. (Lamiaceae)	**jawade**	WP	20 mL plant decoction mixed with a small piece of jaggery is taken twice daily to manage cold and cough.	38	0.51	42	0.57
Persicaria amplexicaulis (D.Don) Ronse Decr. (Polygonaceae)	**masloon**	R	Paste prepared from dried roots is applied externally on boils once or twice daily until recovery.	21	0.28	21	0.28
Picrorhiza kurroa Royle ex Benth. (Plantaginaceae)	**kaadu**	R, Rh	15-20 mL rhizome or root decoction is taken warm twice daily for abdominal pain and constipation.	68	0.92	78	1.05
Pistacia integerrima J.L. Stewart ex Brandis (Anacardiaceae)	—	G	Roasted galls are taken with honey to cure asthma and diarrhea.	26	0.35	32	0.43
Podophyllum hexandrum Royle (Berberidaceae)	**ban kakri**	R	One glass root decoction is taken orally twice daily for 5 days against chronic constipation. Extract prepared from crushed rhizomes and roots is administered orally for liver disorders. One glass fruit decoction is taken orally twice daily for 7 days against cough and other respiratory ailments.	58	0.78	85	1.15
Polygonatum verticillatum (L.) All. (Asparagaceae)	—	B	2-3 g dried bulb powder boiled in water is administered as a warm draft once daily in the early morning on an empty stomach for the treatment of leucorrhea.	23	0.31	23	0.31
Rheum australe Don. (Polygonaceae)	—	R,L	15-20 mL root decoction is taken orally twice daily for 3-5 days against stomach disorders and liver ailments. Fresh leaf poultice is applied externally 1-2 times daily on swellings until recovery.	50	0.68	68	0.92

Rhododendron campanulatum D. Don (Ericaceae)	**taangal**	L	Fresh leaf paste is applied externally 1-2 times daily to treat fungal infections and itching.	14	0.19	14	0.19
Roscoea purpurea Sm. (Zingiberaceae)	—	Tb	One teaspoon powder of dried tuber is taken orally with water twice daily for 3-5 days against indigestion.	29	0.39	29	0.39
Rubia cordifolia L. (Rubiaceae)	—	WP	½-1 teaspoon (approximately 2-4 g) whole plant powder is taken with lukewarm water three times daily after meals for 7-10 days to treat abdominal disorders.	32	0.43	32	0.43
Rumex nepalensis Spreng. (Polygonaceae)	—	L	Fresh leaf paste is applied externally for 3-4 days on boils, pimples, burns, cuts and wounds.	42	0.57	50	0.68
Skimmia anquetilia N.P. Taylor & Airy Shaw (Rutaceae)	**ner**	L	About 1-2 teaspoons of fresh leaf juice are taken orally once daily to relieve abdominal pain and digestive discomfort.	27	0.37	27	0.37
Swertia ciliata (D.Don ex G.Don) B.L.Burtt (Gentianaceae)	**chirayata**	AP	½ teaspoon powder of dried aerial parts is taken orally with water once daily for 2-3 days against fever and stomachache.	46	0.62	54	0.73
Tanacetum longifolium Wall. ex DC. (Asteraceae)	**langri**	L	5-10 mL fresh leaf juice is taken orally twice daily to relieve stomachache, indigestion, abdominal discomfort, and fever.	16	0.22	22	0.30
Taxus contorta Griff. (Taxaceae)	**rakhaal**	WP	15-20 mL plant decoction is taken warm orally twice daily after meals for 5-7 days to treat asthma and cough.	41	0.55	48	0.65
Thalictrum foliolosum DC. (Ranunculaceae)	**pilijadi**	R	10-15 mL root decoction is taken orally twice daily before meals for 10-14 days to manage jaundice and other liver-related ailments.	34	0.46	40	0.54
Thymus linearis Benth. (Lamiaceae)	**ban-ajwain**	WP	15-20 mL warm plant decoction is taken twice daily for 3-5 days against cold, cough, fever, and stomach disorders.	53	0.72	72	0.97
Tribulus terrestris L. (Zygophyllaceae)	**gokharu**	L	One glass cold leaf decoction is taken orally once daily for 5-7 days against typhoid fever.	12	0.16	12	0.16
Trillium govanianum Wall. ex D. Don (Melanthiaceae)	—	Rh	½ teaspoon powder of dried root is taken with warm water twice daily for 2-3 days against abdominal pain.	45	0.61	45	0.61
Valeriana jatamansi Jones (Caprifoliaceae)	**mushkbala, nihani**	R	About 10 g root powder is taken orally with lukewarm water during acute stomachache. One glass root decoction is taken orally at bedtime for the management of insomnia.	63	0.85	76	1.03
Verbascum thapsus L. (Scrophulariaceae)	**kolomasta**	L	1-2 teaspoons of freshly crushed leaf juice or paste is taken with warm water once daily, preferably at bedtime, for the management of constipation and acute stomach pain.	30	0.41	36	0.49
Viola pilosa Blume (Violaceae)	**banafsha**	R	15-20 mL root decoction is taken orally twice daily after meals for allergic cough.	37	0.50	37	0.50
Viola serpens Sm. (Violaceae)	**banaksha**	WP	15-20 mL whole plant decoction is taken orally twice daily for sore throat and expulsion of phlegm.	42	0.57	42	0.57

Woodfordia fruticosa (L.) Kurz (Lythraceae)	**dhai**	R,L	Root paste is applied externally twice daily for relief from muscular pain, while 5-10 mL fresh juice of young leaves is taken with water once daily for 15 days as a traditional blood purifier.	19	0.26	26	0.35

Abbreviations: AP - Aerial Part; B - Bulb; FS - Flowering Shoots; G - Galls; Kn - Kernel; L - Leaves; R - Root; Rh - Rhizome; Sd - Seeds; Tb - Tuber; WP - Whole Plant, FC - Frequency of Citation; RFC - Relative Frequency of Citation; ΣUR - Total Use Reports; UV - Use Value

Discussion

The present study documented 47 ethnomedicinal plant species belonging to 31 families used in the traditional healthcare system of the study area. The predominance of Asteraceae (8 species) and Lamiaceae (4 species) may be attributed to their high species richness, ecological adaptability, and abundance in temperate and alpine habitats of the Himalaya. These families are known to produce diverse secondary metabolites, including terpenoids, flavonoids, alkaloids, and phenolic compounds, which contribute to their wide therapeutic applications (Thakur *et al.* 2014, Singh *et al.* 2017, Singh *et al.* 2019, Michel *et al.* 2020)

The predominance of roots, rhizomes, tubers, and bulbs among the plant parts used indicates a preference for underground organs in traditional medicine. These structures often serve as storage sites for bioactive metabolites and are therefore, considered more potent than the aerial parts (Kala 2005). Similar patterns have been reported in several Himalayan ethnomedicinal studies, in which underground parts were the principal source of herbal remedies (Uniyal *et al.* 2006, Rana *et al.* 2014). However, the extraction of subterranean plant parts poses a significant threat to plant survival, as harvesting often results in the plant's death. This is particularly relevant for species such as *Aconitum heterophyllum*, *Dactylorhiza hatagirea*, *Picrorhiza kurroa*, *Angelica glauca*, and *Trillium govanianum*, which are subjected to intensive collection pressure and have experienced population declines across the Himalaya (Gowthami *et al.* 2021, Ved *et al.* 2008, Kala 2005).

The dominance of oral administration and the frequent use of decoctions and powdered formulations reflect the practical nature of indigenous healthcare systems. Decoction is one of the oldest extraction methods and enhances the release of water-soluble phytochemicals, including glycosides, tannins, and phenolics, thereby increasing therapeutic efficacy (Kunwar & Bussmann 2008). Powdered preparations, on the other hand, provide ease of storage and prolonged shelf life while retaining medicinal properties.

Analysis of therapeutic applications revealed that gastrointestinal disorders represented the largest disease category. More than one-third of the documented species were used for ailments such as stomachache, indigestion, diarrhea, constipation, gastritis, hyperacidity, intestinal worms, liver disorders, and jaundice. The high representation of digestive ailments may reflect their prevalence in rural mountain communities, where dietary changes, consumption of untreated water, and limited healthcare access contribute to gastrointestinal morbidity (Bussmann & Sharon 2006, Hussain *et al.* 2023). The widespread use of species such as *Angelica glauca*, *Picrorhiza kurrooa*, *Rubia cordifolia*, *Roscoea purpurea*, *Valeriana jatamansi*, and *Tanacetum longifolium* for digestive complaints suggests a well-developed traditional understanding of gastrointestinal health. Pharmacological investigations have demonstrated hepatoprotective, anti-inflammatory, digestive stimulant, and antimicrobial activities in several of these taxa, supporting their traditional applications (Gairola *et al.* 2014).

Respiratory disorders constituted another major therapeutic category. Species including *Origanum vulgare*, *Taxus contorta*, *Pistacia integerrima*, *Viola pilosa*, and *Viola serpens* were commonly employed against cough, cold, asthma, sore throat, and excessive phlegm. Essential oils rich in thymol, carvacrol, and related terpenoids from *Origanum vulgare* and *Thymus linearis* possess well-documented antimicrobial and expectorant activities, which may explain their effectiveness in treating respiratory ailments (Baser 2008). Likewise, galls of *Pistacia integerrima* contain tannins and phenolic compounds that exhibit bronchodilatory and anti-inflammatory properties (Ahmad *et al.* 2010).

Several species were repeatedly cited for the treatment of fever, including *Aconitum heterophyllum*, *Ajuga bracteosa*, *Allium humile, Swertia ciliata*, *Jurinea macrocephala*, and *Tanacetum longifolium*. Fever management is among the most common applications of medicinal plants in mountain communities, as febrile illnesses are frequently associated with seasonal infections and environmental stress. Species belonging to the genera *Aconitum* and *Swertia* are known to contain diterpenoid alkaloids, secoiridoids, and xanthones that exhibit antipyretic, anti-inflammatory, and immunomodulatory activities (Joshi & Dhawan 2005, Kshirsagar *et al.* 2019, Wani *et al.* 2021).

The use of several taxa for wound healing and dermatological conditions highlights the importance of plant-based topical therapies. *Arnebia benthamii*, *Galium aparine*, *Hedychium spicatum*, *Rumex nepalensis*, and *Rhododendron campanulatum* were employed for wounds, burns, boils, fungal infections, itching, and skin disorders. The efficacy of these plants may be associated with the presence of antimicrobial, antioxidant, and anti-inflammatory compounds that accelerate tissue regeneration and inhibit microbial growth (Ganie *et al* .2014). For instance, naphthoquinone derivatives isolated from *Arnebia* species have shown remarkable wound-healing and antimicrobial properties in experimental studies.

The documentation of species used for specialized conditions such as insomnia (*Valeriana jatamansi*), leucorrhea (*Asparagus adscendens* and *Polygonatum verticillatum*), renal calculi (*Bergenia ciliata*), hypertension (*Allium humile*), and post-partum recovery (*Aesculus indica*) demonstrates the depth and sophistication of local ethnomedicinal knowledge. Many of these uses closely correspond to pharmacological findings reported in scientific literature, suggesting that traditional knowledge systems are based on long-term empirical observations and therapeutic outcomes (Fabricant & Farnsworth 2001).

A comparative assessment with published ethnobotanical studies from the Parvati Valley, Kullu District, and adjacent Western Himalayan regions reveals several novel therapeutic applications, plant part selections, and modes of administration recorded in the present investigation for the first time (Uniyal *et al.* 2006, Sharma et al. 2018, Singh *et al.* 2019). Most notably, *Fritillaria cirrhosa* is documented as an external poultice for bone setting, diverging from its conventional Himalayan use as an internal remedy for chronic respiratory ailments and tuberculosis (Kala 2005, Sharma *et al.* 2018). Similarly, the transdermal febrifuge application of *Hymenidium brunonis* flowering shoots mixed with fresh cow's butter as a massage represents a unique local formulation not previously reported in regional surveys (Singh *et al.* 2019). Additional distinct practices recorded in the study area include the preparation of *Aesculus indica* kernel flour porridge as a post-parturient restorative tonic (Rana *et al.* 2014), the administration of *Tribulus terrestris* cold leaf decoction specifically for typhoid fever, whole-plant decoctions of *Taxus contorta* for cough and asthma, and direct leaf applications of *Achillea millefolium* for toothache, dysentery, and urinary tract infections (Thakur *et al.* 2014).

Overall, the observed pattern of medicinal plant use indicates that local communities possess a comprehensive healthcare strategy centered on readily available plant resources. The concentration of remedies for gastrointestinal, respiratory, febrile, and dermatological ailments reflects the major disease burdens of mountain populations and their adaptive responses to local environmental and socioeconomic conditions. The strong agreement between traditional uses and reported pharmacological activities further highlights the potential of these species as sources of novel therapeutic agents. Nevertheless, the extensive reliance on underground plant parts raises concerns regarding sustainability and underscores the need for conservation interventions, cultivation initiatives, and scientific validation through phytochemical and pharmacological studies.

Conclusion

The present study provides a quantitative assessment of the traditional ethnomedicinal knowledge of the Parvati Valley, Western Himalaya, and demonstrates that medicinal plants continue to play an important role in community-based healthcare. By integrating ethnobotanical documentation with quantitative analyses, the study identified culturally important medicinal species and highlighted the continued relevance of indigenous healthcare practices in the region. These findings contribute to the ethnobotanical knowledge of a relatively underexplored Himalayan landscape and provide a scientific basis for future research.

The concentration of ethnomedicinal knowledge among older informants suggests that this knowledge system is vulnerable to intergenerational erosion. Moreover, the reliance on several culturally important wild medicinal species underscores the need to integrate traditional knowledge with conservation strategies that promote their sustainable utilization. The documented species constitute valuable candidates for further phytochemical, pharmacological, and toxicological investigations to evaluate their therapeutic potential. Overall, the present study provides an important foundation for future research while supporting the conservation of medicinal plant diversity and the preservation of the biocultural heritage of the Western Himalaya.

Declarations

Ethics approval and consent to participate: The study was a non-interventional ethnobotanical field survey; therefore, formal Institutional Ethics Committee (IEC) approval was not required. The study complied with the International Society of Ethnobiology (ISE) Code of Ethics. The purpose and procedures of the study were explained to all participants, and Prior Informed Consent (PIC) was obtained before interviews and data collection. Indigenous knowledge, cultural values, and participant confidentiality were respected, and no sensitive or restricted traditional knowledge was disclosed without permission.

Consent for publication: All informants provided verbal consent for the use of ethnobotanical information in scientific publication, with assurance that no personal identifiers would be disclosed.

Availability of data and materials: The datasets generated and/or analyzed during the current study are included in this published article. Additional data is available from the corresponding author upon reasonable request.
Competing interests: The authors declare that there are no conflicts of interest associated with this study.
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Author contributions:
H.S. and M.R. contributed to the conception and design of the study, data collection, plant identification, data analysis, and manuscript preparation. D.A., S.M., and B.V. contributed to critical revision of the manuscript. All authors reviewed and approved the final manuscript.

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